ISSN: 1863-5598

ZKZ 64717
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Bodo´s Power Systems®

Electronics in Motion and Conversion

October 2012

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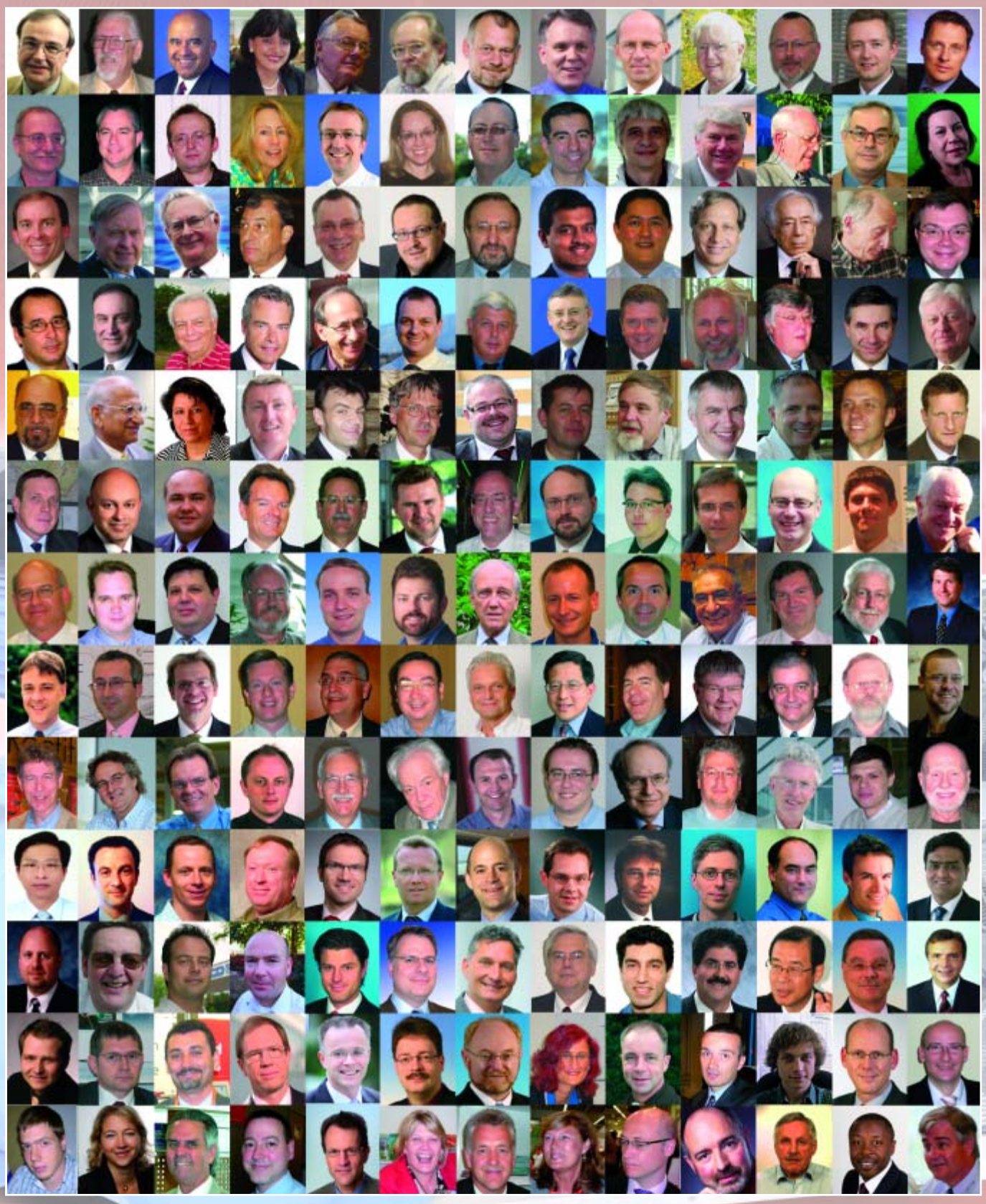
Read online and search for key subjects from all articles in Bodo's Power Systems by going to Powerguru:

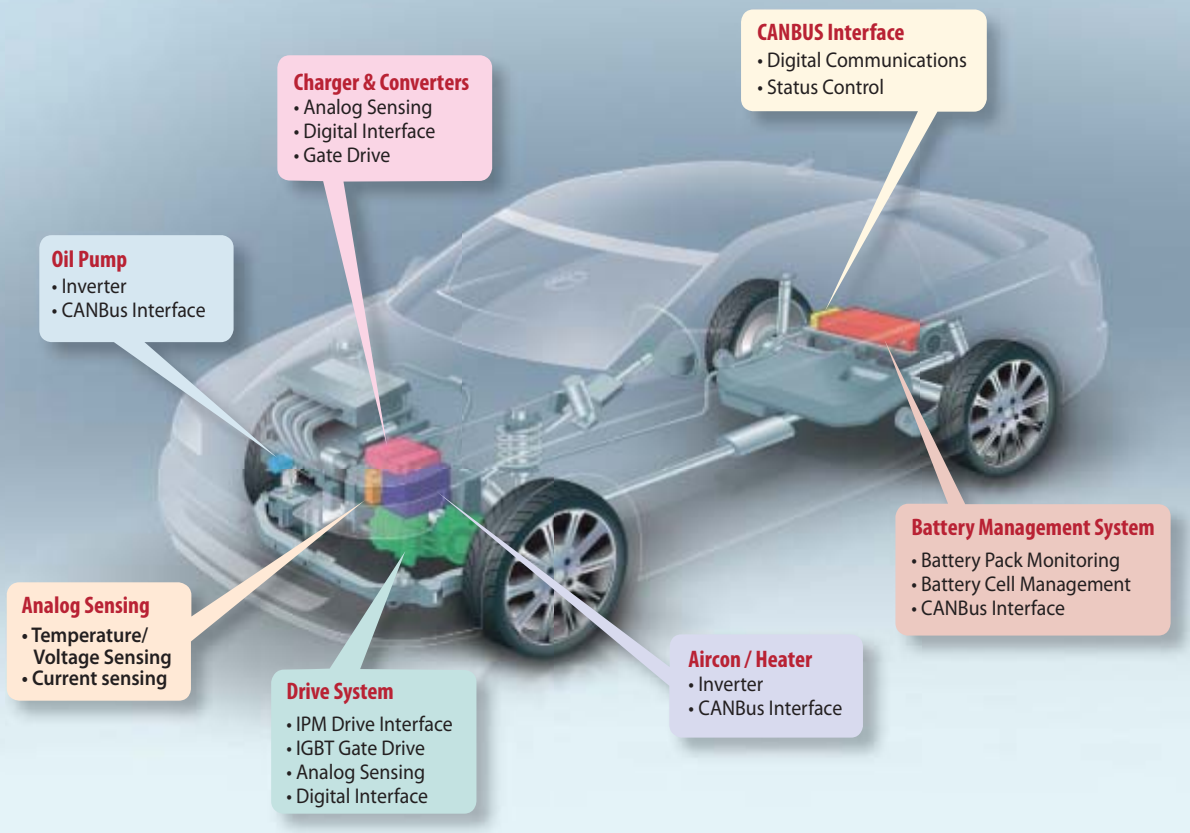
powerguru.org

The Gallery



Technology You Can Trust

EMC, EMI, and CMR Immunity for Automotive Subsystems... All In One Device!



- Automotive digital optocouplers
- Automotive IGBT optocouplers
- Automotive IPM optocouplers
- Automotive miniature isolation amplifiers

Avago Technologies R²Coupler™ Optocouplers deliver high common-mode (CMR) immunity and are immune to EMC and EMI to protect automotive subsystems that are typically associated with noisy environments and electromagnetic interference.

Avago R²Couplers are certified to IEC 60747-5-5 international safety standards and are packaged with thick multilayer insulation which is vital for long-term DC stress from battery packs as well as fast high-voltage transients that occur during testing, charger connection/disconnection and DC/DC conversion.

For more information on Avago R²Couplers go to: avagotech.com/r2couplers

IEC 60747-5-5 Certified

AVAGO TECHNOLOGIES

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Sense · Illuminate · Connect

Bodo´s Power Systems®

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Free Subscription to qualified readers

Bodo´s Power Systems
is available for the following
subscription charges:
Annual charge (12 issues) is 150 €
world wide
Single issue is 18 €
subscription@bodospower.com

circulation print run 20 000

Printing by:
Central-Druck Trost GmbH & Co
Heusenstamm, Germany

Events

Distribution Automation Europe, London UK, October 8th -9th www.smi-online.co.uk/distributionautomation38.asp

SEMICON Europa, Dresden Germany, October 9th -11th www.semiconeuropa.org

Electric Drives E / DPC 2012, Nuremberg, Germany, October 16th-17th www.edpc-expo.com

ESARS 2012, Bologna, Italy, October 16th -20th www.esars.org

e-car-tech, Munich Germany, October 23 th-25th www.ecartec.de

electronica, Munich Germany, November 13th-16th www.electronica.de

SPS/IPC/DRIVES, Nuremberg Germany, November 27th-29th www.mesago.de/de/SPS

Power Electronics Moscow, November 27th to 29th http://power.primexpo.com

Autumn has arrived in the Northern Hemisphere

As the publisher of a magazine which is distributed worldwide, I have to be specific. While those of us in Europe and North America enjoy the muted hues of autumn, South America and South Africa are awakening to bright greens of spring time. What we found out centuries ago, that the Earth is a globe and not a flat disc, must be taken into consideration. The good thing is there is no way to fall off the edge anymore while sailing around the world. Thanks to both Columbus and the Vikings!

All around the world, on both the top and the bottom, events are going on. These all help drive innovation for higher efficiency to consume less energy of all kinds. Our resources are finite and we need to preserve as much as possible for future generations. Our kids will thank us for being careful and the world will keep turning.

The most important event in Bavaria, the world-famous Oktoberfest, started on September 22nd and ends on October 7th, so there is still a little time to make it if you are close to Munich. It would be interesting to see how many carousels and other rides have converted from traditional bulbs to LEDs. Are the variable speed drives benefiting from modern inverter technology with IGBT power switches? We will soon celebrate the 30th anniversary of the invention of the IGBT, thanks to Hans Becke and Frank Wheatley. This device helps the whole world go 'round! In just a few years it has become the world's preferred switch – it's "gone viral" as they say today - and it's success will continue in new semiconductor materials like silicon carbide (SIC).

The LED event in Bregenz, Austria, in September provided a wonderful update on what is already possible and what will be for using modern semiconductor materials to light buildings. The most popular electronic show this fall will be the Electronica in November.

But before then, we will have a busy October in Germany with the SEMICON Europa in Dresden, the Electric Drives E / DPC 2012 in Nuremberg and the e-car-tech conference in Munich. Travelling to Munich is always initiated by great events, whether social or business.

Communication is the only way to progress. We delivered twelve issues last year and will continue each month, on time, every time. So far this year we have published 121 technical articles, amidst 720 pages of information overall. As a media partner, Bodo's Power Systems is internationally positioned. If you speak the language, or just want to take to look, don't miss our Chinese version: www.bodospowerchina.com.

My Green Power Tip for October:
Porcupines love to hole-up in a pile of leaves to survive the winter, sleeping away as the world awaits a warmer season. Don't panic about all the leaves falling in your garden. Find a corner, pile them up and the porcupines will thank you for it. It is a treat to see this live and not just in children's storybooks.

Best regards,

SPS/IPC/
Drives
Hall 4.330

Future precision.
Future performance.
Now available.

CAS-CASR-CKSR

The transducers of tomorrow. LEM creates them today. Unbeatable in size, they are also adaptable and adjustable. Not to mention extremely precise. After all, they have been created to achieve great performance not only today – but as far into the future as you can imagine.

- Several current ranges from 6 to 50 A_{RMS}
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- High Accuracy @ +85° C
- Access to Voltage Reference
- Analog Voltage output

www.lem.com

At the heart of power electronics.

40 Years Anniversary 1972 - 2012
LEM

Automated Production Center

Leveraging $6MM in U.S. Department of Energy (DOE) funding, Powerex, Inc. is pleased to announce the opening of a new automated production center capable of producing both, silicon and silicon carbide modules used in inverters for the electric vehicle, aerospace and industrial marketplaces. This project positions Powerex as the leading U.S. manufacturer of medium volume high power semiconductor modules.

The DOE grant, awarded in March 2010, provided 70 percent of the funding for the $8.6MM project which increases Powerex' silicon module production capacity from 17K units produced in 2009 to 100K units in 2015.

Looking towards the future of the semiconductor industry, Powerex created this new center to accommodate the production of cutting edge SiC (silicon carbide) MOSFET (Metal Oxide Semiconductor Field Effect Transistor) modules.

Since its inception in 1986, Powerex has been manufacturing custom silicon IGBT (Insulated Gate Bipolar Transistor)-based modules. Recently, Powerex offered the first commercially available SiC MOSFET module. These SiC MOSFET modules can operate at temperatures well beyond the temperature limits possible with the traditional silicon IGBT-based modules, allowing for 38 percent lower conduction losses and 60 percent lower switching losses for a total power loss reduction of 54 percent when operated at 20 kHz.

www.pwrx.com

Back in Business as Privately-Held Corporation

The hybrid product line from Cirrus Logic Inc.'s Tucson-based Apex Precision Power business unit has been sold for USD26 million to a group of private investors led by Alerion Capital, headquartered in Scottsdale, AZ. In doing so, Apex Microtechnology, Inc., which Cirrus Logic acquired in July 2007, has been re-established as a stand-alone corporation.

The Apex Microtechnology brand has a long-standing reputation as an innovator in the design and manufacturing of high-power analog microelectronics that help customers work with the inherent electrical and thermal management issues of end-use circuitry requiring power levels of up to 50 A and 1200 V. These devices are typically used to generate motion control, such as driving piezo electrical devices, and brush and brushless DC motors. Target application markets include high-reliability industrial, test and measurement, medical, aerospace and defense. During its five-year, Cirrus Logic tenure, the Apex Precision Power business unit added precision voltage references to complement its existing power operational and pulse width modulation (PWM) amplifiers. Today, the company has more than 300 product models in its catalog of off-the-shelf component solutions.

"This is an exciting transition for the Apex Microtechnology brand," explained Greg Brennan, president and chief executive officer. "The company is well positioned to capitalize on the growth in customer demand for precision power solutions that deliver higher levels of performance integration. As always, Apex will focus its resources on evolving the technical design expertise needed to keep the company poised as an industry innovator."

Apex Microtechnology will continue design engineering and manufacturing operations at its headquarters facility at 5980 North Shannon Road in Tucson, AZ. This 50,000 square-foot facility includes a 20,000 square-foot Class 5 clean room. The company will retain more than 80 full-time and part-time degreed professionals and skilled employees.

www.apexanalog.com

Promotion of Andy C. Mackie, PhD, MSc

Indium Corporation announces that Andy C. Mackie, PhD, MSc has been promoted to senior product manager, semiconductor and advanced assembly materials.

Dr. Mackie leads the product development and marketing of Indium Corporation's advanced materials for their semiconductor customers' most demanding applications. Through his partnerships with sales, and research and development teams, he has opened up new business opportunities in Asia and the Americas.

Dr. Mackie earned a PhD in physical chemistry from The University of Nottingham, UK, and a Master of Science (MSc) in surface and colloid chemistry from the University of Bristol, UK. He has over 20 years of experience in new product and process development and materials marketing in all areas of electronics manufacturing, including wafer fabrication, electronics assembly, and semiconductor packaging. He is an electronics industry expert in physical chemistry, surface chemistry, rheology, solder materials properties and processes (including solder paste printing), and reflow processes.

Dr. Mackie has written papers and lectured internationally on subjects ranging from sub-ppb metals analysis in supercritical carbon dioxide to pin-probe testing of flux residues. Additionally, he holds patents in novel polymers, gas analysis, and solder paste formulation, and is trained in Six Sigma – Design of Experiments. He is an active blogger and the author of the Semiconductor Assembly blog.

Indium Corporation is a premier materials supplier to the global electronics, semiconductor, solar, thin-film, and thermal management markets. Products include solders, preforms, and fluxes; brazes; sputter targets; indium, gallium, germanium and tin compounds, and high purity metals; and Reactive NanoFoil®. Founded in 1934, Indium Corporation has global technical support and factories located in China, Singapore, South Korea, the United Kingdom, and the USA.

www.indium.com

CUI Signs License Agreement for Advanced Bus Converter Products

CUI Inc, a subsidiary of CUI Global, Inc. has entered into a license agreement with Ericsson, the world's leading provider of technology and services to telecom operators, for their 32-bit processor-based FRIDA II 3E digital Advanced Bus Converter (ABC) family, including the newly released BMR456 quarter brick and BMR457 eighth brick series. The license agreement will enable original equipment makers (OEMs) to address interoperability challenges, reduce time to market, and decrease supply chain risk for these leading-edge digital products. The Advanced Bus Converter family is intended to provide unprecedented performance to system architects developing equipment for ICT (Information and Communication Technology) applications that require a small footprint, fast response time, tightly regulated intermediate bus voltages and high efficiency at any point of operation to reduce power consumption.

“We are excited to add the Frida II products to our Novum® Advanced Power portfolio,” stated Matt McKenzie, President of CUI Inc. “This license agreement will allow CUI to offer our customers an intelligent intermediate bus (IBC) solution to pair with our existing portfolio of digital Point-of-Load products."

“The expansion into IBC was a logical next step in our relationship with Ericsson Power. We are both driving to offer our customers the most advanced digitally controlled products on the market,” McKenzie concluded.

Along with the formal license agreement, CUI and Ericsson announced an expansion of their multi-source power platform cooperation to include a common standard for digital intermediate bus converters on their respective product roadmaps moving forward. This expansion adds to the existing initiative between the two companies to develop and market multi-source, digital Point-of-Load power solutions that are based on the Ericsson footprints and designs. The expanded cooperation provides CUI with a foundation to develop future intermediate bus designs that will incorporate Ericsson’s footprint for digital communication established in their Advanced Bus Converter family.

www.cui.com

Showcase of Europe’s Competitiveness

41 programs and events and 350+ exhibitors await you at SEMICON Europa, Dresden, Germany, October 9-11. This is your platform to exchange and drive forward technology advancements. Programs are matched to the specific needs of today’s European semiconductor industry. Speakers include experts from all major European fabs. SEMICON Europa will demonstrate the readiness of the industry to remain competitive in its successful segments and deal with the innovations to cope with new, disruptive technology such as further scaling, the 450mm transition and 3D-IC to name only the most common breakthroughs which will take off shortly. And, after many years of research and development efforts around the global, Plastic Electronics is gaining momentum for commercialization in areas such displays, lighting flexible and organic photovoltaic and integrated smart systems.

www.semiconeuropa.org

Collaboration Focuses on Reliability of Vehicle Safety Functions

Automated lane-keeping, brake assist systems and other highly complex microelectronic systems in vehicles are already reducing the number of serious traffic accidents. The increasing number and complexity of such safety systems makes tremendous demands on the hardware and software components from the different suppliers – and means that the development of the safety systems and their components need to be better aligned. That is the purpose of the "VeTeSS" project, headed by Infineon Technologies AG. VeTeSS, which stands for "Verification and Test Support for Safety Standards," is working on standardized, reliable and cost-effective development methods to help avoid errors in subcomponents leading to the malfunction of the entire safety system.

There are a total of 24 European partners from the automotive industry and its connected areas working on the VeTeSS research project. Besides Infineon, its German partners include the Fraunhofer-Gesellschaft's Institute for Integrated Circuits IIS, TWT GmbH Science & Innovation, ikv++ technologies AG and exida.com Excellence in Dependable Automation GmbH. The German Federal Ministry of Education and Research (BMBF) is supporting the research project with Euro 2.5 million and the European Union is contributing Euro 3.2 million.

The objective of the VeTeSS project partners is to prepare new automated processes for safety system and subcomponent development in accordance with ISO 26262. With VeTeSS, procedures for the reliability and performance testing in the design phase of the safety system and subcomponents will be standardized for the first time. This will make it possible to correct errors at an earlier stage and further improve the quality and durability of the electrical and electronic safety systems in the vehicle. What is more, the risk of error will be reduced during the certification process that is typically required to prove the efficiency of the safety system.

www.exida.com

www.eas.iis.fraunhofer.de

www.ikv.de

www.twt-gmbh.de

www.infineon.com

Mouser and IDT Sign Partnership for Global Distribution

Mouser Electronics, Inc. announced a new worldwide distribution agreement with Integrated Device Technology, Inc. (IDT), a world leader in the design and manufacture of high-performance analog, mixed signal and power management semiconductors. Mouser's agreement with IDT means customers have faster access to IDT's newest cutting-edge and power-efficient semiconductor solutions, as well as a trusted source for IDT products. IDT is the world leader in timing, serial switching and memory interfaces, and develops products that deliver system-level innovations that optimize customers' applications and enrich the end-user experience.

"We are very excited at the opportunity to offer IDT's world class semiconductor products to our global customers. Our collaboration with IDT is great news for design engineers who want to speed their time-to-market without sacrificing system-level innovations to create the next great product," says Mike Scott, Mouser's Vice President of Semiconductors. "We look forward to a mutually beneficial partnership."

"Mouser has decades of experience as a trusted, authorized distributor of leading edge components for design engineers. We are excited to partner with them to distribute our products," says David Beadle, Director of Distribution Sales and WW EMS at IDT. "This global agreement will allow us to expand our customer bases with Mouser's best-in-class service and streamlined logistics. We're confident that this union will be a plus for everyone involved."

www.idt.com

www.mouser.com

electronica 2012

Hall A6 Stand 163

THEY SAY:

"ANALOG INTEGRATION CAN'T BE DONE."

TRANSLATION:

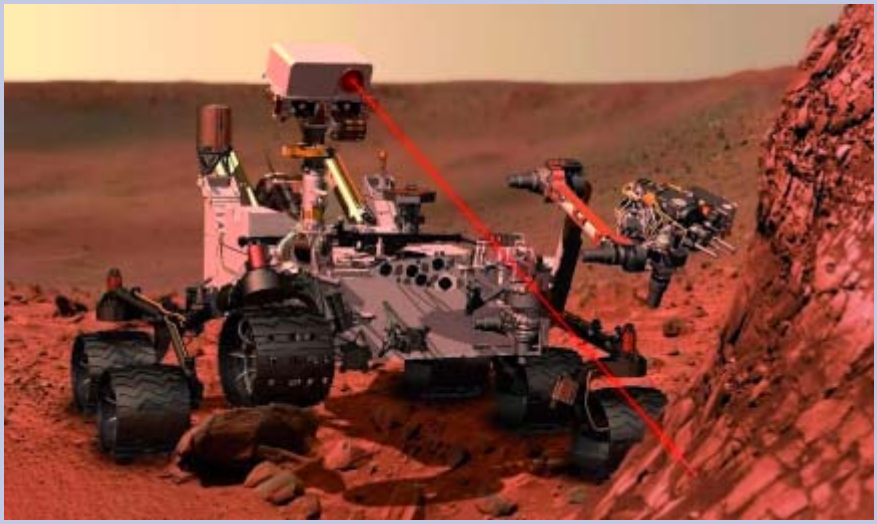
"UM...WELL, THAT SOUNDS LIKE A LOT OF WORK."

IT'S TIME TO BRING ANALOG *TOGETHER*.

www.maximintegrated.com

maxim integrated™

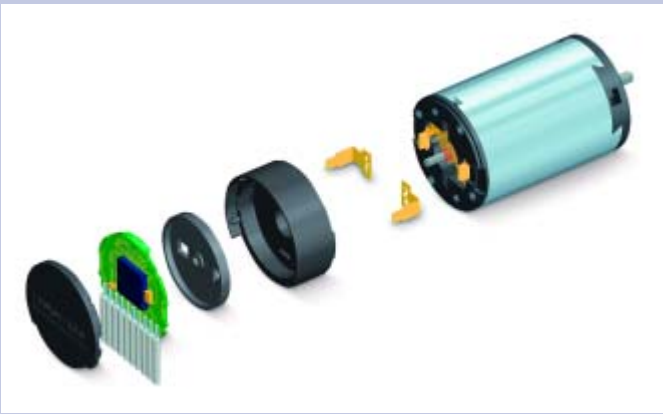
Encoder Technology on Board Curiosity



The landing of the Mars rover Curiosity took seven exciting minutes. Now it will be looking for signs of life on the Red Planet. maxon encoder technology will play a part in the successful excursion of the rover. This is the continuation of the success story of maxon products in outer space and on far away planets.

The new Mars rover Curiosity ended its six month long journey to Mars with a successful landing on August 6th 2012. As everything went according to plan, the control center at Jet Propulsion Labora-tory (JPL; California) erupted in cheers. "It was a wonderful landing, everything looked extremely good" said Adam

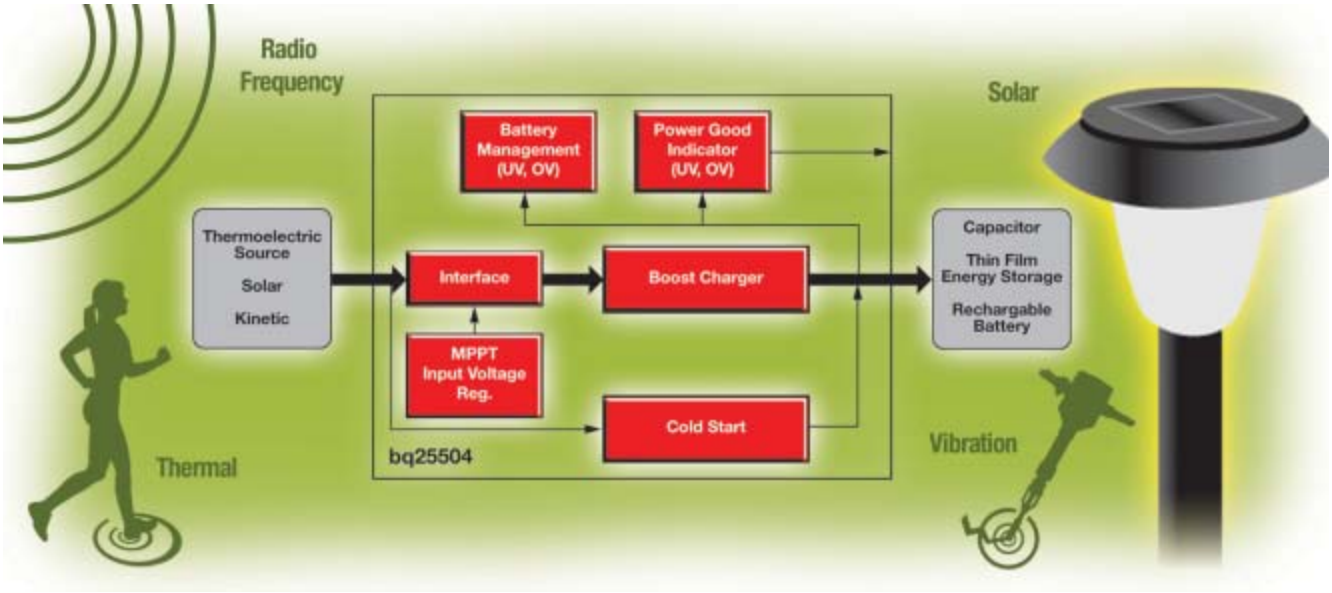
Steltzner, NASA engineer and lead scientist of the JPL landing team, enthusiastically at a press conference. This is the start of a new, exciting excursion on the Red Planet. In contrast to the rovers Opportunity and Spirit, Curiosity can travel further distances on its six wheels and run longer without solar energy as a radionuclide battery gives energy for years. The plan is that the rover shall explore the immense Gale Crater on Mars for signs of life, for two years. And this with impressive equipment on board - a gas chromatograph will hopefully uncover organic compounds; a spectrometer will analyze the composition of rocks which will be collected by the two meter long robot arm and a neutron source will look for hydrogen in the ground.



“From Mars via the International Space Station to the moon“
On its „Mission to Mars“ Curiosity also has maxon products on board. The MR Encoder technology is built in to the electromechanic joints of the rover. The magnetic sensors are mounted on the drive shafts and are responsible for controlling the motors. Apart from that, maxon development services for the drive systems have also played a part in the 900 kilogram rover being able to carry out its Mars Mission successfully. Curiosity's little brother Opportunity is still on its journey on Mars; for the past 8 years the rover has been exploring Mars with the help of maxon motors. A further success for maxon motor is the SpaceX-Mission to the International Space Station (ISS). Amongst other things, brushless EC motors have been used to move the 2 solar panels which always have to be facing the sun in order to supply the Dragon Capsule with power. More flights to the ISS are already planned; the next in September 2012. In 2015 a further rover will be sent explore Mars for the Exomars Mission. The moon is also in sight - at least for the Chinese Lunar Exploration Program (CLEP) when an exploration rover will be sent to the moon. Numerous research satellites nearer to Earth will also be fitted with maxon drives. The next start of such a satellite it’s the ESA Sentinel 3 which will fly into space in 2013. Here maxon motors will be used, for example, in a possible emergency to control and secure the fuel valves.

www.maxonmotor.com

Industry's most efficient boost charger for nano power energy harvesting



The **bq25504** is a highly efficient boost charger IC for nano (ultra-low) power energy harvesting and management applications. The device manages microwatts (µW) to milliwatts (mW) of power generated from a variety of sources such as solar, thermoelectric, electromagnetic and vibration energy.

Its low quiescent current, high conversion efficiency, and flexibility in interfacing to a variety of energy sources and energy storage elements makes the IC unique to the market.

Features

- Extremely low quiescent current (330nA) for this level of integration (i.e. Including battery management and MPPT)
- Unprecedented input voltage 330mV (cold-start) / 100mV (warm-start)
- High conversion efficiency at very low input voltages (>80% @ 400mV)

Applications

- Consumer electronics
- Computer peripherals
- Industrial
- Medical
- High reliability

Wireless sensor networks (WSN) applications

- Area monitoring
- Industrial monitoring
- Structural monitoring
- Waste/water monitoring

www.ti.com/bq25504
Get samples and evaluation modules

Texas Instruments

600V IGBTs Deliver Higher Power Density and Increased Efficiency for Motor Drive Applications

International Rectifier has introduced a family of 600V insulated-gate bipolar transistors (IGBTs) optimized for motor drive applications operating below 10kHz including compressors for refrigerators and air-conditioners.

IR's latest generation Gen7 F devices employ punch-through Trench technology to deliver higher power density and the ability to optimize conduction and switching losses for a specific frequency of operation. The new IGBTs achieve very low VCE(ON) to improve efficiency with zero temperature coefficient for high efficiency across the entire operating range. The devices also offer smoother switching to reduce EMI and overshoots, and are short-circuit rated for motor drive applications.

The IRG7RC10FD and IRG7IC30FD are co-packaged with a soft recovery diode while the IRG7SC12F is a single IGBT that allows the designer to choose a specific diode for the application.

Two motor control reference designs featuring Gen 7 F IGBTs are available. The IRMDKG7-400W features the IRG7SC30FD DPAK IGBT and IRS2334S 3-phase HVIC driver for motors up to 400W. The IRMDKG7-600W features the IRG7SC30FD DPAK IGBT and IRS2334S 3-phase HVIC driver for motors up to 600W. Both reference designs include an optional heat-sink.

The new devices are RoHS compliant and datasheets and an IGBT online selection tool are available on the International Rectifier website at www.irf.com. The selection tool can be accessed directly at mypower.irf.com/IGBT.

Specifications

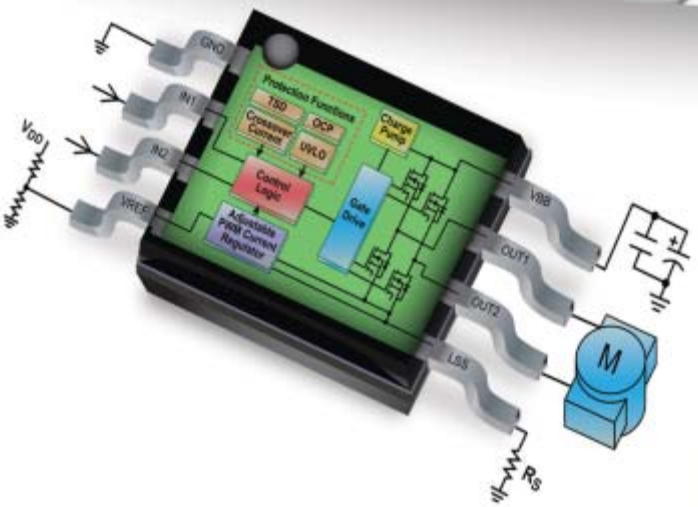
Part Number	Package	Volt	Ic (@100C)	Vceon (typ 25C)	Tsc rating	Speed
IRG7RC10FD	DPAK	600V	9A	1.6V	3us	1-10 kHz
IRG7IC30FD	TO-220FP	600V	12A	1.6V	3us	1-10 kHz
IRG7SC12F	D2PAK	600V	13A	1.6V	3us	1-10 kHz

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

Allegro Motion Control



Brush DC Motor Driver IC Solutions

Allegro MicroSystems, Inc. offers a complete lineup of DC motor driver ICs for all markets, including office automation, automotive and industrial. Depending on the needs of a given application, Allegro IC solutions can include features such as:

- Low standby current for energy efficiency
- Internal DMOS outputs or gate controllers to drive external MOSFETs
- Parallel interfaces with forward, reverse, coast, and brake modes
- Low standby current
- Commercial grade and fully automotive qualified drivers
- Small footprint and reduced external components
- Strong protection and diagnostic features

Featured Allegro Brush DC Motor Driver ICs

	Part Number	Output Voltage Range (V)	Output Current Range	Number of Bridges
Internal MOSFET	A4950*	8 to 40	3.5 A	Single full
	A4952	8 to 40	2 A	Single full
	A4953	8 to 40	2 A	Single full
	A4954	8 to 40	2 A	Dual full
MOSFET Gate Drivers	A3946*	7 to 60	>5 A Typical	Half bridge
	A3921/41*	7 to 50	>5 A Typical	Single full
	A4940*	5.5 to 50	>5 A Typical	Single full
	A4957	4.5 to 50	>5 A Typical	Full bridge

* Automotive Grade Available

Applications include:

Office Automation
- Inkjet / laser printers
- Copiers
- Office equipment peripherals

Industrial
- Power tools
- Factory automation
- Gaming electronics
- Scanners
- Vending machines

Automotive
- HVAC systems
- Hydraulic pumps
- Actuators
- Electronic Power Steering (EPS)

Representatives

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www.allegromicro.com/camp1136

Using Digital Controllers to Provide Greater Flexibility and Precision Control

By David New, Director, Product Marketing, Powervation Inc.

A number of factors are helping to progress the adoption and use of digital power in today's power supply solutions. Advances in our technological capabilities, improvements in IC cost structures, and the demands of the system or loads, to name just a few.

During a product's design phase, its specification may change several times. Perhaps in response to shifting market requirements, in response to competition, or due to changes related to the components that are to be used in making the product. Whatever the reason, these changes frequently impact the requirements of the power supplies used within these products. And with the urgency to bring new products to market quickly and on schedule, there may be little or no time to completely redesign and optimize the power system. As a result, cost, performance, and even reliability may suffer.

Flexibility and a greater level of control are often cited as the reasons why digital has so much to offer. A digital approach can offer a greater flexibility than analog, which can improve a design's time to market, lower engineering costs, and help to more quickly optimize the solution. With DSP/RISC-based digital controllers running firmware, digital solutions are able to utilize complex firmware-based algorithms that would be impractical to implement in hardware, and offer features that autonomously adjust and adapt according to various conditions experience by the power supply. And with precise control of parameters, these feature-rich controllers can allow a greater level of performance in the power supply and system, while enabling a reduction in engineering design margin and costs.

Looking at the topic of protection features, digital solutions can offer a full suite of protection features, and the ability to fine-tune multiple aspects of each of these features (e.g., thresholds, timing, response behaviour, etc.) over a digital bus. While with an analog based solution, the designer's access to the parameters and the ability to customize them, per the design's needs, is more limited and often requires the use of external components to program the parameters that are accessible.

With all the benefits of digital power, can we predict the end for analog power systems in the near future? Well, certainly not yet. Today there are many designs that, while they may find some benefits in digital power, they do not need or currently would not use many of the features brought by a digital solution. A traditional power solution with basic functions is sufficient.

But in time, as requirements for these power supplies and end products evolve, as market demand and legislation requirements changes, and cost structures improve further, we will see further increase in the use of digital control in power supplies. Low-cost AC/DC chargers and power supplies have already undergone a similar evolution as many basic linear transformer based designs have been replaced by switching power supplies, and the efficiency of the chargers have pushed higher and higher in part due to legislation requirements and the improved capabilities in the technology.

To address the need for digital power solutions and to help designers take advantage of digital power's benefits, Powervation develops PMBus™ compliant digital control solutions that provide a high level of flexibility, precision control and reporting, and provide features aimed to improve the converter's efficiency and reliability.

Additionally, Powervation introduced the industry's first and only autonomous, real-time adaptive automatic compensating technology, Auto-Control®, for DC/DC point-of-load converters. As the power supply's load and input conditions change or changes occur in the circuit (e.g., adding/dropping a phase in a multi-phase system, or as changes are made to the circuit during the supply's design), the Auto-Control algorithm continually adjusts the compensation of the loop to achieve stability. During the design phase, this feature helps engineers bring new designs up quicker and helps reduce the time required to complete the design. Once the design is done, Auto-Control adapts to help to ensure stability of the system without having to build in excessive design margin which may add cost and/or reduce performance.

And with the PowerSMART™ GUI-based design tool and the controllers' extensive PMBus command lists, users have the ability to adjust and program >60 power supply design parameters (e.g., protection features). Through the controller's digital interface and via a standard laptop computer, designers are able to quickly configure the power supply and modify the configuration per their design's needs within the GUI environment.

While Powervation's "digital" controller solutions employ a digital core with on-board processors and memory, the controllers actually utilize both analog and digital IC blocks, in an attempt to use the best technology for the function at hand. The resulting solutions give the full performance capabilities of digital (such as precision telemetry, exceptional solution flexibility, and firmware-based algorithms for novel features), but relies on analog blocks when more advantageous.

In the end, it's about using the right tool to get the job done right.

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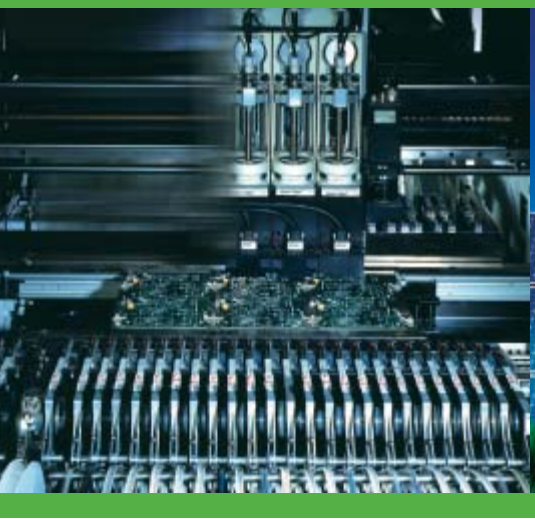
Tamura's New Flux-Gate Current Sensors – The Ideal Solution



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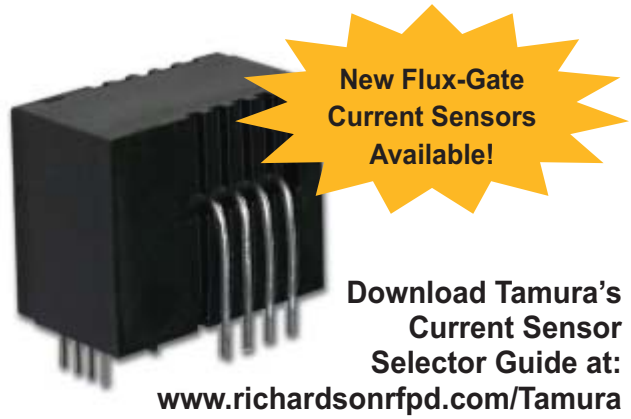

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Series	Primary DC Current	Power Supply	Mounting	Primary	Output Connection	UL 508
F01P***S05	±6A, ±15A, ±25A, ±50A	+5VDC	PCB	Integrated Primary	2.5V±0.625V	Yes
F02P***S05	±6A, ±15A, ±25A, ±50A	+5VDC	PCB	Integrated Primary	2.5V±.625V & VREF IN/OUT	Yes
F03P***S05	±6A, ±15A, ±25A, ±50A	+5VDC	PCB	Integrated Primary	2.5V±.625V & VREF IN/OUT	Yes

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Electronics Industry Digest

By Aubrey Dunford, Europartners

SEMICONDUCTORS

The semiconductor industry continues to navigate the turbulent global economy better than most sectors, but macroeconomic uncertainties are limiting overall recovery and growth. Worldwide sales of semiconductors reached $ 24.38 billion in June 2012, a slight decrease of 0.1 percent from the prior month, so the WSTS. Sales from June 2012 were 2 percent lower than the June 2011 total. Compared to June 2011, sales in June 2012 increased in Japan (3.7 percent) and Asia Pacific (1.0 percent) but fell steeply in the Americas (-8.1 percent) and Europe (-12.1 percent). Measured in Euro, semiconductor sales were € 2.199 billion in June 2012, up 1.2 percent on the previous month and down 1.4 percent versus the same month a year ago. Second quarter worldwide sales of $ 73.1 billion represent a 4.7 percent increase from the first quarter 2012. Quarter-to-quarter sales in Europe are nearly stable, showing a 0.2 percent decline.

IDT has acquired NXP's high-speed data converter assets and Alvand Technologies, an analog IP company specializing in data converters. Terms of the deals were not disclosed. These transactions solidify IDT's position as a comprehensive solutions provider for wireless infrastructure. Intel has also selected IDT to develop an integrated transmitter and receiver chipset for Intel's wireless charging technology based on resonance technology.

International Rectifier, a supplier in power management technology, announced operational restructuring activities including the closure of its El Segundo, California, fabrication facility by the end of March 2013. The company is also resizing its Newport, Wales, fabrication facility, which is expected to continue in several phases through the middle of calendar year 2015.

ON Semiconductor committed to a cost reduction program to align its costs to the slower growth environment. The plan includes the elimination in workforce of approximately 250 employees.

The hybrid product line from Cirrus Logic's Apex Precision Power business unit has been sold for $ 26 M to a group of private investors. In doing so, Apex Microtechnology, which Cirrus Logic acquired in July 2007, has been re-established as a stand-alone corporation involved in high-power analog microelectronics.

Lincoln-based Dynex Semiconductor has opened a new Research & Development Centre for power electronics as part of an £ 11.25 M investment. This project is developed by Dynex in partnership with Zhuzhou CSR Times Electric (the majority shareholder of its parent Dynex Power, Canada). Dynex makes high power bipolar semiconductors, IGBT modules and electronic assemblies.

Total silicon wafer area shipments were 2,447 million square inches during the second quarter 2012, a 20 percent increase from the 2,033 million square inches shipped during the previous quarter, so SEMI. New quarterly total area shipments are 2 percent greater than second quarter 2011 shipments. Given the ongoing market uncertainties and challenges, the overall wafer demand for 2012 is expected to be relatively flat compared to 2011.

OPTOELECTRONICS

Sharp will slash 5,000 jobs, or 9 percent of its global workforce, by next March 31 to turn around its business, hit hard by a slump in television sales. Hon Hai Precision Industry has also struck a deal with Sharp to revise the agreement under which it will take a 9.9 percent stake so as to reflect the Japanese electronics manufacturer's wallowing stock price.

PASSIVE COMPONENTS

Powerstax has acquired DP Energy Services, a transformer rectifier and transformer designer and manufacturer based in Wickford, Essex. The acquisition expands Powerstax's product range and market address which fits with their strategy of moving into higher power sectors and 'greener' markets.

OTHER COMPONENTS

Agilent Technologies has acquired the assets of AT4 wireless' Test Systems business. Privately held AT4 wireless, based in Malaga, Spain, is a provider of testing services and solutions for wireless communications, especially in the rapidly growing LTE market.

TDK-Lambda has opened a new European Logistics and Supply Centre in Achern, Germany. The 2,300 m2 facility is an increase of 900 m2 and will hold around € 5 M worth of stock. Last year the European Warehouse supplied more than 8,000 customers with more than 1 million products.

EMS PROVIDERS

DISTRIBUTION

European distribution bookings in Q212 declined by 4.6 percent compared to the previous quarter and by 16.3 percent when compared to the same period in the previous year, so the IDEA (International Distribution of Electronics Association). Sector specific bookings changes in Q212 compared to the same period in 2011 were: semiconductors declined by 23.1 percent; passives declined by 12.7 percent; and electro-mechs and other components declined by 11.2 percent. European distribution billings in Q212 declined by 7.8 percent, when compared to the previous quarter and by 17.8 percent compared to Q211.

Avnet has acquired the operating assets of C.R.G. Electronics, an Israeli company. CRG is a distributor of PC products and electronic components serving the Israeli electronics industry. In 2011, the electronic components business of CRG generated revenue of approximately $ 23 M.

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:

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DC Microgrids a Growing Worldwide Trend

By Richard Ruiz, Research Analyst, Darnell Group

The growing demand for electric power generation outside of the traditional utility power grid is expected to provide microgrids with a substantial opportunity for growth over the next several years. Although microgrids have been around for decades, they were typically ac powered and operated using dirty fossil fuel generation. However, with today's variety of efficient small, renewable energy sources available, distributed generation using private renewable energy systems is now possible and is seen by many as a new energy paradigm. In addition, the adoption of dc power is expected to play an important role in the expansion of microgrid technology.

Actually, direct current microgrid power distribution is widely used in telecom central offices today, and this technology, in conjunction with the development of an intelligent grid, open up possibilities for microgrids to supply dc power instead of ac power in other areas, such as data centers and other facilities that would traditionally rely on ac power. The adoption of a dc power delivery system has the potential to enhance the integration, operation and performance of a microgrid facility. In fact, dc microgrids are an emerging concept that could gain traction as other emerging technologies become more established.

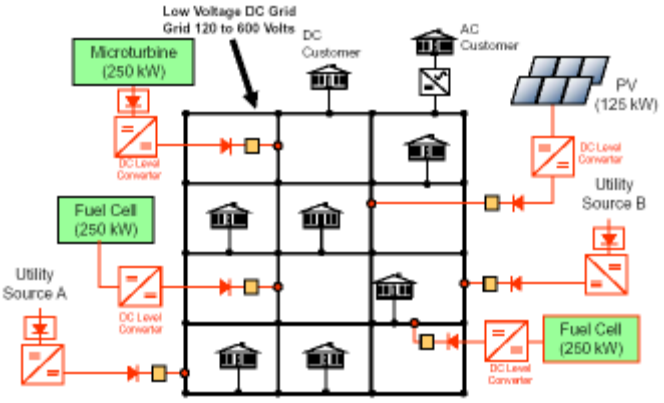
At the third-annual DC Building Power Asia conference in Taipei, Taiwan in December 2011, Dr. Tsai-Fu Wu, Chair Professor and Vice President of National Chung Cheng University in Taiwan and Director of the Elegant Power Application Research Center, presented the concept of the „smarter grid" where smart grid technologies are used to efficiently and comprehensively integrate local dc micro grids with the larger ac-power grid.

A dc microgrid generally consists of some form of dc power generation (i.e. fuel cell, solar PV panels, or micro wind turbines); dc electrical storage (e.g. battery or super capacitor); dc power distribution (e.g. wiring and control); dc powered devices (e.g.. laptops, telephones, satellite TV controllers) and dc lighting systems (e.g. LED's). They may take the form of a shopping center, industrial park, college campus or other facility. Dc microgrids can also be defined as power generation systems on a much smaller scale, at the facility level, either a single building or a group of buildings.

With the emphasis on energy efficiency, dc microgrids could be a cheaper and more efficient alternative to ac mains powering. Fuel cells and many small-scale renewables natively generate low-voltage dc power, and they require power inverters that can be costly and inefficient. A number of companies have proposed installing a dc network linking dc devices to dc power supplies.

Adding intelligence and Internet connectivity to dc microgrid controllers would further enable these systems. Companies like Moixa Energy, Horizon Fuel Cell, BOC, Sun Microsystems, and Philips are already offering products to support the dc microgrid concept. Although some homes and facilities generally require an ac supply for inherently "high" power devices such as washing machines and dryers, there are quite a number of environments, such as offices site and outdoor events, where these devices are not used. In such cases, a dc microgrid could be the sole power provider.

The elimination of inverter costs, along with simplified installation procedures and reduced fuel costs, provide microgrids with the potential to become cost-effective and operate independently of the electricity grid and conventional mains-power generators. The adoption of a system allowing the delivery of dc power to a microgrid has the potential to provide a facility with a number of advantages. With dc distribution, solid state switching can quickly interrupt faults, providing better reliability and power quality. If tied into the ac transmission grid, a dc powered microgrid makes it easier to avoid back-feeding surplus generation and fault contributions into the bulk utility system (by use of a rectifier that only allows one-way power flow).



Source: Electric Power Research Institute (EPRI)

Figure 1: DC Microgrid Configuration (Simplified for Illustration)

Also, in a low-voltage dc system like one that would be suitable for a home or group of homes, a line of a given voltage rating can transmit much more dc power than ac power. An example of this type of arrangement could be a neighborhood microgrid that runs entirely on direct current – rather than alternating current. In fact, as renewable energy technologies such as solar photovoltaics and wind power become more widespread at a household level, the development and use of a dc microgrid could be a cheaper and more efficient alternative. A possible course of action is to install a dc network linking dc devices to dc power supplies.

So far, due to higher electrical losses associated with transmitting a fixed amount of power as low voltage dc, rather than higher voltage ac, such networks have not yet emerged. However, with the proliferation of low power electronic devices, offering the potential for LEDs to reduce lighting loads by up to a factor of 10, along with the potential for efficient distributed power generation, localized dc networks – or dc microgrids – may finally be practical.

In addition to reducing resource and financial costs, a key advantage of developing a dc microgrid is the low risk of dangerous electric

shocks and injury from low voltage dc, making plug-and-play grids a possibility. This greatly reduces the installation cost of micro-generation, and could encourage end users to take responsibility for understanding and controlling their individual energy consumption. Another step towards the viability of microgrids could be the addition of intelligence and internet connectivity to dc micro-grid controllers, which would further enable consumer engagement with ac mains devices – through the use of smart metering and ultimately dynamic demand management. Implementation could greatly reduce the costs associated with periods of high and low power consumption.

The use of dc microgrids is also being considered as a way to decentralize the power architecture of the US telecom system. According to Dr. Alexis Kwasinski of the University of Texas, de-centralized power architecture would have kept the lights and phones on in New Orleans, Louisiana during Hurricane Katrina in 2005. The Gulf coast region after Katrina showed how devastating a single downed line or incapacitated substation can be. The answer to this problem is diverse power input. Different types of local power sources are integrated with diverse energy delivery infrastructures through multiple-input converter modules.

Dr. Kwasinski maintains that a microgrid-based power plant with its own local power sources and independent control would be more dependable, efficient, and cost effective than traditional telecom power systems. Microgrids would also be a quick and inexpensive way to include renewable energy sources for both existing and developing systems.

Since the communications industry power standard is direct current local networks, dc generation systems using a microgrid-based telecom power plant with a modular distributed architecture is a reasonable choice. Energy would come from a mixture of renewable energy sources such as microturbines or fuel cells, and interconnection to the existing utility grid. Converters in secondary distribution frames would isolate short circuit currents. Since the utility grid is a secondary source, the microgrid would be protected against the grids surges and failures. The savings would be generous. In fact, microgrids could sell excess power to the utility grid.

Costs decrease because of reduced energy storage, less down time, equipment operating at maximum efficiency, lower hardware expense, and optimal power input control based on energy costs. The approach is flexible, as existing systems can be retrofitted with a microgrid system operating as a secondary distribution method. In most cases, the common source of power outside the microgrid will be ac from the utility grid. The microgrid will, as required, generate and store power locally from a variety of chosen technologies that are driven by each client's specific requirements. Excess generated power will, preferably, be stored serving client back-up or peak-mitigation needs. Most locally available power will be converted to or generated as dc because dc is the most common currency required by today's electronic devices.

High Reliability for 1200V High Voltage Integrated Circuit for Half Bridge Applications

Reduce the IC's supply current for about 50%

This article presents a high reliability 1200V High Voltage Integrated Circuit (1200V HVIC) for half bridge driver applications. It is suitable to drive Power MOSFET/IGBT module in industrial inverter systems. The pin configurations and the functions are compatible with the previous 1200V HVIC, where high reliability is achieved by high switching noise immunity realized by using a new process and protection circuits.

By Masahiro Yamamoto, Liang Xiaoguang, Manabu Yoshino, Takanobu Takeuchi and You Habu, Power Device Works, Mitsubishi Electric Corporation, Japan, and Marco Honsberg, Mitsubishi Electric Europe B.V., Germany

As the inverter system market for industrial purposes grows motivated by the energy saving trend, the demand of IGBT module driver for motor drives is increasing. MOSFET/IGBT modules in AC 400V inverter systems require high reliability of a 1200V HVIC driver, because the operating condition is severe under the various switching noises. Mitsubishi Electric Corporation released a 1200V HVIC (M81019FP) in 2005 [1]. A new 1200V HVIC (M81738FP) has now been developed applying the 2nd Generation Divided RESURF structure. It has evolved from the previous 1200V HVIC (M81019FP) [2] [3], and is pin- and package compatible with the M81019FP.

Technologies for High Reliabilities

High latch-up immunity by utilization of a new 1200V HIC process

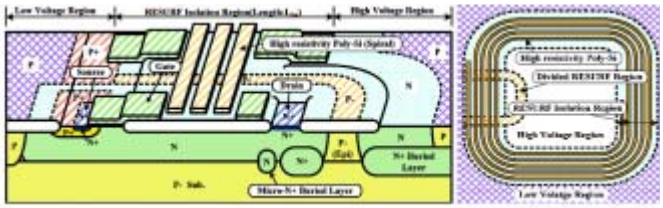


Figure 1: A cross-sectional view of 1200V Nch-LDMOS applying the 2nd Generation Divided RESURF Structure, and a top view of a PolyRFP

As shown in Figure 1, the main different features between the new process structure and the conventional process are P-epi/P-substrate, N+ buried layer and high resistivity Polycrystalline silicon Resistor Field Plate 'PolyRFP" [2]. Figure 1 shows a top view of a PolyRFP around the high voltage region [2]. The high resistivity Poly-Silicon area shaped like a spiral connects the high voltage electrode to the low voltage electrode on the RESURF Isolation Region. Furthermore, it relaxes the surface electric field effectively more than the conventional Multiple Floating Field Plate "MFFP". Thus it achieves a break-down voltage above 1200V as shown in Figure 2.

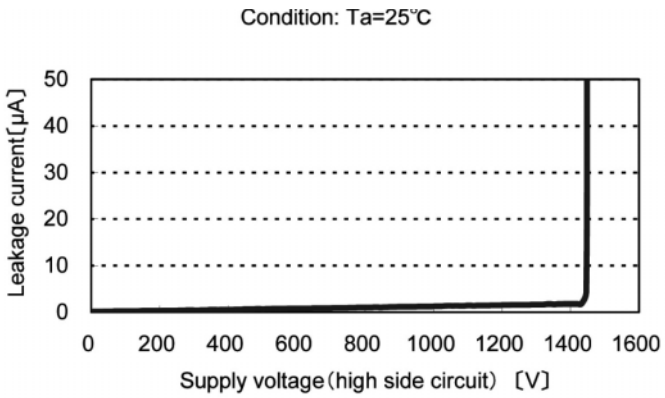


Figure 2: A breakdown voltage of M81738FP (high side Circuit)

The conventional process structure is the 1st Generation Divided RESURF Structure which has a deep N well diffusion layer in the P-substrate [4]. Since the deep N well diffusion layer has a very high impedance, switching noise may cause a latch-up by the activation of the parasitic PNP transistor. Therefore, the CMOS transistors in the chip are placed with a distance to each other in order to prevent a latch-up. As a consequence of this distance requirement the chip size had to be enlarged respecting the applied design rule. The 2nd Generation Divided RESURF Structure indicates the N+ buried layer with-in the Pepi / P-substrate as shown in Figure 1. The N+ buried layer impedance is lower than the N diffusion layer achieving a high latch-up immunity [2]. A parasitic PNP transistor action is generally caused by a transient current (which for example is caused by the noise from the power supply) which flows through the N diffusion layer. However, the N+ buried layer, which is shown as RN+ in Figure 3, can prevent this action, because the low voltage which occurs in the RN+ (low impedance) does not reach the threshold voltage of the parasitic PNP transistor. Thus the new 1200V HVIC process pattern layout now allows to approximating the CMOS transistors to each other maintaining a high latch-up immunity. In addition, the CMOS

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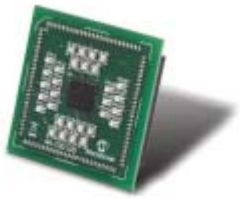

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transistors themselves were shrunk. Figure 4 shows the chip photographs of both M81738FP and M81019FP. The M81738FP's chip size is the half size of the M81019FP's chip. The new 1200V HVIC process realized both, high latch-up immunity and shrunk chip size.

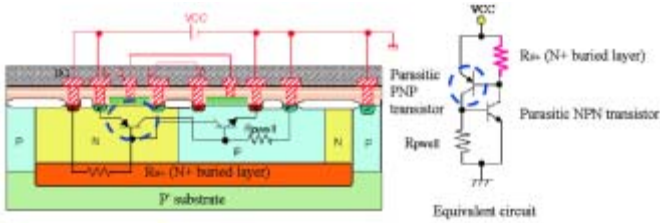


Figure 3: N+ buried layer of the 2nd Generation Divided RESURF structure in low side circuit and the equivalent circuit

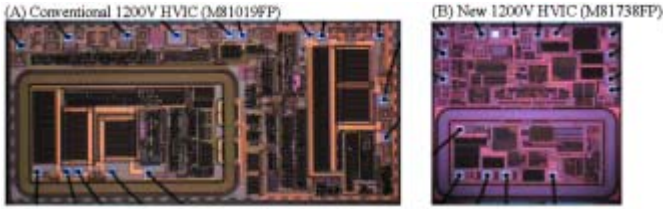


Figure 4: Chip photos of the 1st generation (A left) and the latest generation of 1200V HVIC (B right)

High immunity to power supply surges

Using a shrink wafer process may reduce the immunity to switching noise originating from the power supply during operation.

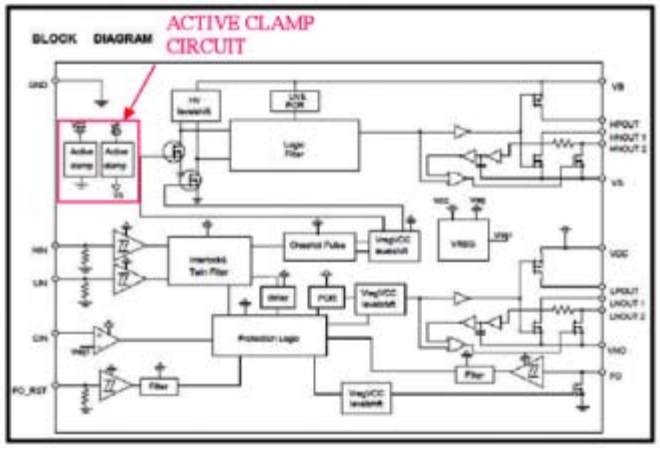


Figure 5: Functional block diagram of M81738FP

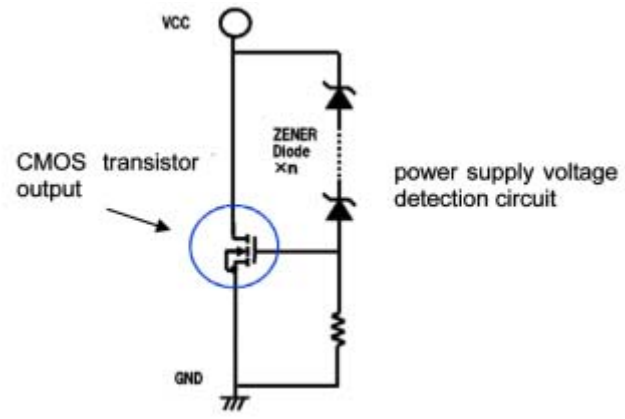


Figure 6: Active supply clamp circuit diagram

Figure 5 shows the M81738FP's functional block diagram that reveals an active power supply clamping circuit to protect the other internal circuits from the power supply surges which are generated by switching noise.

Figure 6 shows that this active clamp circuit is composed of the CMOS transistor output, which absorbs the surge energy, and the power supply voltage detection circuit.

When a power supply surge occurs exceeding the threshold voltage of the detection circuit, the CMOS transistor output is turned-on. Hence the CMOS transistor absorbs the surge energy and prevents that the other internal circuits would be destroyed.

The performance of the active clamp circuit depends on the transistor size of the CMOS transistor output. If the CMOS transistor size is large, the active clamp circuit performance is higher. But that means that the high performance causes a large chip size. However the CMOS transistor output size of M81738FP is optimized between the chip size and the performance requirements based on several evaluation results. As a conclusion Figure 7 shows that M81738FP achieves higher performance and more safety margin than the previous 1200V HVIC (M81019FP).

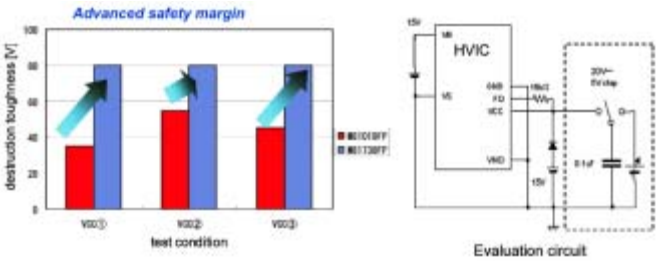


Figure 7: Destruction toughness at V_{cc} node: M81019 vs M81738FP Condition: Vcc(1):HIN=0V, LIN=5V, V_{cc}(2): HIN=5V, LIN=0V, V_{cc}(3): HIN=0V, LIN=CIN=5V

High immunity to Vs minus undershoot noise

Figure 8 shows typical connection diagram of a half bridge application circuit. In the switching action, when the high side transistor Q1 is turned-off, the inductive load causes the current (IFW) to keep on flowing. Therefore, because the current (IFW) flows through the parasitic inductance L3-L4 and the FWDi of Q2, a transient Vs minus undershoot peak occurs at the Vs node. This peak may lead to two problems which are the HVIC destruction at worst case or a wrong signal at the HO output.

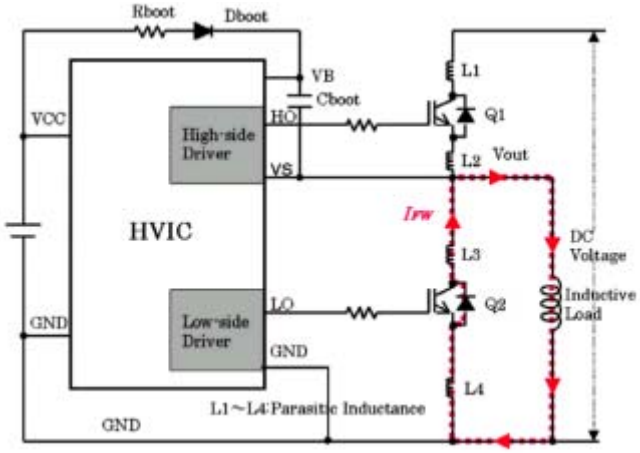


Figure 8:
Typical connection diagram of a half bridge application circuit

However, the M81738FP has got a high immunity to Vs undershoot. Figure 9 shows the turn-off waveforms of a DIPCIBTM which is driven by a M81738FP [1]. Thus no destruction and no wrong function occurred even at 3 times the Ic rating.

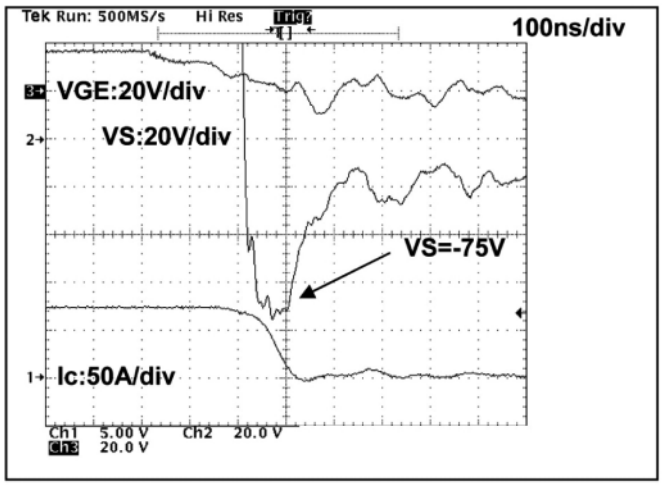


Figure 9: Waveforms of DIPCIB™ during turn-off, Conditions: Ta=25°C, Vs=600V, Rg=0Ohm, VGE015V

Compatibility with the previous industrial standard 1200V HVIC model M81019FP

It is easy to substitute the previous 1200V HVIC model (M81019FP) with this latest generation product (M81738FP), because they are pin- and package compatible to each other. The product's pin configurations and functions are the same as those of the M81019FP.

Future developments

This new shrink process which is applied to M81738FP has several potentials to benefit to the inverter system. The M81738FP's propagation delay is designed to be equal to that of the M81019FP by using delay circuits. However, the circuit operation speed of the new shrink process is 2 times faster than that of the conventional process. Next new 1200V HVICs will be able to realize a short propagation delay contributing to reduce the dead time. Thus the reduced dead time will provide an advantage to the inverter's control system design.

Another potential is the reduction of the power supply current. It will be possible to reduce the IC's supply current for about 50% more than the M81738FP today. More potential is realized by a laser trimming technique which equalizes the lot by lot performance deviations. Such an optimization can be employed e.g. for the threshold level linked to the current detection level of the short circuit protection circuitry.

Literature

[1] Marco Honsberg, et al., Proc. of PCIM2005, pp.461-468, (2005).
[2] M. Yoshino et al., Proc. of ISPSD'10, pp.93-96., (2010)
[3] K. Shimizu and T. Terashima, 'The 2nd Generation divided RESURF structure for High Voltage ICs', Proc. ISPSD, 2008,pp.311-314.
[4] T. Terashima, K. Shimizu and S. Hine: 'A new Level-shifting Technique by divided RESURF structure', Proc. ISPSD, 1997, pp.57-60.

Using Bidirectional Power Supply to Modulate Voltage on the Output

Special technical requirements for switch mode power supplies are pushing to the limits of their performance, requiring a well optimized topology like the latest telecom RF power amplifiers, are well optimized.

By Milan Marjanovic and Roberto Scibilia, Texas Instruments

The key to increasing efficiency is envelope tracking or, “envelope of envelope tracking”, so-called slow drain modulation. In this case, the supply voltage will be modulated according to the required RF power, in order to minimize power dissipation on the output stage. Following on from the previous article, “High Speed, Two Quandrant DC/DC Power Supply describes the practical limitations of 350W telecom SDM power supplies.

Let us start with principles of the envelope tracking technique and slow drain modulation as shown in Figure 1.

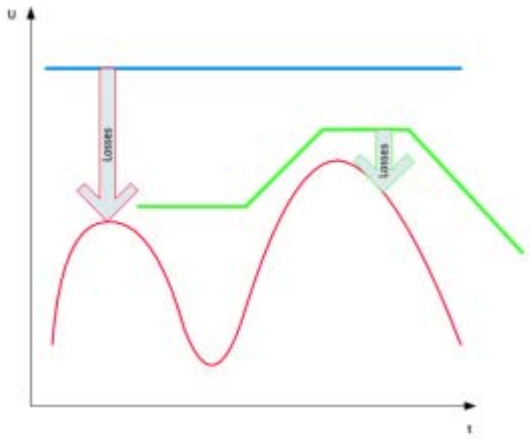


Figure 1: Envelope tracking technique and slow drain modulation

The red line represents the envelope of the output RF signal. The blue line represents a voltage level of the system with constant voltage supply at the power amplifier. In this case the power losses are directly proportional to the length of this red arrow. Having the possibility to modulate the supply voltage (represented by the green line) accordingly, it is possible to reduce the average power losses dramatically.

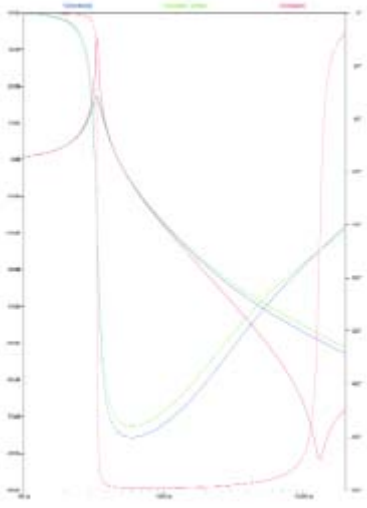
This decreases the power consumption, thermal interface and its costs. All this is only possible using high speed, high dynamic Two Quadrant Power Supplies.

The repetition rate of this modulation can be in the range of several hundred Hz and the amplitude of the modulation can be greater than 12Vpp. If we take 500us as the maximum required for up slope and down slope, we can talk about 1kHz modulation. Tuning the voltage up and down periodically in no load condition, the converter will try to charge and discharge the capacitance on the output accordingly. Since we have a big capacitance at the output filter and big capacitance at RF amplifier as well, it is clear that the optimization of this parameter plays a key role. Usually the output filter is a LC filter. L has to be a storage choke (with low R_{esr} and low core losses, a good rule of thumb is 25% ripple current) and an electrolytic capacitor big enough to place the frequency corner at two decades lower frequency than switching frequency. This is only the start point, the cross check with load step transient response has to be done as well. However, in this case we get the value of 160uF. If we calculate the power losses (caused by tanδ - low frequency losses in a capacitor) we will get the following:

$$P_d = \tan\delta \times 2 \times \pi \times f \times C \times U_{rms}^2 = 0.1 \times 2 \times \pi \times 1E^3 \times 160 \times 10E^{-6} \times 4.25^2 \approx 2W$$

Considering that we have a 1kHz sine wave, the modulation amplitude is 12Vpp. If we have a triangular wave form these losses are going to be higher owing to high frequency harmonics. In addition, there are high frequency ripple current losses. Altogether, this results in very high losses for a small capacitor in a high temperature environment.

The alternative is to use ceramic capacitors. Ten or twenty such parts (standard 10uF/50V X7R capacitors) are needed to reach the required capacitance for filtering and sufficiently low impedance for transient response. The electrolytic capacitor has an apparently ‘magic’ behaviour with its low frequency zero:



$f_z = 1/(2 \times \pi \times R_{esr} \times C)$; i.e. 25kHz for this capacitor. This zero pushes up the phase of the power stage and changes the slope from -2 to -1, making possible loop compensation at higher cross-over frequency.

Figure 2: Using ceramic capacitor causes strong phase loss (red line), using simple resistors in series will pull the phase back (green line)

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Using ceramic capacitors, there is very low R_{ESR}, pushing the f_z to very high frequency (>250kHz). These force possible instabilities, since slope remains at -2, and push the practical cross-over frequency to lower frequency range, which is not of interest.

We can see these two situations in the simulated plots in Figure 2.

We can see that, only using ceramic capacitor causes strong phase loss and huge Q of the filter itself (high peaking of the resonant frequency, red line). Using simple resistors in series with the ceramic capacitor bank will pull the phase back and dampen the filter (green line). The new R_{esr} value chosen is 50mOhm, which is close to the R_{esr} of the electrolytic capacitor. This is why these two curves are close to each other. This value could be higher (giving more phase margin and better damping), but it is limited by reflected ripple voltage. Since the impedance of the capacitor bank is now minuscule versus external R_{esr}, the complete measured ripple voltage on the output is now a measured voltage drop of the ripple current across this resistance. On the one hand the ripple voltage is given by the specification, and on the other, the ripple current is now limited by this external resistance. To make the right selection of these resistors we have to take care of the following power losses:

- Ripple current losses (high frequency currents)- P_{d_ripple}
- Modulation losses (low frequency losses)- P_{mod_sine}, P_{mod_trian}
- Peak power losses (caused by huge load step current)- P_{peak}

These power losses are calculated as follows:

$P_{d\_ripple} = R \times I_{rms}^2$

$$P_{mod\_sine} = R\frac{(\omega CU)^2}{1+(\omega CR)^2}$$ For sine wave

$$P_{mod\_trian} = RC^2D\left(\frac{\Delta U}{\Delta t}\right)^2$$ For triangular wave form; D is a duty cycle, in this case 0.5

$P_{peak} = R \times I_{load\_step}^2$

Practical results

In figure 3 we see a top side view of a 350W SDM power supply for telecom applications- hardware.

Figure 3: 350W SDM power supply, hardware top side view

In figure 4 a sine wave modulation is shown. Input control voltage is 1Vpp; output voltage is 12Vpp and modulating frequency is 1kHz.

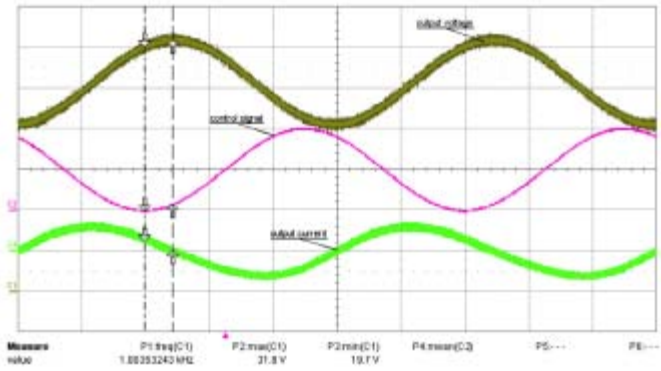

Figure 4: Modulating voltage on the output, CH1 Output voltage 5V/div; 200us time base, CH2 Control voltage 500mV/div and CH4 Output load current 5A/div

In summary, the converter's specifications are shown in the table 1.

Input	• Telecom DC bus input voltage range 36..60V
Output	• 20..32V DC adjustable • 11A continuous, 22A peak (350W, 700W peak) • Ripple 100mVpp (@ 20MHz BW measured) • Load step 0% to 100% with voltage deviation < 2% • Up slope settling time 20V->32V better then 150us, • Down slope settling time 32V->20V better then 300us • 88%< Efficiency < 96% • Isolation 1500VDC
Mechanics	• Single side assembly, slim line, maximum height < 16mm
Extras	Forward power: cycle by cycle current limitation • Backward power: average current limitation • SDM control signal: slope limitation

Table 1: Converter specifications

Summary:

We discussed bi-directional power supplies (see also Article "High Speed, Two Quandrant DC/DC Power Supply", "Voltage Mode Versus Current Mode"); using these to make high speed power supplies and how to modulate the output voltage. We discussed system setup, synchronous rectification, practical issues with regulation techniques and how to use it. In summary:

Use a topology with synchronous rectification for a high performance and high speed power supply. Only for this reason it is possible to work in two quadrants and therefore, achieve a good load transient behaviour.

Disable any burst or power saving mode and enable continuous conduction mode all the time. This reduces efficiency at low or no load conditions, but it is the only way to react quickly to high load current changes.

Avoid any components with low pass behaviour like optocouplers in the voltage feedback loop. The highest bandwidth is achieved, if the PWM controller is placed on the secondary side.

Use voltage mode control and bi-directional current sensing to avoid instabilities when current flows backwards (from the secondary side to the primary side).

References:

"High Speed, Two Quandrant DC/DC Power Supply", "Voltage Mode Versus Current Mode"

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Power Modules Featuring a Split Output

Having proven its merits in DC/DC converters

Customers want smaller, even more affordable devices, compelling manufacturers to conserve installation space and cut costs. To do both, engineers have to come up with new designs that combine technologies in unprecedented ways.

By Patrick Baginski, Field Application Engineer, Vincotech GmbH

The trend tendency towards IGBTs and MOSFETs with higher switching frequencies is also picking up momentum, particularly for solar inverters and other applications where high efficiency is a must. This places even greater demands on drivers and power supply modules. In many applications, IGBTs and MOSFETs are driven by unipolar gate voltage, which presents considerable challenges when it comes to parasitic turn-on. The MOSFETs' body diode is not powerful enough for many applications, which impedes reactive power. In this document, Vincotech looks at the benefits of its standard modules featuring H-bridges with split outputs, neutral point clamped (NPC) inverters, and MNPC (mixed voltage NPC) topologies. What sets these modules apart is that their phase output is split, which deactivates the MOSFETs' body diode and makes it easier to power the semiconductors.

Introduction:

To survive and thrive on the solar market, companies have to meet their customers' increasingly rigorous demands for higher efficiency and lower costs. The pressure to drive down costs by optimizing their technology is also rising as the rates paid out for electricity fed into the grid continue to drop.

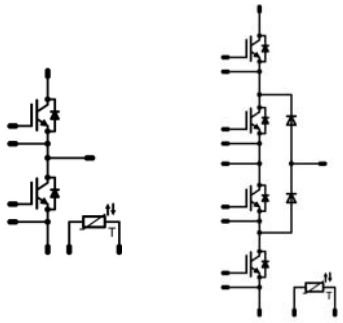

Figure 1: 2-level and 3-level NPC topologies

One way to achieve higher efficiency is to employ three-level topologies with 600 V IGBTs rather than half-bridge modules with 1200 V switches. Although this requires twice as many components, the 600 V versions are far less susceptible to switching loss. And the semiconductors are also more affordable because their silicon area is smaller.

A device's success on the market hinges on the overall system costs. With 3-level inverters, the filter is just half the size of that in a 2-level topology with the same switching frequency. This drives down costs and makes the devices more compact. Switching frequencies are often increased because this can easily be done with 600 V components. However, the drivers' supply units also have to be matched to the higher switching frequency. Often switches are addressed using unipolar voltage, which means highly efficient power supplies may be installed to increase the system's overall efficiency.

However, unipolar voltage is counterproductive for fast-switching components. There are varies ways of mitigating parasitic turn-on – for example, by installing a Miller clamp or an additional capacitor between the gate and emitter. Unfortunately, these methods' are not entirely effective or they have other drawbacks.

MOSFETs are used to achieve even higher switching frequencies. Many applications require a level of reactive power that in many cases cannot be achieved with MOSFETs' body diodes. This is why additional diodes are installed to commutate current.

Modules with a split output:

Vincotech modules with a split output are the way to go for manufacturers seeking to increase efficiency without having to opt for more elaborate drive circuits.

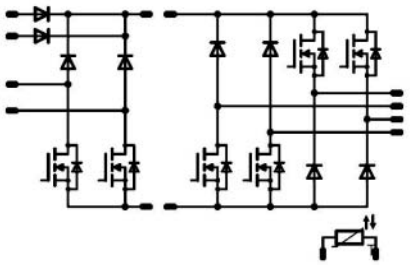

Figure 2: Topology with a split output

The example in figure 2 shows a topology designed for solar applications. Two boost stages with bypass diodes are on the panel side; an H-bridge with a split output is on the grid side. The two branches in the module are split to a switch and the associated freewheeling diode.

This has two obvious advantages in that it:

- Decouples the junction capacitance of the complementary device
- Decouples the MOSFET body diode

The inductance at the output retains some stored energy during turn-off that wants to continue flowing. It will commutate to the lowest inductance inside the module rather than the other outer inductance. A higher inductance at the output will boost this effect. The low inductance of each pin has a positive effect in that it helps prevent shoot-through and makes life much easier when it comes to configuring the driver circuit.

Decoupling the complementary device's junction capacitance helps prevent parasitic turn-on owing to the low pin inductance or the fact that a PCB layout in the range of 10_nH to 100nH is used. The complementary switch does not have to cope with high du/dt values so that parasitic turn-on can be avoided in most cases, or the driver circuit will be that much easier to implement. Often

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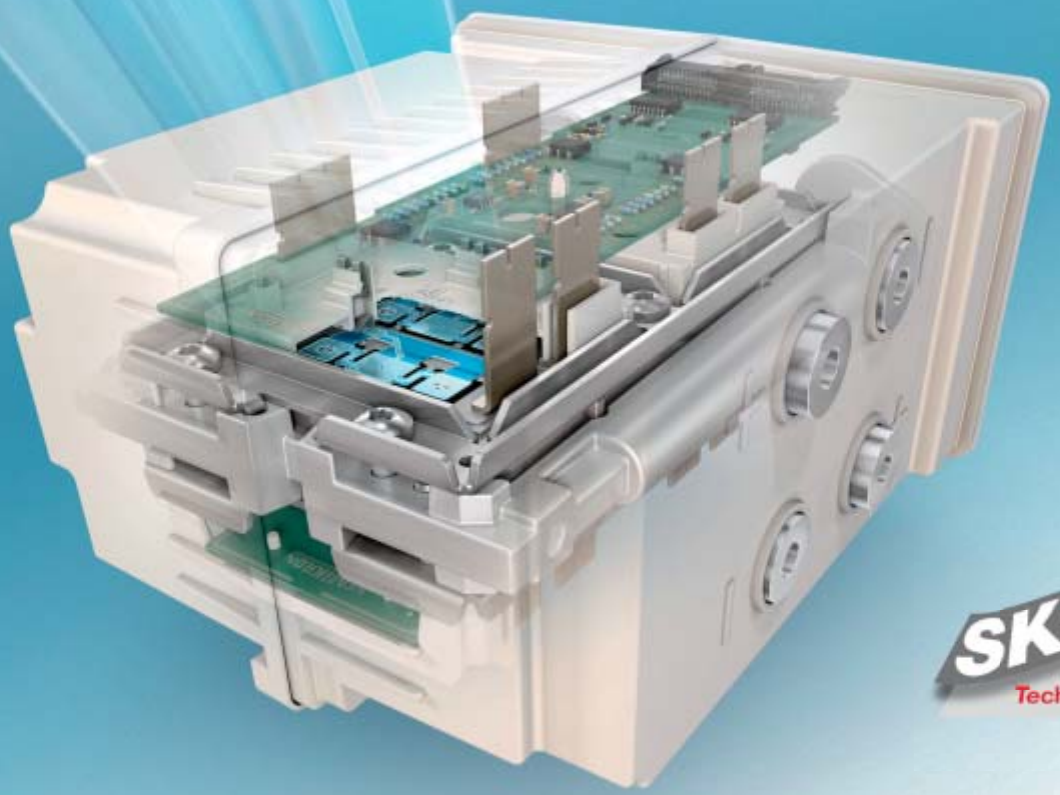

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a Miller clamp can prevent shot-through without requiring negative gate voltage. The complementary device's capacitance is not charged, so this also increases efficiency.

If MOSFET body diodes are decoupled, they will not be loaded during commutation. This can be accomplished by adding extra inductance either on a separate core or on the same core with leakage inductance of two windings in the range of 10 µH to 100 µH. At this high level of decoupling, the diodes are loaded with the same current as the body diodes would be in the original H-bridge.

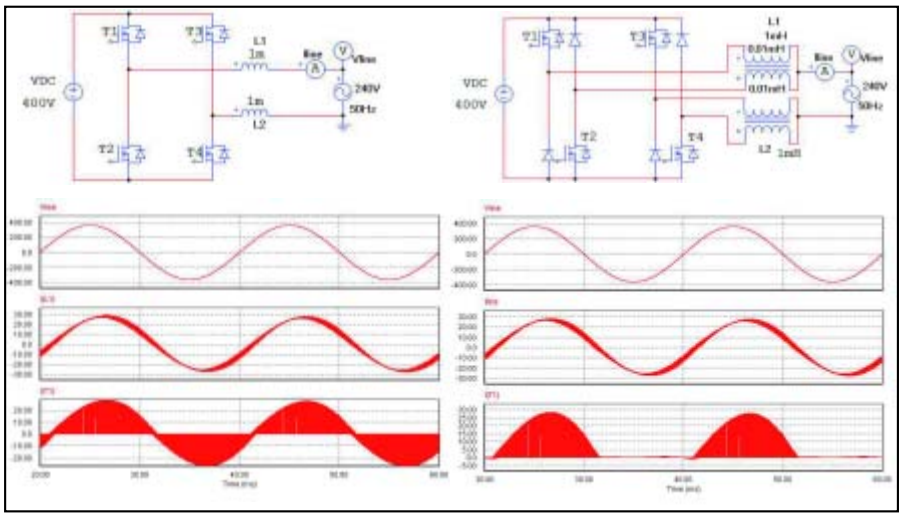

Figure 3: An H-bridge and a pseudo H-bridge with split outputs and 10 µH decoupling

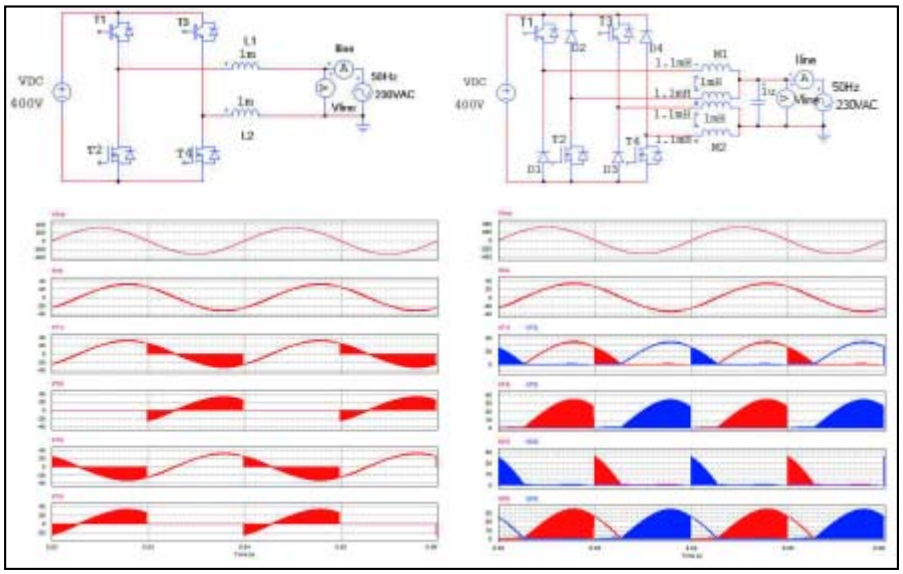

Figure 4: An H-bridge and a pseudo H-bridge with split outputs in reactive power mode

Figure 3 shows a standard H-bridge on the left and a pseudo H-bridge with split outputs on the right. The simulations below these two topologies show the forward current through T1 and the reverse current through the diode. An inductance of 10 µH serves to all but fully decouple the diode from the switch, as can be seen in the exploded image. This leaves just a very low amount of negative current. The inductance value depends on the MOSFET's body diode.

One side effect of deactivating the body diodes is that commutation is much faster. Parasitic diodes are often slow, much to the detriment of efficiency. Switching losses can be drastically reduced if faster diodes are used for commutation.

Reactive power capability:
Single-phase applications based on H-bridges are often operated with bipolar PWM control where the upper and lower switches run on the same carrier frequency. Vincotech has developed H-bridges with MOSFETs to meet the demands of applications with higher switching frequencies and fewer filters. A good cost-benefit ratio is achievable using modules featuring IGBTs with low saturation losses and MOSFETs with low switching losses. The IGBTs used here switch at 50 / 60 Hz and the MOSFETs are PWM-controlled. Known as unipolar PWM control, this works very well when voltage and current are in phase.

The upper switches have to be chopped to achieve reactive power, and the body diodes of the MOSFETs will be loaded as shown in the left simulation. The topology on the right with split outputs and additional decoupling inductors attains high efficiency in real power mode and also enables operation in reactive power mode. The right simulation shows no negative currents on the MOSFETs.

Although each topology has its benefits, there are also some drawbacks:

- A bootstrap circuit cannot be used to feed the upper devices.
- Synchronous rectification by means of Si MOSFET is not possible.

Both switches are decoupled and do not interact, which is why the upper switches cannot be fed via a bootstrap circuit.

A Si MOSFET cannot be used for synchronous rectification because if the decoupling inductance is high enough to hinder the MOSFET body diode's conduction, then the current from the freewheeling diode will not commute into the MOSFET's inverse channel. If the inductance is not high enough, then high currents will circulate in the low-side MOS and low-side diode and in the high-side MOS and high-side diode of the same phase, which decreases switching losses but increases conduction losses.

Conclusion:
Vincotech has presented a novel concept for power modules. Having proven its merits in DC/DC converters for many years now, the split output has now found its way into a semiconductor module. Its great benefit is that it decouples the complementary device's junction capacitance and the MOSFET's body diode. This not only enables reactive power even with unipolar PWM control, it also makes control that much easier. Both boost efficiency by a considerable degree, and these days high efficiency is precisely what manufacturers want and engineers need. This is why the split output will feature prominently in many more modules that are in the pipeline and soon to be launched.

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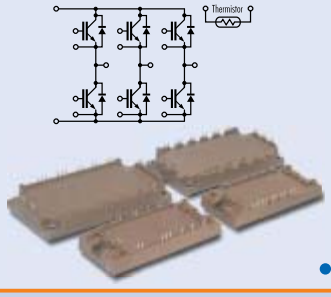

Package	I_C	600V	1200V	1700V
45x107.5 mm	50A	● ■	● ■	
	75A	● ■	● ■	
	100A	● ■	● ■	
62 x 122 mm	100A		● ■	●
	150A	● ■	● ■	●
	180A		● ■	
	200A		● ■	

● With solder pins ■ With PressFit contacts

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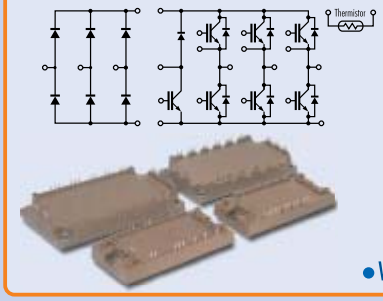


Package	I_C	600V	1200V
45x107.5 mm	25A		● ■
	35A		● ■
	50A	● ■	● ■
	75A	● ■	
	100A	● ■	
62 x 122 mm	50A		● ■
	75A	●	● ■
	100A	● ■	● ■
	150A	● ■	● ■

● With solder pins ■ With PressFit contacts

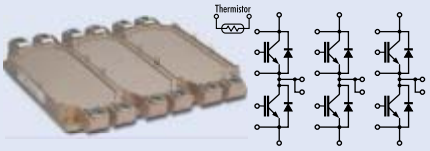
The 2-PACKs

● With Solder Pins

● With Spring Contacts

Package	I_C	1200V	1700V
62 x150 mm	225A	● ●	
	300A	● ●	●
	450A	● ●	●
	550A		● ●
	600A	● ●	

The High Power 6-PACKs



Package	I_C	1200V	1700V
150 x 162 mm	225A	●	
	300A	●	●
	450A	●	●
	550A	●	

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PowerTrench® MOSFET with Shielded Gate Technology

Device meets major requirements for synchronous rectification

Higher system efficiency and power density in modern data and telecommunication power systems are core focus since making a small and high efficiency power system means saving space and energy bills in the places.

By Won-suk Choi, Dong-wook Kim and Dong-kook Son, Fairchild Korea Semiconductor, HV PCIA PSS Team Bucheon-si Republic of Korea, Application Engineering

In topology point of view, synchronous rectification that converts the AC voltage from the transformer back to DC, becomes essential building block for the secondary-side of switch-mode power supply in many applications because it offers improved efficiency for these conversion stages with both lower conduction loss and switching losses. In device point of view, the power MOSFET transistor has made a significant evolution with last decade and it has enabled new topologies and high power density in power supply. Major requirements are for synchronous rectification MOSFET on the following:

- Low $R_{DS(ON)}$
- Low Q_G
- Low Q_{RR} and C_{OSS}
- Less snappy body diode characteristics
- Low Q_{gd}/Q_{gs} ratio

Fairchild designed a new highly optimized power MOSFET, called PowerTrench® MOSFET with shielded gate technology, for synchronous rectification with deep analysis of power losses in synchronous rectification of server power supplies or telecom rectifiers

Power Losses Analysis in Synchronous Rectification

Conduction loss

The conduction loss of diode rectifier contributes significantly to the overall power loss in a power supply. Power losses in synchronous rectification can be lowered when the product of MOSFET's on resistance and drain current is less than the diode forward voltage drop. Therefore secondary side synchronous rectification is excellent solution to improve system efficiency. Conduction loss can be obtained through below equation 1.

$$P_{Con} = I^2_{RMS} \cdot R_{DS(ON)} \qquad (1)$$

$R_{DS(ON)}$ can be achieved 1~2mohm in TO-220 standard package depend on voltage rating by using modern medium voltage MOSFETs technology. For high voltage MOSFETs, the resistance of packages has not been a concern. Different from high voltage MOSFET, the package itself contributes a significant portion of the total resistance for medium voltage MOSFETs due to wire bonding, lead and source metal. Total on-resistance of medium voltage MOSFET can be dramatically reduced by using SMD package such as Power56. It can also reduce package inductance that causes undesirable voltage spikes. It enables to use lower $R_{DS(ON)}$ MOSFETs by replace to lower voltage rating MOSFETs.

Gate Driving Loss

Driving losses at gate driver is related to gate charge, Q_G. In low voltage applications, the driving losses could take up quite big portion of total power losses as low voltage switches have very low conduction losses compared to high voltage switches. During light load conditions, conduction losses are minimal, and the driving losses are even more important. It is well known that the driving losses can be obtained through below equation 2.

$$P_{drive} = Q_g \cdot V_{gs} \cdot f_s \qquad (2)$$

In synchronous rectification, current flows through MOSFET channel from source to drain during conduction time and flows through body diode during dead time. Since the MOSFET does soft switching at switch turn-on and turn-off transients, dV_{ds}/dt is zero. There is no plateau region on gate-source voltage of power MOSFET for synchronous rectification. Therefore, a resulting gate charge in SR, Q_{SYNC}, becomes approximately a value that gate-drain portion of gate charge, Q_{GD} subtracted from total gate charge, Q_G. As shown in Table 1, Q_{SYNC} of FDP032N08B is reduced by 28% and 34% compared to FDP032N08 and 75V/3.3mΩ competitor. Fig. 1 shows a calculated loss ratio between driving loss and conduction loss in a 12V synchronous rectification stage with gate driving voltage of 10V and switching frequency is 100kHz. There are two synchronous switches, the gate driving losses of Competitor is over three times higher than the conduction losses at 10% load condition. This graph simply indicates that FDP032N08B can dramatically reduce driving loss at light load condition due to small Q_{SYNC}.

DUTs	Q_{SYNC} (nC)	Q_G (nC)	Q_{GS} (nC)	Q_{GD} (nC)	Q_{RR} (nC)	I_{RRM} (A)	Softness
80V/3.3mΩ, the latest shielded-gate trench MOSFET FDP032N08B	98.2	111.8	37.4	29.2	215.4	8.82	0.665
75V/3.2mΩ, conventional trench gate MOSFET FDP032N08	135.9	163.4	49.9	47.3	210.7	10.62	0.396
75V/3.3mΩ Competitor	147.5	171.1	41.3	48.6	239.9	11.62	0.348

Table 1: Critical Specification Comparison of DUTs

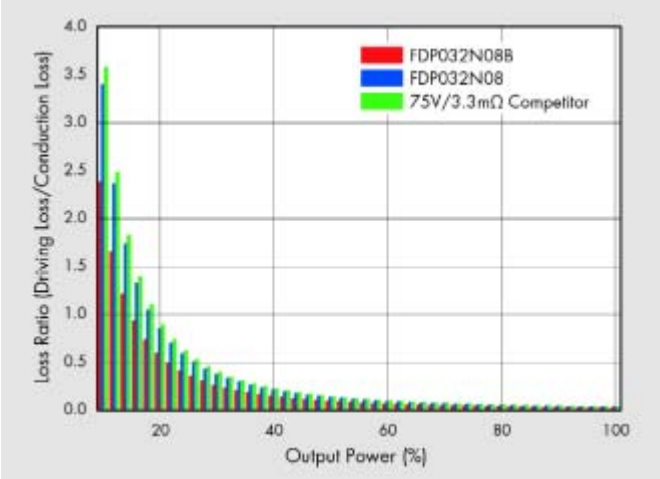

Figure 1: Comparisons of loss ratio [driving loss / conduction loss] according to output load

Body Diode Losses

During the dead time, body diode conduction occurs. Body diode conduction leads to substantial power loss because of high voltage drop across the P-N junction compared to the voltage drop caused by MOSFET channel. This MOSFET loss due to body diode conduction during dead time has a degrading effect on overall efficiency, especially at low voltages and high frequencies. Body diode conduction loss can be calculated equation 3.

$$P_D = V_F \cdot I_{OUT} \cdot (t_{BD(rise)}) \cdot f_s \qquad (3)$$

At MOSFET turn-off transient, the Q_{rr} has to be removed and C_{oss} has to be charged up to the transformer voltage of secondary side. The reverse recovery charge, Q_{rr} also produces power losses in the system while turning off the switch. Power losses by the body diode characteristics can be obtained through equation 4.

$$P_{Qrr} = Q_{rr} \cdot V_{ds} \cdot f_s \qquad (4)$$

The stored charge in output capacitance, Q_{oss} also affects to the capacitive losses. This portion of loss is proportional to the switching frequency and V_{DS}. Therefore, power losses by C_{oss} can be obtained through equation 5.

$$P_{coss} = 0.5 \cdot Q_{oss} \cdot V_{ds} \cdot f_s \qquad (5)$$

Voltage Spikes effect

For a practical alternative, snubbers could be used to manage the voltage spikes within the maximum drain-source voltage ratings. Additional power losses are inevitable in this case. In addition, the power losses due to the snubbers are not negligible at light load. Besides the circuit board parameters, device characteristics also affect to the voltage spike level. In synchronous rectification, a major device-related parameter is a softness of the body diode during reverse recovery. Basically, reverse recovery characteristics of diodes are determined by device design. Figure 2 shows measured peak drain-source voltage levels due to body diode characteristics comparing Fairchild's FDP032N08B, FDP032N08 and 75V/3.3mOhm competitor at I_D=50A, V_{DD}=40V and *di/dt* of 400A/µs. The peak drain-source voltage of FDP032N08B during body diode reverse recovery is lower to 10.1V and 12.8V than that of FDP32N08 and 75V/3.3mOhm competitor thanks to its soft body diode characteristics.

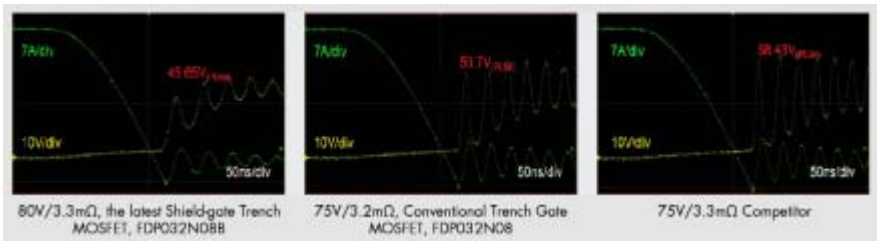

Figure 2: Voltage Spikes Comparisons under Reverse Recovery behavior

The parasitic inductance can strongly influence MOSFET switching characteristics, usually causing increased switching losses and deviations from the expected performance. Parasitic inductance arising from both component packaging and circuit layout is a reality of any circuit. The length of the lead takes quite a bit of the source inductance of the package. Industry standard through-hole type TO-220 package has 7nH of typical lead inductance, but typical lead inductance of PQFN56 SMD package is only 1nH. Other important parasitic components are layout parasitic inductance and capacitance. In circuit board layout, 1cm of trace pitch has an inductance of 6-10nH. These parasitic inductances directly affect to body diode reverse recovery characteristics and peak voltage spikes. The body diode recovery charge on datasheet is sum of C_{OSS} displacement current, the recovered minority carrier current, and the reactive currents arising from common source inductance of test circuit. Figure 3 shows the simulation waveforms of body diode reverse recovery according to various common source inductances. It is clear that higher inductance could cause larger Q_{rr} and higher peak voltage. The peak voltage is reduced from 59.2V to 55.6V by using 1nH source inductance of Power56 SMD package. Minimizing common source inductance is therefore critical to system efficiency.

Medium Voltage MOSFETs Technologies

Several new technologies have been developed to improve the $R_{DS(ON)} \times Q_G$ FOM. The trench gate structure can dramatically reduce the channel resistance ($R_{channel}$) and JFET resistance (R_{JFET}) that are the major contributors to on-resistance of medium voltage MOSFETs (BV_{DSS} < 200V). With compelling advantage of the trench structure in the ability to reduce $R_{DS(ON)}$ by providing the shortest possible current path (vertical) from drain to source, it is possible to

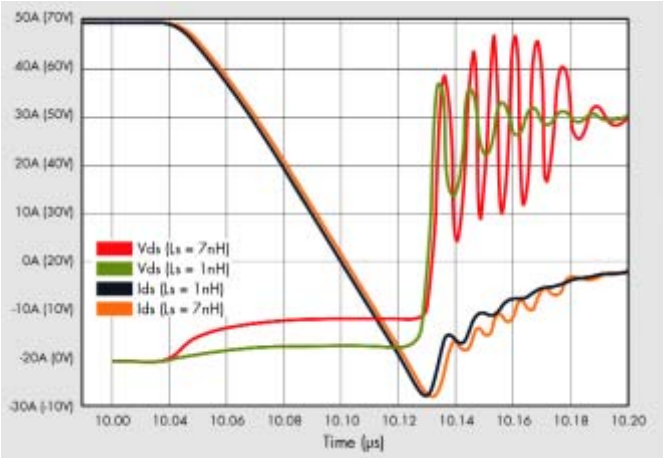

Figure 3: Body diode reverse recovery waveforms comparisons according to source inductance

increase cell density without any JFET pinch-off effect. Figure 4 shows the Fairchild PowerTrench® MOSFET family. The conventional trench gate structure of Figure 4(a) enables lower on-resistance by increasing the channel width to length ratio. The other concept that was originally developed for high-voltage devices, but now being used for low-voltage devices as well, is the use of charge balance or Super-Junction device structures. With the use of charge balance approach, one can obtain two dimensional charge coupling in the drift region. The latest middle voltage power MOSFETs at Fairchild employ this shielded-gate structure, where the shield electrode is connected to the source as shown in Figure 4(b). The shield electrode, along with the thicker oxide between electrode and drift region, provides charge balance for drift region. This enables the use of higher doping in the drift region, resulting in reduced drift resistance.

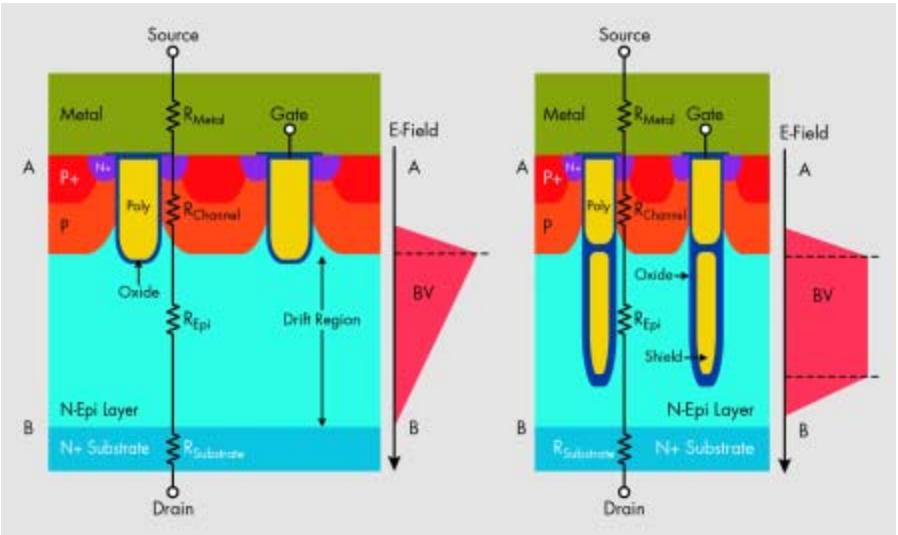

Figure 4: Vertical Structure of Fairchild PowerTrench® MOSFET Family

The specific resistance of new medium voltage power MOSFET has been significantly improved compared to the previous generation while improving on the already superior switching characteristic. Apart from $R_{DS(ON)}$ and Q_G, other parameter, such as the body diode reverse characteristics, internal gate resistance and the output charge of the MOSFET (Q_{OSS}) are now becoming more relevant in synchronous rectification. The importance of these loss components rises at higher switching frequencies and higher output currents. Fairchild new medium voltage MOSFETs are now being optimized to improve the diode characteristics as well as the output capacitance. The latest PowerTrench® MOSFETs, FDP032N08B, employ shielded-gate structure that provides charge balance.

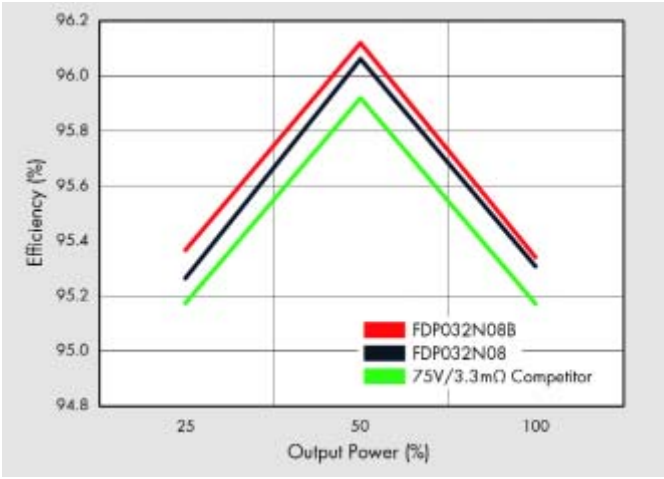

Figure 5: Efficiency comparisons in 600W synchronous rectification

Conclusion

As light load efficiency is getting important, the gate driving losses and the snubber losses become serious factors. Consequently, low Q_{SYNC} and soft body diode are critical characteristics for better synchronous rectification efficiencies. However, the $R_{DS(on)}$ is still key parameter of the application. Figure 5 shows the system efficiency comparison for the three devices from the Table 1 in 600W phase-shifted full bridge converter with synchronous rectification. The total system efficiency with FDP032N08B, the latest shielded-gate trench MOSFET is 95.36% at light load condition and 95.34% at full load condition. It is 0.1% and 0.19% higher than that of FDP032N08, conventional trench gate MOSFET and 75V/3.3mOhm best competitor due to lower driving loss and turn-off switching loss at 10% load condition. From the efficiency results as shown in Fig. 5, it is clearly seen that FDP032N08B, the latest shielded-gate trench MOSFET shows significant loss reduction under both full load and light load conditions because of its optimum design. The Fairchild latest shielded gate trench power MOSFET, which combine a smaller Q_{SYNC} and soft reverse recovery intrinsic body diode performance with fast switching could substantially improve the efficiency of synchronous rectification.

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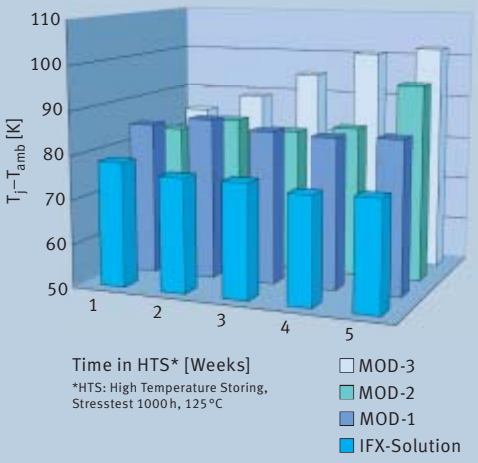

www.infineon.com/tim

Increasing the Efficiency of Power Factor Correction (PFC) Boost Inductors

Switching to litz wire, reducing the turns, and reducing the gap size have significant impact

For the past few decades, power supply efficiency has increased steadily. The materials improvements in semiconductor and magnetics materials have reduced their respective losses. As Energy Star and similar standards have gained acceptance, they've spurred the improvement on a voluntary basis. A mandatory date for minimum efficiency requirements for power supplies is rapidly approaching.

By Nelson Garcia, Renco Electronics

These mandates leave design engineers searching for new ways to increase efficiency. The Power Factor Correction (PFC) boost inductor offers an opportunity to gain a few percentage points. This paper discusses ways to increase the efficiency of PFC Boost inductors.

With the prolific discussion and research surrounding PFC circuit design, it would be logical to assume significant innovation in PFC circuitry and inductor design. To date, subtle methods, which increase PFC inductor efficiency, lack proper discussion in the electronics' industry. In order to meet Energy Star and similar standards, the various ways to increase PFC boost inductor efficiency must be understood.

Typical PFC inductor designs require the inductor handle a large peak-to-peak ripple current. The larger peak current requires a large gap in the center leg of the core of a ferrite-based design. A significant percentage of efficiency can be lost in this step of the design process.Figure 1 illustrates the EF25 ferrite package commonly used in PFC inductors.

PFC inductor Design comparison

The following tables compare two real-world designs and the respective results. The comparison clearly shows problems with the PFC inductor as well as ways of correcting them.

Figure 1: EF25 PFC Inductor

Scenario: A design engineer had an urgent need for a PFC inductor with an inductance of 380 uH at a peak current of 6A in an EF25 package.

The design below was wound on the EF25 bobbin using #24 AWG. The gap size listed in Table 1 was a concern, but the design had to be completed and samples had to ship.

Inductance (µH) =	380
Peak Current - Ipk (A) =	6
Frequency (Hz) =	70000
Turns =	133
Lgap(in) =	0.125

Table 1: Design #1

The design engineer found the provided PFC inductor's recorded power supply efficiency at 120V input with a 100W load was 90%. The goal for efficiency was 94%+. Upon further investigation, it was determined that the initial efficiency measurement was in error, as it was recorded only minutes after the power supply began operating. Temperature rise test results revealed that the initial design had a flaw. The temperature of the PFC inductor after only 5 minutes was 90 ºC; indicating a mandatory redesign.

It was evident that the initial design parameters were not correct. The final peak current was lower than originally specified, therefore, requiring less turns and smaller gap. These changes would greatly lower the temperature rise. See Table 2. It was also decided to use the multi-stranded and strategically bundled wire known as litz. Using litz wire would ensure the Ac resistance would be as low as possible. Litz wire is commonly used to combat the skin effect and proximity losses that are commonly combined and simply known as Ac resistance losses. Samples of the design listed in Table 2 were built with 25 strands of #38 SPN.

Inductance (µH) =	380
Peak Current - Ipk (A) =	4.25
Frequency (Hz) =	70000
Turns =	94
Lgap(in) =	0.06

Table 2: Design #2

Again a few days later, Renco Electronics was informed that the latest inductor samples were approved since the efficiency at 120V input with 100W load was 95%. How can a reduction in gap and the use of litz wire make such an impact? This will be covered later.

PFC inductor losses

Once feedback was received on the samples built per Design #1, Renco conducted a detailed analysis of the losses of the original design vs. the losses of the revised design that was eventually approved. Review of this information will be helpful in future PFC inductor designs.

The comparison in Table 3 is not a true comparison since the design was changed after #1 was tested; however, it does provide valuable information. In Design #1, the largest contributor to the total losses is the loss directly related to the Ac resistance of the winding. The loss of almost 17 watts of Ac resistance is the main contributor to the estimated 230 ºC temperature rise. Design #1 would have gone into thermal runaway if allowed to operate for more than five minutes.

Using litz wire in Design #2 reduced the Ac resistance losses to 1.4W. More importantly the combination of the reduction of the gap size by more than half and the use of litz wire reduced the estimated temperature rise to 39 ºC. The measured temperature rise was 45 ºC.

	Design #1	Design #2
Core loss of inductor (W) =	0.637	0.237
Pdcr (W) =	1.023	0.725
Pacr (W) =	15.227	1.401
Total Inductor Losses (W) =	16.888	2.363
Estimated Temperature rise (ºC) =	**230.183**	**39.240**
Transformer (%) =	83.604	97.706

Table 3: Inductor Losses for Design #1 and Design #2

It can be clearly seen, in Table 3, how the transformer efficiency is increased by the reduction in total inductor losses.

Resistance vs. Frequency Losses

When reviewing Table 3 it is evident that the use of litz wire greatly reduced the Ac resistance, the total losses and ultimately the temperature rise. This reduction in temperature rise does come with a price. Magnetics designs that use litz wire can easily cost 30%+ more than designs that using copper wire.

For cost purposes, it would be ideal to use copper wire, but the Ac resistance does increase as the frequency is increased. In the case of the above mentioned designs, the inductors are operated at 70 kHz. In Figure 2 it is clear that after 20 kHz, the Ac resistance of the wire increases substantially. The Ac resistance of the litz wire, on the other hand, stays reasonably flat from 60 Hz to 80 kHz.

At 70 kHz, the Ac resistance for the solid wire is more than 4 ohms vs. the ½ ohm of Ac resistance measured on the design using the litz wire. When calculating the I2R losses directly related to theses Ac resistances, the Irms value of the peak-peak ripple current must be used.

Solid wire could still be used in this type of design, but the peak current, inductance, or both have to be reduced in order to reduce the turns, the number of layers of the winding, and ultimately the Ac resistance. Another option is to select a different inductor package that will allow more turns per layer and thus, fewer layers. These designs both had windings with approximately six layers. Design #1 would have had much less Ac resistance if there would have been only two layers or less of solid wire.

Taking a close look at Figure 3, it is evident that as layers are reduced, Ac resistance is also reduced. Furthermore, at 70 kHz the Ac resistance is reduced by 75% to approximately 1 ohm by simply reducing the number of layers of solid wire to 3. Comparing Figure 2 to Figure 3 it is also evident that the inductor with 2 layers of solid wire has an Ac resistance, at 70 kHz, which is less than the Ac resistance of the 6 layers of litz wire. Therefore, if the Ac resistance is a concern and costs must be kept low, by avoiding litz wire, reducing the layers of the winding to two or less is a viable alternative.

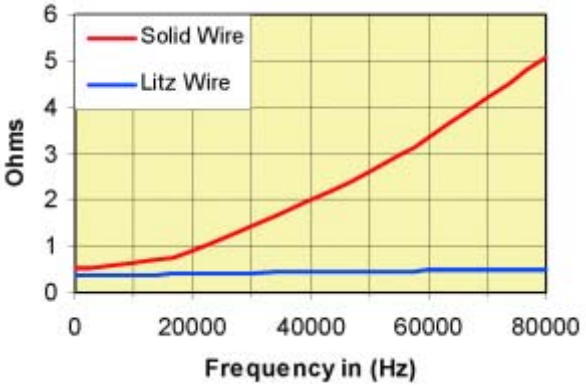

Figure 2: Winding Resistance vs. Frequency for EF25 PFC Inductor

Gap Size

If the Ac resistance can be kept low by simply using two layers or less of solid wire then the only other area of concern is the gap size. The fringing flux that surrounds a large gap will intersect with the eddy currents in the windings and cause localized heating. See Figure 4. In other words, melted bobbins and fused copper. If the gap size is large and solid wire is used in more than two layers the design can easily go into thermal runaway, as was the case with Design #1.

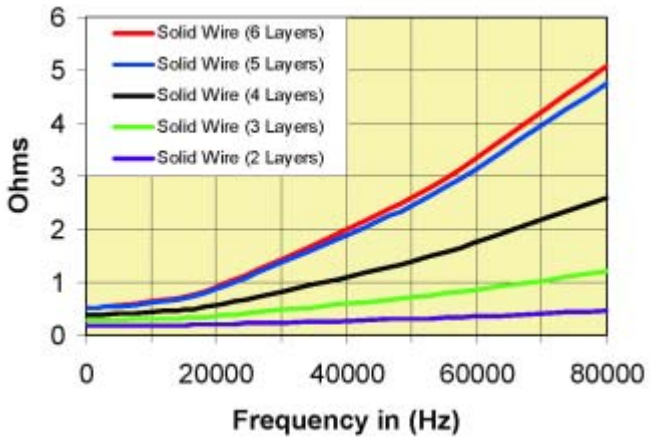

Figure 3: Winding Resistance - Various layers for EF25 PFC Inductor

If the gap size is large and copper wire is still the desired choice, then the winding has to be kept at a safe distance from the fringing flux that is radiated by the gap. There are different techniques used to keep the winding away from the fringing flux or to reduce the amount of flux that is fringing in ferrite based designs. Renco Electronics' Design Engineering Team assists with PFC inductor designs and addresses the various ways to keep the windings away from the gap.

One option available to eliminate the fringing flux and the related consequences is to use a powder core made of Kool Mu, MPP, or Hi-flux materials manufactured by Magnetics, Inc. These powder cores do not require a physical gap in the center of the core since the gap is distributed throughout the material. The downside is that powdered cores are more expensive than ferrite cores and have higher core losses. The trade-offs should be investigated carefully.

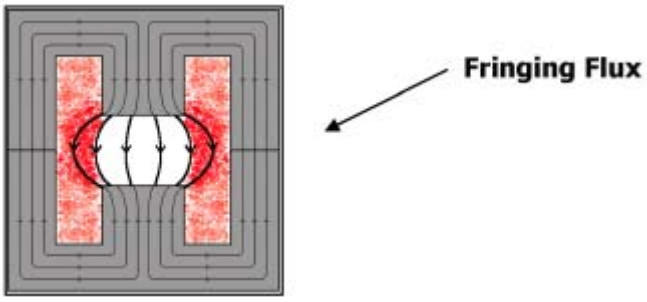

Figure 4: Fringing Flux – Courtesy of Magnetics, Inc.

Conclusion

This article has compared two real world PFC inductor designs in detail. Furthermore, it was discussed how the inductor losses can be reduced and the efficiency increased by switching to litz wire, reducing the turns, and reducing the gap size. Finally, it is clear that in order to increase the efficiency of PFC inductors or any magnetic component a careful review of the magnetics design must take place.

About the Author

Nelson Garcia has over 18 years of design engineering experience in the magnetics industry. He has spent the last 6 years growing and leading the engineering design team at Renco Electronics based in Rockledge, Florida. In addition, Nelson has spent the last 3-4 years helping customers with the design of magnetic components for their LED based products. Nelson Garcia can be reached directly at engineering@RencoUSA.com

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LXMS31 MAGICSTRAP® UHF RFID Modules

Mouser Electronics announced it is stocking new MAGICSTRAP® UHF RFID modules from Murata. Murata's LXMS31 Series MAGICSTRAP UHF RFID modules provide an ideal solution for product traceability when mounted on a printed circuit board.

These Murata UHF RFID modules use the board traces as an antenna for the transponder. Once the RFID module is mounted, information can be stored and retrieved on MAGICSTRAP devices using any EPCglobal Gen2 / ISO 18000-6C compatible UHF reader/writer.

LXMS31 devices are ideal for use in telecom, automotive, and computer applications, as well as other designs in which an onboard RFID transponder is needed. To learn more about Murata MAGICSTRAP RFID modules, visit

www.mouser.com/murata-magicstrap

NPT IGBT Product Family

Microsemi announced the availability of three more devices in its new generation of 1200 volt (V) non-punch through (NPT) IGBTs: the APT85GR120B2, APT85GR120L and APT85GR120J transistors. All of the devices in this product family are based on Microsemi's advanced Power MOS 8™ technology, which enables a significant reduction of at least 20 percent in total switching and conduction losses as compared to competitive solutions. The devices are designed for high power, high performance switch mode products such as arc welders, solar inverters, and uninterruptible and switch mode power supplies.

Microsemi's 1200V solutions can be packaged with Microsemi's FREDs or silicon carbide Schottky diodes to provide engineers with a highly integrated solution that allows them to streamline product development efforts. Additional features include:

Faster switching due to a significantly lower gate charge (Qg) than similar devices;

More efficient power conversion enabled by hard switching operation greater than 80 kilohertz (KHz);

Easy to parallel (positive temperature coefficient of Vcesat) to improve reliability in high power applications; and

Short Circuit Withstand Time Rated (SCWT) for reliable operation in applications requiring short circuit capability.

In addition, Microsemi will soon offer an APT85GR120JD60 device that is packaged in a SOT-227 and includes a 60A anti-parallel, ultrafast recovery diode built with Microsemi's proprietary "DQ" generation of low switching loss, avalanche energy rated diode technology.

www.microsemi.com

Automotive-Grade High-Current LED Driver IC

The A6268 from Allegro MicroSystems Europe is an automotive-grade high-current LED driver IC for applications such as LED headlights, daytime running lights and fog lights. The device has full AEC-Q100 Grade 0 automotive qualification.

This new LED driver IC is based on a DC-DC converter controller which provides a programmable constant current output for driving high-power LEDs in series.

The A6268 operates from a wide input voltage range from 5 to 50 V, making it ideal for start/stop designs as well as handling double-battery and load-dump conditions. It provides a cost-effective solution in configurations using an external logic-level MOSFET and minimum additional external components.

The maximum LED current is set with a single external sense resistor, and can be modified using a current reference input. Direct PWM (pulse width modulation) control is possible via the “enable” input, which also provides a shutdown mode.

The DC-DC converter can be configured as either a ground-referenced boost converter or a supply-referenced boost converter providing buck-boost capability. The buck-boost topology used ensures that there is no leakage path through the LEDs when in shutdown mode and no inrush current at power-up. A programmable switching frequency between 100 and 700 kHz offers flexibility to minimise EMI/EMC effects and AM band interference.

Integrated diagnostics and two fault outputs give indication of input and output undervoltage, chip overtemperature, output open circuit,

LED short circuit and LED undercurrent, and can be configured to provide short-circuit to supply and short-circuit to ground protection for the LED connections, LED overcurrent and short-circuited LED string protection. A unique feature of the A6268 is the ability to detect one or more short-circuited LEDs.

The A6268KLPTR-T is available in a 16-pin TSSOP package with exposed pad (suffix LP) for enhanced thermal performance.

www.allegromicro.com

Application-Specific Reverse Polarity Switches Protect Mobile Devices

To help protect both electronic devices and their users, Fairchild Semiconductor offers a line of low-power, application-specific, reverse polarity protection switches which also feature optional over-voltage transient protection.

Improperly installed batteries, hot-plug transients, faulty connections, and reversible third party USB chargers can all generate a dangerous reverse bias or reverse transient situation as well as over-voltage spikes. These complications may lead to device failure and returns, lost revenue, and damaged brand reputations. The devices provide low resistance, fast response, and with nearly 50X less power consumption than a traditional series Schottky solution at 1Amp, they offer noticeable power savings all while protecting the system from dangerous reverse polarity. To simplify design and remove the guesswork, these reverse polarity protection switches have been optimized for the application to provide an easy "plug and play" implementation solution.

Part of Fairchild's initial offering in the reverse polarity family are the FR011L5J low-side reverse polarity protector and the FR014H5JZ high-side reverse polarity protector with integrated over-voltage transient suppression (OVS). In the event of a reverse bias condition, both devices shut off power and provide a full voltage block to help protect downstream circuits.

Both protectors dissipate less than 0.02W during 1A normal operation, and less than 20µW in a 16V reverse bias event, a performance not possible with a diode solution. The low dissipation of the FR0XXX5J series significantly minimizes the need for heat sinking and allows for smaller package sizes, reduced board space requirements and lowered component costs. Additionally, the devices' nSec scale reverse bias blocking response time blocks negative transients and other potentially damaging DC events. The FR014H5JZ and FR011L5J parts are both USB tested and compatible.

www.fairchildsemi.com

Fully Integrated 1.8-V and 3.3-V, Seven-Channel Relay Driver

Texas Instruments introduced the industry's first fully-integrated, seven-channel relay driver that can support low-voltage relays from as low as 1.8 V up to 5 V. The ULN2003LV relay driver replaces a handful of discrete components with a single device to drive lower voltages for data relays and rails within telecommunications equipment. Using the ULN2003LV integrated circuit (IC), customers can reduce board space by up to 80 percent, while lowering power consumption and cost. For more information and to order samples, visit www.ti.com/uln2003lv-preu.

Key features and benefits of the ULN2003LV
High performance in noisy environments:
Input resistor capacitor (RC) snubber greatly improves the driver performance in noisy operating conditions.
Channel grouping for higher current loads:
Internal input pull-down resistor allows input logic to be tri-stated for greater efficiency at higher loads.
Lower power:
Seven low-output impedance drivers minimize on-chip power dissipation, providing five times lower power consumption versus the competition.
Wider device compatibility:
The relay's 1.8-V to 5-V CMOS logic input interface is compatible with a wider range of microcontrollers and other logic interfaces compared to the competition.

Availability, packaging and pricing
The ULN2003LV is available in 10-mm x 4-mm, 16-pin SOIC and 5.1-mm x 4.5-mm, 16-pin TSSOP packages. Suggested retail pricing in 100-unit quantities is $0.15.

www.ti.com

Baseplate-Cooled AC-DC Power Supplies Deliver 1000W

TDK-Lambda Germany, a group company of the TDK Corporation, introduces the CPFE1000F range of baseplate-cooled AC-DC power supplies for applications requiring 1000W bulk power. As with the existing lower power CPFE500F modules, the CPFE1000F is conduction cooled and therefore does not require a fan thus satisfying applications that need high power but cannot use fans or where the unit is sealed in an enclosure.

The CPFE1000F single output power supplies are available in 12V, 28V or 48Vdc versions, which are adjustable by ±20%, enabling the units to be used in a variety of customer specific bulk power applications. With an extended temperature range (-40 to +85°C) and shock and vibration approvals according to MIL-STD-810E methods, the CPFE1000F is both rugged and reliable. Efficiency of up to 86% ensures heat dissipation is minimised.
Operating from a universal input of 90 to 265Vac with PFC, the CPFE1000F can be paralleled together with active current share to accommodate increased power requirements and/or redundancy.

www.emea.tdk-lambda.com

MOSFETs and Schottky Diodes for Wireless Power Transfer Applications

Toshiba Electronics Europe (TEE) has expanded its line-up of small-signal, medium-power Schottky barrier diodes (SBDs) and MOSFETs that are especially suitable for wireless power transfer applications. The range of devices covers single and dual n- and p-channel MOSFETs as well as SBDs. The miniature devices are optimised to meet the low power consumption and compact form factor demands of wireless charging applications for portable, battery-powered devices such as mobile phones, digital cameras and video recorders, tablet computers and notebook PCs.
Among the new devices is a MOSFET ideally suited to load switching in a wireless charging transmitter circuit. The 30V SSM6N55NU is the industry's highest performance dual -channel MOSFET in a UDFN6 package measuring just 2.0mm x 2.0mm x 0.75mm. A drain current of just 4A and a maximum ON resistance (RDS(ON)) down to 46mÙ ensure high-efficiency operation. The device joins a comprehensive family of MOSFETs that combine low RDS(ON) with ultra-compact packaging.
Toshiba's latest single and dual SBDs are rated for reverse voltages of 30V and feature very low forward voltage (VF) ratings down to just 0.45V. Ultra-miniature packaging options range from USC (SOD-323) with dimensions of 2.5mm x 1.25mm x 0.9mm to CST2B options that measure just 1.2mm x 0.8mm x 0.6mm.

www.toshiba-components.com

Digital Point-of-Load Modules Dynamically Set Optimum Stability in Real Time

CUI Inc announced the release of its second generation digital point of load dc-dc modules for distributed power architecture applications. The NDM2P series is the latest addition to CUI's Novum® Advanced Power product line, which focuses solely on the design and development of leading edge power platforms. The modules offer true cycle-by-cycle compensation, autonomously balancing the trade-offs between dynamic performance and system stability. With this feature, designers are able to bypass the traditional practice of building-in margins to account for factors such as component ageing, manufacturing variations, and temperature, which inevitably lead to higher component cost and longer design cycles. With the NDM2P's self compensation feature, the module is able to dynamically set optimum stability in real time as conditions change. With the addition of these second generation modules based on Powervation's digital IC, CUI continues to be the only module manufacturer in the industry to offer a full portfolio of self compensating digital POL modules.

The NDM2P series is available with an input range of 4.5~14 Vdc and a programmable output range of 0.6~3.3 Vdc. Features include active current sharing, voltage sequencing, voltage tracking, synchronization and phase spreading, programmable soft start and stop, as well as a host of monitoring capabilities.

electronica hall B2 at booth 518

www.cui.com

eGaN® FETs Offer Superior Safe Operating Area Capabilities

eGaN® FETs Offer Superior Safe Operating Area Capabilities
Efficient Power Conversion Corporation (EPC) is releasing safe operating area (SOA) data for their entire product line of eGaN FETs. The positive temperature coefficient across virtually their entire operating range allows a square SOA limited only by average device temperature.

SOA is an indicator of the device's ability to transfer heat away from a resistive junction. The more efficient a device is at getting rid of generated heat, the lower thermal resistance and the better the SOA performance.

EPC's eGaN FETs have many major advantages over the power MOSFET needed for today's high performance applications. eGaN FET's offer superior device on-resistance while its positive temperature coefficients inhibit hot spot generation within the die, resulting in superior Safe Operating Area capabilities.

An application note presenting the Safe Operating Area for EPC eGaN FETs is available at:
http://epc-co.com/epc/documents/product-training/SafeOperatingArea.pdf

Additionally, EPC is in the process of updating each of its product data sheets to include SOA performance curves.

www.epc-co.com

High Speed 600V Discrete IGBTs Feature very Low Saturation Voltage

Advanced Power Electronics Corp. (USA), a leading Taiwanese manufacturer of MOS power semiconductors for DC-DC power conversion applications, has recently released a family of high speed 600V discrete IGBTs for use in AC and DC motor control, home appliances (such as air conditioning, refrigerators, microwave ovens), UPS, solar inverters, and induction cookers.

All AP20GT60 family IGBTs feature a collector/emitter voltage rating, VCEs, of 600V, a peak gate emitter voltage rating, VGE, of ±20V, and a very low saturation voltage.

AP20GT60P-HF-3 benefits from a typical saturation voltage, VCE(sat), of 1.8V at Ic=20A, a maximum power dissipation at 25degC of 104W, and comes in a fully RoHS-compliant and halogen-free TO-220 package. AP20GT60ASP-HF-3 (with internal diode) has a typical saturation voltage of 1.7V at Ic=19A, a maximum power dissipation at 25degC of 78W, a diode forward current rating of 8A, and a diode pulse forward current rating of 40A. It comes in a fully RoHS-compliant and halogen-free TO-220 package.

Featuring a saturation voltage of 1.8V at Ic=20A and a maximum power dissipation at 25degC of 25W, the AP20GT60I-HF-3 device comes in a fully RoHS-compliant halogen-free TO-220CFM insulated package. The corresponding AP20GT60ASI-HF-3 IGBT with internal diode has a typical saturation voltage of 1.7V at Ic=12A, a maximum power dissipation at 25degC of 33W, a diode forward current rating of 8A, and a diode pulse forward current rating of 40A . The device comes in a fully RoHS-compliant halogen-free TO-220CFM insulated package.

AP20GT60W-HF-3 is in the fully RoHS-compliant halogen-free TO-3P allowing maximum power dissipation at 25degC of 125W. It also benefits from a typical saturation voltage of 1.8V at Ic=20A. The equivalent AP20GT60SW-HF-3 device has the built-in fast recovery diode, with a diode forward current rating of 40A, and a typical saturation voltage of 1.8V at Ic=20A. Maximum power dissipation at 25degC is also 125W in a fully RoHS-compliant halogen-free TO-3P package.

www.a-powerusa.com

Low Inductive Film Capacitors

Fischer & Tausche Capacitors has developed capacitors for low-inductance applications. Upon special request, film capacitors with values even under 10 nH are now available. In classic applications, such low-inductive capacitors are used to resolve EMC problems. On the other hand, they can also be used to reduce overall inductance in other critical applications.

This design allows ultra-fast discharge. Although designed for PCB mount, several connection types are available on request. There are two different versions:

- Insulated plastic housings for low inductance applications
- Aluminum housings for very low inductance applications

Both versions offer solid, robust construction. Multiple contact pins make the capacitors extremely resistant to vibrations. The compact design allows the capacitor to withstand high current values. Optimized heat dissipation guarantees long lifetimes. Excellent self-healing properties ensure reliability.

www.ftcap.de

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www.electronica.de/embeddedplatforms

Enhancements to Versatile Link Plastic Optical Fiber Product Family

Avago Technologies announced their latest product enhancements to the popular Versatile Link Plastic Optical Fiber product family. This product platform has become a widely adopted solution for industrial communications and control links for industrial applications.

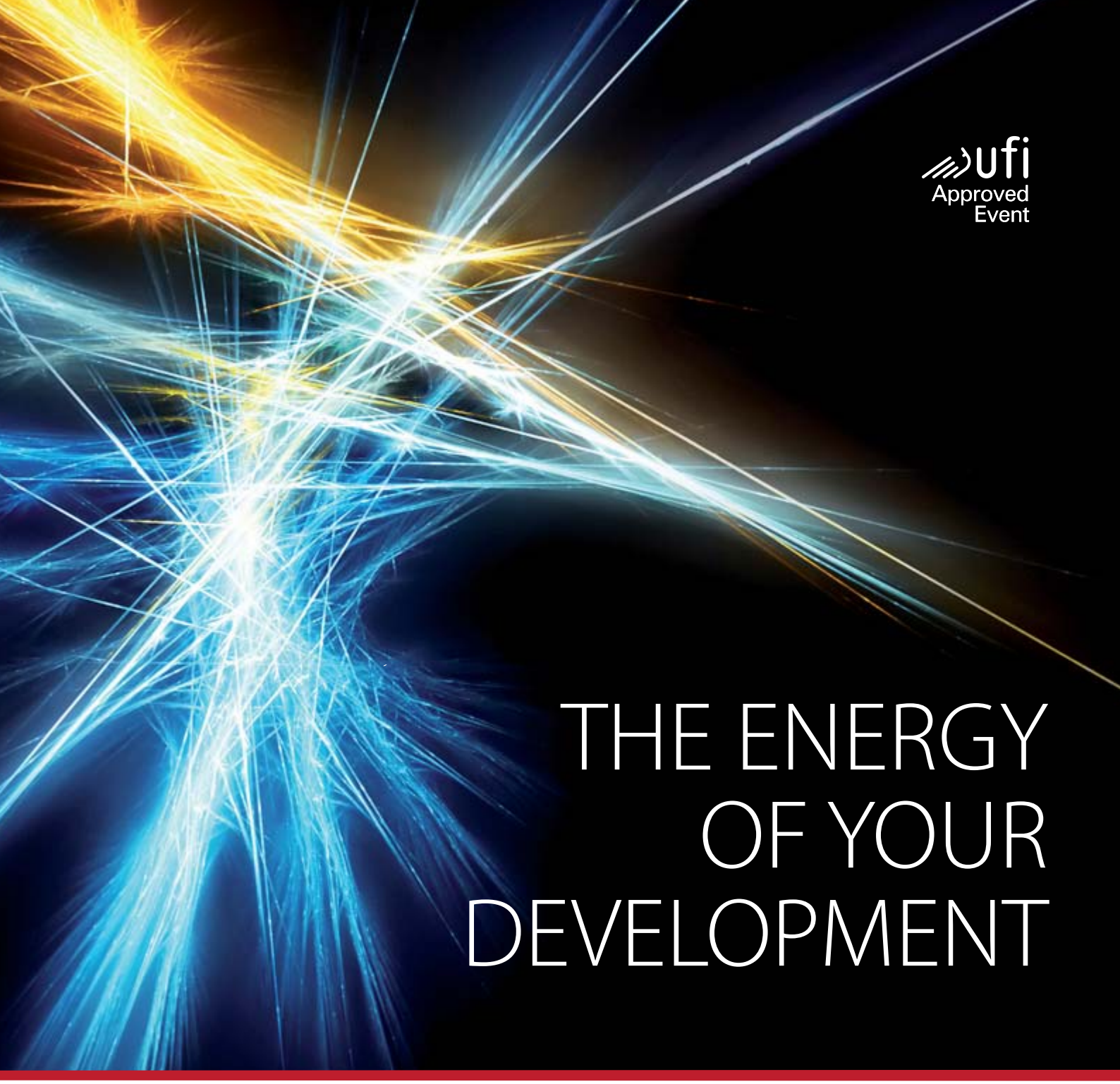
Avago POF products offer infinite voltage isolation and EMI immunity performance that far exceeds what can be achieved with traditional copper cable standards. POF cable solutions can weigh up to 75% less then copper cables, while providing similar or greater performance with a 50% tighter bend radius at comparable cost.

"The enhanced Versatile Link POF product family is already an industry-standard for robust industrial communications" said Bernd Luecke, Director of Marketing for Avago Industrial Fiber Optic Products in Regensburg, Germany. "The enhancements Avago has released now give designers more capability to integrate their designs and achieve lower cost without compromising on performance or circuit isolation."

Designed for robust industrial networking applications, communications over plastic optical fiber (POF) offers key benefits versus copper-based implementations. Since optical fiber has no metal in its construction, the communication link has infinite isolation between nodes at the same time and since light is used to transmit the signals there are no effects from or creation of electromagnetic interference (EMI) on the transmission line.

There are additional challenges of copper cables caused by the longer assembly time and labor costs due to the steps needed for cable prep (stripping multiple layers of insulation, tinning the strands, multiple wires to solder and terminate the foil shield). Testing an assembled copper cable is also slightly more complex the Plastic Optical Fiber as copper requires tests for continuity, shorts, opens and breakdown voltage.

www.avagotech.com



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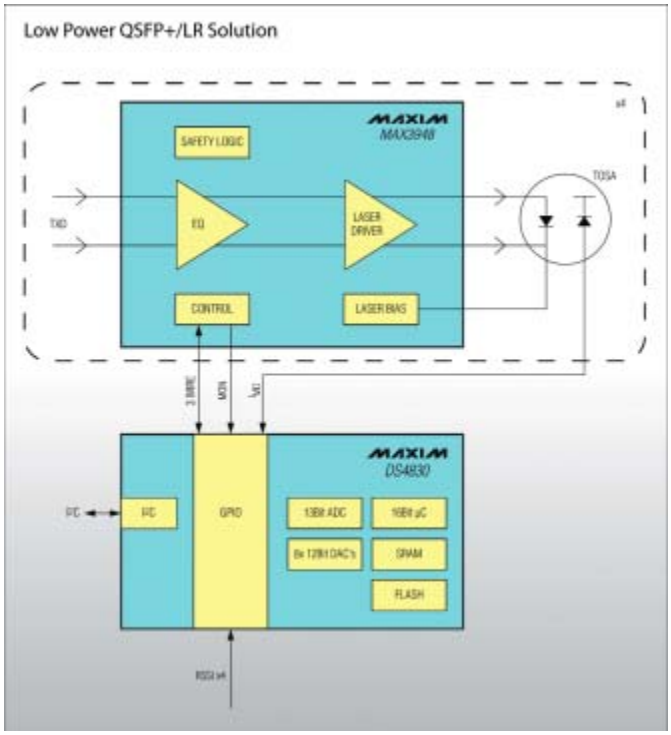
www.powerelectronics.ru

Chipset Reduces Power Consumption and Boosts Data-Center Throughput

axim Integrated Products, Inc. announced a 40G transmitter chipset that provides data centers with 4x the data throughput, at very low power, and in little more space than conventional single-channel alternatives. The new 4-channel 40GBASE-LR4 QSFP+ chipset comprises the MAX3948 DC-coupled laser driver and the DS4830 optical microcontroller.



Data centers and data communication networks need to significantly increase data density while staying within their already constrained power budgets. Maxim's QSFP+ transmitter solution addresses both challenges. The QSFP+ modules supply 4x the data throughput in only 1.5x the area of a single-channel SFP+ solution. Equally important, Maxim's chipset enables 4 x 10Gbps QSFP+ modules to consume less power per channel than single SFP+ modules. Service providers and network operators can now enjoy the benefits of a low-power solution that extends system life, reduces operational expense, and conserves valuable energy resources.

MAX3948 Key Advantages:

Consumes less than 2W for 4 transmit channels, enabling less than 3.5W QSFP+ module power consumption.

DC-coupled laser interface (patent-pending, application number 13/352,011) reduces power consumption and external component count.

DS4830 Key Advantages:

On-chip 13-bit ADC with dedicated round-robin offloads 16-bit microcontroller core and lowers clock speed; saves 75mW to 100mW compared to competitive solutions.

Single-cycle multiply accumulator (MAC) allows DS4830 to speed through filter calculations and easily maintain four average power control (APC) loops.

electronica 2012, Hall A6, Booth 163

www.maxim-ic.com

Industry's First No-Bus Self Compensating Digital Point-of-Load Modules

CUI Inc releases the industry's first self-compensating No-Bus digital point of load dc-dc module family. The modules are specifically designed for customers who value the efficiency and compensation advantages inherent in digital power but do not want to incorporate digital bus communication in their systems. The NSM2P series will allow customers to access many of the same features as a fully digital POL, however the access will be via header pins that will connect to a USB dongle and CUI's Digital Power GUI. The designer can dynamically test and manipulate the desired functions within their system, monitor the results, and set the desired fault management functions. In production, the engineering header is pulled and the specified parameters are loaded into the module by CUI based on the customer's specific requirement.

The NSM2P has the same features and functions of the recently announced NDM2P series without the need for a serial bus connection on the board, also offering true cycle-by-cycle self compensation, autonomously balancing the trade-offs between dynamic performance and system stability. With this feature, designers are able to bypass the traditional practice of building-in margins to account for factors such as component ageing, manufacturing variations, and temperature, which inevitably lead to higher component cost and longer design cycles. The NSM2P's take full advantage of Powervation's cycle by cycle self compensation feature, the module is able to dynamically set optimum stability in real time as conditions change.
electronica hall B2 at booth 518

www.cui.com

Complete Ultrabook™ Vcore Solutions that Shrink Footprint by 40-50 Percent

International Rectifier has launched the IR3588 CHiL® digital control IC and IR3552 and IR3548 single- and dual-phase PowIRstage™ devices, delivering the industry's smallest solutions that meet Intel's VR12.6 specifications for 15W and 25W Ultrabook™ laptop computers that significantly extend battery life.

IR's IR3588 and optimized single-phase and dual-phase IR3552 and IR3548 PowIRstage devices reduce footprint by more than 50 percent compared to leading monolithic solutions and offer a 40 percent smaller footprint compared to alternative reference designs. Additionally, the IR solutions extend battery life as a result of the IR3588's low quiescent current while offering lower operating current and sleep state power of less than 1mW, which exceeds Intel's VR12.6 Ultrabook power specifications. Battery life is further enhanced with IR's Regenerative Braking technique which returns energy to the battery that is normally lost when waking a laptop computer from a sleep state.

The IR3588 matched with the dual-phase IR3548 is optimized for high performance Ultrabooks up to 25W while the IR3588 paired with the single-phase IR3552 is designed for standard Ultrabooks up to 15W.

These new power management solutions are designed to meet Intel's specifications for Ultrabooks and to achieve a dramatically smaller footprint compared to alternative solutions while significantly extending battery life. Moreover, a new GUI with enhanced design tools simplifies and speeds up the design process

The IR3588 maintains full digital flexibility and telemetry and offers true-off capability for PS4. The device also offers clean ultrafast DVID Up and Down performance, lossless input current telemetry and supports up to 1.5MHz per phase.

The new PowIRstage devices integrate a low quiescent synchronous buck gate driver, and synchronous MOSFETs and Schottky diode into a compact PQFN package. The devices have an input range of 4.5V-16V and can be operated up to 1.5MHz, and true-off capability enabling the driver to shut off to minimize quiescent current.

The dual-phase IR3548 PowIRstage device supports up to 30A per phase and delivers up to 95 percent efficiency at 7.2Vnom to 1.8Vnom in a 6mm x 8mm PQFN package. The single-phase IR3552 supports up to 40A and offers 94 percent efficiency at 12Vnom to 1.8Vnom. in a 4mm x 6mm PQFN package.

www.irf.com

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Circuit Protection Diodes Provide Surge and ESD Protection for Gigabit Ethernet

Infineon Technologies released a new TVS (Transient Voltage Suppression) diode to protect Gigabit Ethernet interfaces from potential damage due to voltage surge or electrostatic discharge (ESD) events. The new TVS3V3L4U diode features exceptionally low capacitance to meet the high signal integrity requirements of this application, while delivering the robustness and clamping voltage characteristics typical of Infineon's broad portfolio of circuit protection devices.

TVS diodes respond to potentially damaging electricity surge and ESD events by shunting the unwanted force to a ground state before it can damage delicate system components. Performance requirements for protection of the Gigabit Ethernet interfaces include the following key characteristics:

Surge absorption capability of 20A without signs of degradation, meeting requirements of IEC61000-4-5, and high ESD absorption capability of ±30kV that exceeds IEC61000-4-2. Very low clamping voltages of VCL

Very low dynamic resistance of RDYN= 0.15Ù I/O-GND (according to surge standard IEC61000-4-5) and 0.09 Ù GND-I/O (ESD standard IEC61000-4-5) enables extremely low clamping voltages of VCL

Low capacitance of typically 2.9pF I/O-GND and 1.5pF I/O-I/O to meet the signal integrity requirements of Gigabit Ethernet.

Cost-effective implementation in industry-standard SC74 leaded array package, with one component replacing up to four devices.

TVS3V3L4U is tailored for protection of signal lines operating up to a maximum voltage of 3.3V.

www.infineon.com/tvsdiodes

High-Speed Differential Probe for High-Voltage Oscilloscope Measurements

The Yokogawa Model 701927 is a new high-speed differential probe for high-voltage floating signal measurements using the company's DLM2000 Series of mixed-signal oscilloscopes and other instruments equipped with the Yokogawa probe interface.
The 701927 has a 3 dB bandwidth of DC to 150 MHz, and can measure differential or common-mode voltages up to ±1400 V (DC plus AC peak) or 1000 V RMS. For ease of use, the compact unit features automatic attenuation detection, and obtains its power supply via the Yokogawa probe interface. Input attenuation ratio is switchable between 1/50 and 1/500.
A one-metre long extension cable allowing the probe to be used in thermostatic chambers or for measurements on large or hot devices is included as standard. Even when this extension is used, a high bandwidth of 100 MHz is maintained
The new probe is ideally suited to the requirements of the mechatronics, automotive and power electronics sectors for testing devices such as motors, power supplies and invertors, and thus further extends Yokogawa's ability to offer an extensive choice of solutions for testing in these sectors, including high-speed oscilloscopes, versatile and flexible ScopeCorders, and high-precision power analysers.

www.tmi.yokogawa.com

Modules for Photo-Voltaic String and Multi-String Inverters

Infineon introduces an all-new family of tailor-made modules for photo-voltaic string and multi-string inverters. Optimised inverter efficiency and performance can be achieved. Fast and solder-less assembly is possible using the proven PressFIT technology.
3-level inverter and flexible booster modules are available for 3-phase photovoltaic inverters. These modules are applicable for PV inverters with maximum DC input voltage of 1000 V, max. efficiency beyond 98% and an output power up to 25 kVA. Three inverter modules – each one phase leg in 3-level topology – can be combined with as many booster modules as desired. Advantages are: excellent efficiency and performance due to state of the art chips like Infineon's HighSpeed3 IGBTs, module types with SiC diodes are available and up to four maximum power point (MMP) trackers are possible using only one booster module.

www.infineon.com/string

ADVERTISING INDEX

1600000 Volt. Thyristor converters deliver energy to megacities via one single transmission line.

ABB Semiconductors' Phase Control Thyristor has been the backbone of the high power electronics industry since its introduction almost 50 years ago. Its field of application ranges from kW DC-drives and MW rated load commutated frequency converters to GW converters for HVDC transmission.
ABB's thyristor portfolio includes both PCT and Bi-directionally Controlled Thyristor (BCT) press-pack devices with ratings of 1600 V – 8500 V and 350 A – 6100 A.
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Innovative Power Module Reduces System Size

µIPM™ Power Modules Deliver up to 60% Smaller Footprint

Specifications:

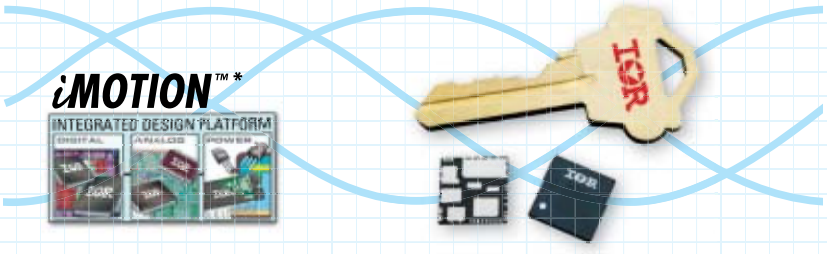
Part Number	Size (mm)	Voltage	IO (DC@ 25°C)	Motor Current**		Motor Power VO=150/75VRMS	Topology
				w/o HS	w/HS		
IRSM836-024MA	12x12	250V	2A	470mA	550mA	60W/72W	3P Open Source
IRSM836-044MA	12x12	250V	4A	750mA	850mA	95W/110W	3P Open Source
IRSM836-025MA	12x12	500V	2A	360mA	440mA	93W/114W	3P Open Source
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

Features:

- 3-phase motor control IC
- 12x12x0.9mm PQFN package offers up to 60% smaller footprint
- Eliminates the need for heat sink
- DC current ratings from 2A to 4A
- Voltage range of 250V – 500V

***µIPM*™ Advantages:**

- Shortens design time
- Shrinks board space requirements
- Simplicity - Eliminates Heat Sink
- Replaces more than 20 discrete parts to deliver a complete motor drive stage
- Slashes assembly time and cost
- Simplifies procurement and inventory management
- Reference design kits available for quick evaluation on any 3-phase motor



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