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Bodo´s Power Systems®

Electronics in Motion and Conversion

April 2013


o-f.de
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Does this sound familiar? You leave your comfort zone and step onto the tightrope of new territories. For MV applications in power electronics installations there's now a "double safety net". The new GvA "ready-to-use switch components", based on IGBT and Thyristor technology. These are available with or without control or current loop feed power supply – always perfectly balanced. So if you want to reach your new goals quickly and above all safely, talk to your House of Competence. It's worth it.
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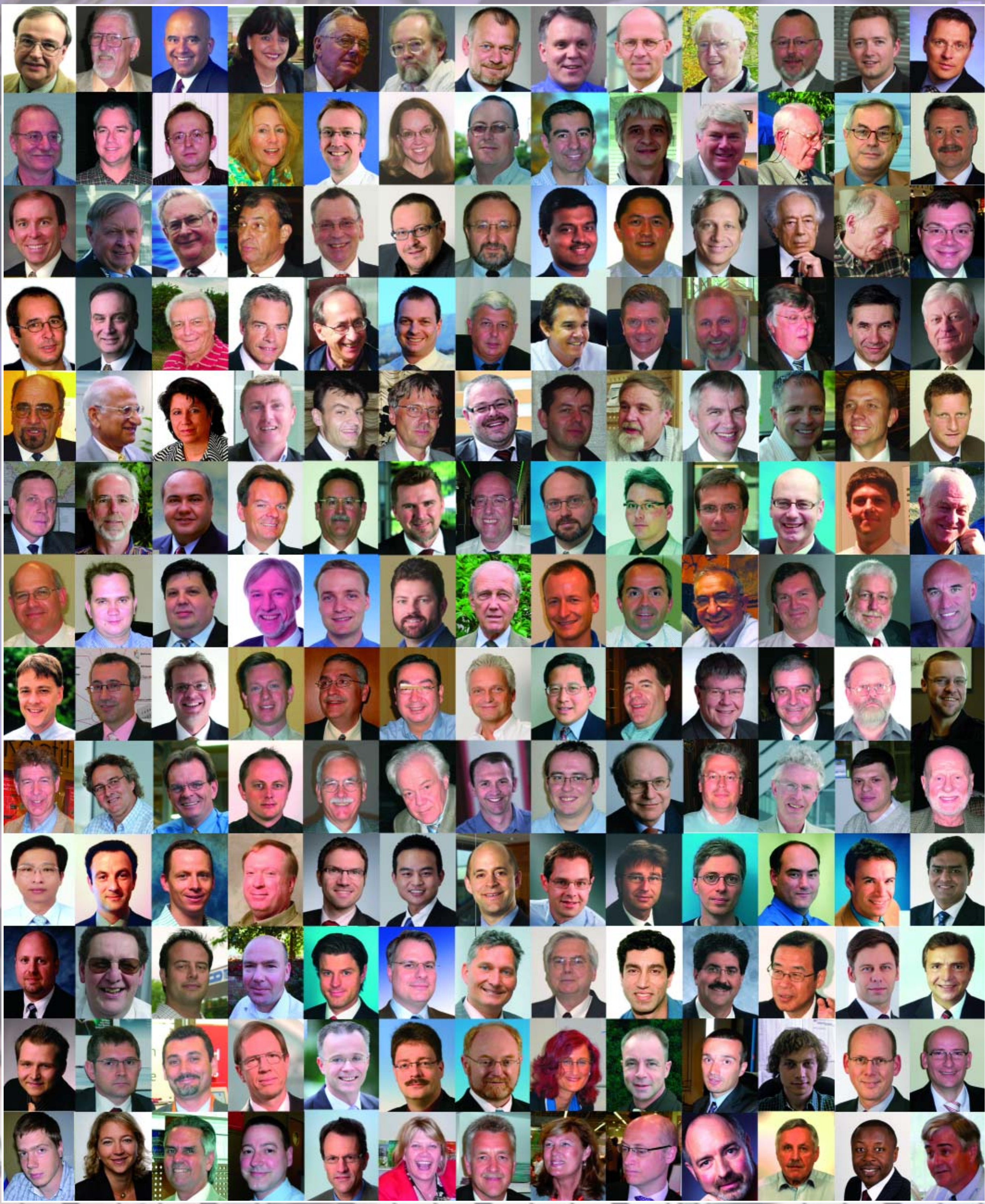
Bodo´s Power Systems®

The Gallery



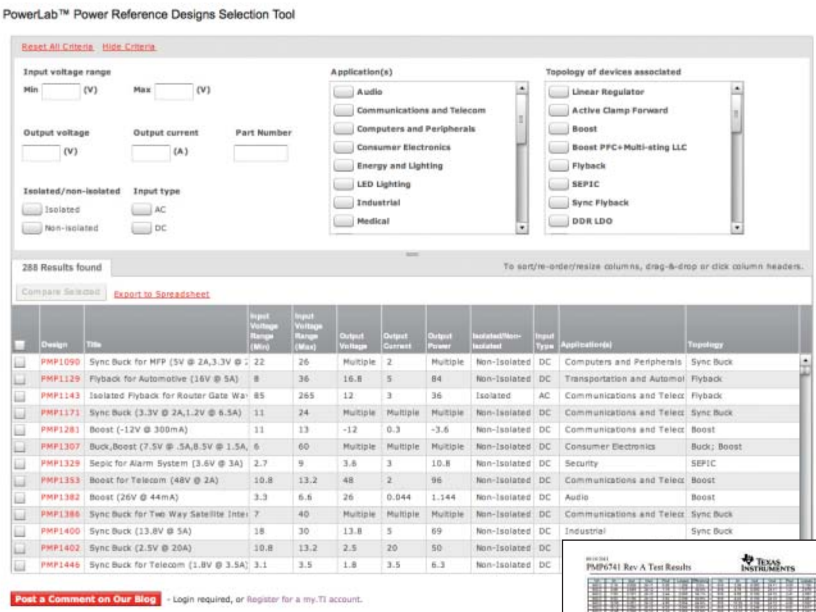
PowerLab™

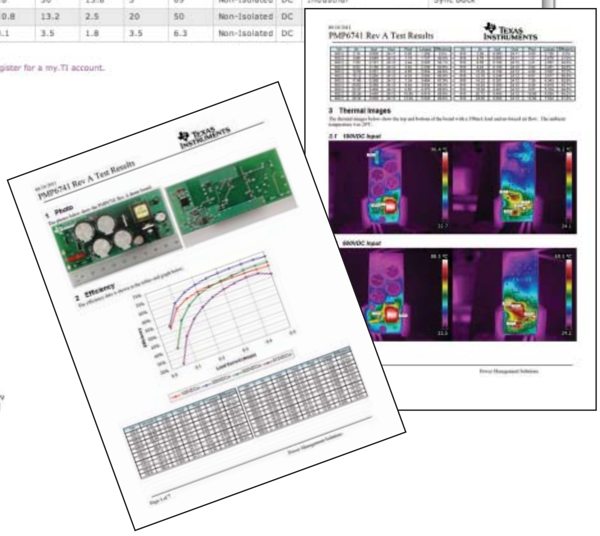
Power Reference Design Library

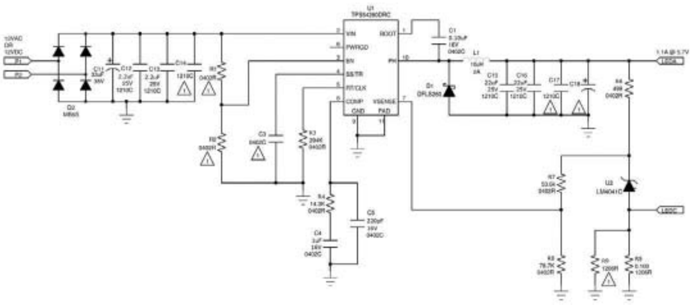
The PowerLab™ library includes an interactive and powerful search engine for design engineers looking for a proven and tested solution to their power supply requirements. This interactive search tool allows engineers to find designs by application, topology, input type, input voltage or output voltage.

Features

- The industry's most extensive collection of tested power management reference designs.
- Hundreds of power management designs for a wide range of applications and power conversion topologies.
- Reference designs include both isolated and non-isolated designs for lighting, telecommunication, computing, consumer electronics and more.







www.ti.com/powerlab-eu

Learn more, find answers and stay up to date

Texas Instruments

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Events

Embedded World 2013,
Nuremberg, Germany, February 26th - 28th
www.embedded-world.eu

New Energy 2013, Husum, Germany,
March 21st-24th www.new-energy.de

EMC 2013, Stuttgart, Germany
March.5th – 7th www.mesago.de/de/EMV

APEC 2013 Long Beach CA, USA,
March 17th - 21st www.apec-conf.org/

SMT/Hybrid 2013, Nuremberg, Germany,
April 16th-18th www.mesago.de/de/SMT/

PCIM Europe 2013,
Nuremberg, Germany, May 14th -16th
www.mesago.de/de/PCIM/home.htm

Sensor + Test 2013, Nuremberg, Germany,
May 14th -16th www.sensor-test.de

Wind Storms – Problems and Possibilities

I was driving with my friend on the Autobahn; a long trip, but we were bonded in good conversation. The neat countryside rolled by, noticeably amongst it - the many, many, wind turbines on tall poles, their huge blades sweeping slowly around; majestic, serene. “You know”, I said, “there’s a huge problem looming with wind-power.” “Oh, what’s that, I think it’s great,” said my friend, I thought it’s going to save the planet?” My response: “They are beautiful, too bad there’s a fatal flaw.” His predictable reply, “What flaw?"

“Don’t you remember Ampere’s law - current through a conductor exerts a sideways force? Well, that’s the basic problem. All that force is pushing on top of those big towers, it’s a huge torque. Have you noticed that they all rotate in the same direction? Everywhere you see them, whether in Europe or the USA, they all rotate clockwise, and so the force they exert on the earth is all pushing one way, thousands of them. As more and more are installed, their collective torque will be enough to flip over the planet. Those windmills in Denmark will end up in Malaysia! All it will take is that one rare time when the winds lineup, sooner or later it’s bound to happen, one of those unimaginable circumstances – like what happened at Fukushima.

I have warned the government regulators about it. As a matter of fact I tried to get funding for a thorough planning study, but of course the government asked the wind industry about the subject and the very idea was squashed – kind of like that story by Ibsen about the contaminated water at the spa, unthinkable. I didn’t want to end up like that guy, going public was not for me, no chance for a whistle-blower against all those lobbyists.

Wouldn’t be so bad if there were the same number of turbines on the other side of the equator, but northern hemisphere installations are just racing far ahead of the southern hemisphere. I proposed an idea of a ‘torque cap-and-trade program’, like the carbon-emissions one, except it would be for Newton-meters. But that’s not likely to happen; the politicos are still trying to understand the carbon thing.

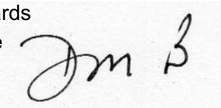
The obvious solution is to make half of the turbines turn the other way. And there’s some big advantages in this, over and above cancelling out the tower torques. Do you remember those vector diagrams of real power on the X-axis, with lagging vars on the positive Y-axis and with capacitive, leading, vars on the negative Y-axis. The preponderance of inductive vars is a huge problem in power grids. If the power angle gets too far reactive then the transmission system falls out of synchronism, so they have to operate lines at a fraction of their real capacity to prevent the system falling apart. Well, if you reverse some of the turbines, the vectors rotate in the other direction, leading becomes lagging, and all the vars will cancel. Voila, problem solved!

Same thing with power quality - if the angular velocity for half the harmonics is in the other direction, the 3rd becomes a -3rd, and so on up the ladder – so, no problem with harmonics. These things are all so obvious; I’m not sure why nothing’s getting done, no alarms are sounding, everyone still worrying about power factor – it just shows how complacent we have become.”

By this time we were approaching our destination, my friend right on time as usual, it was April 1st.

Green Tip of the month:
Keep an eye on the lighter side of life - it shortens the trip and keeps you warm.

Best Regards
Don Burke



IEEE International Electric Machines and Drives Conference

You are invited to the 9th IEEE International Electric Machines and Drives Conference, Chicago, Illinois, May 12-15, 2013. Learn aspects of design, operation, control, and systems integration of electric machines, electromechanical actuators, and the controls and power electronic drives that implement their applications. The 3 days feature over 250 papers, posters, in 5 concurrent sessions and half- and full-day tutorials.

IEEE IEMDC is an ideal venue for disseminating research and determining industry research needs, offering an opportunity to connect with customers, vendors, and other researchers. There is a Student/industry reception and Argonne National Lab tour, plus exhibits of Design tools, test equipment and real-time systems.

www.IEMDC13.org

300-Millimeter Thin-Wafer Power Semiconductor Production

Infineon Technologies AG has achieved a major breakthrough in the manufacturing of power semiconductors on 300-millimeter thin wafers. In February, the company received the first customer go-aheads for products of the CoolMOS™ family produced by the 300-millimeter line at the Villach (Austria) site. The production process based on the new technology has completed qualification from start to finish and customers have given the go-ahead.

"Infineon put its faith in this manufacturing technology very early on and continued to invest even in economically difficult times. We think and act with foresight and are now reaping the benefits: The qualification of our entire 300-millimeter line represents a veritable leap ahead of the competition," says Dr. Reinhard Ploss, CEO of Infineon Technologies AG. "300-millimeter thin-wafer manufacturing for power semiconductors will enable us, with the corresponding demand, to seize the opportunities that the market offers."

Infineon is the first and only company worldwide to produce power semiconductors on 300-millimeter thin wafers. Thanks to their larger diameter compared to standard 200-millimeter wafers, two-and-a-half times as many chips can be made from each one. Customers benefit from the new technology, from the ready availability, enhanced capacity and improved productivity. Power semiconductors from Infineon feature low energy loss and compact design. Although not much thicker than a sheet of paper, the chips have electrically active structures on the front and back. Thin-wafer technology is the basis for this.

v.l.n.r.: Dr. Kurt Aigner, Dr. Reinhard Ploss, Dr. Monika Kircher, Haidas Pantelis

www.infineon.com

Website Launch with Advanced Capacitor Search

Cornell Dubilier announced the official release of its newly designed website, www.cde.com. A manufacturer of capacitors for Power Electronics, CDE offers a broad range of capacitor dielectrics, ratings and values, all searchable using a powerful Advanced Parametric Search program and logical navigation paths.

"Our primary user is the design engineer and our site was developed with that in mind", says Scott Franco, Director of Market Development. "Our main objective was to create a clear path to finding the right capacitor for the application and to offer a means of obtaining parts to facilitate design-in. The most significant change to our site is the addition of an Advanced Parametric Search with a powerful search program that allows users to query our database of more than 40,000 capacitors using multiple search criteria. Once a component is selected, the user can locate distributor stock with direct links to the distributor's shopping cart for that item. For more complex design considerations, the company offers a Technical Center with technical application notes, spice models plus Life and Temperature Calculators for many of its core product types. "

Finding a cross to competitive parts is made simple with a competitive cross reference program that contains tens of thousands of exact crosses and possible substitutes. "This feature has been extremely valuable to customers who are looking to obtain comparable parts when competitive lead times start moving out", says Franco.

www.cde.com

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EU PVSEC 2013 Extends its Focus on Application and Policy Topics

In a time, when Photovoltaic Solar Energy is becoming a major electricity source, the 28th European Photovoltaic Solar Energy Conference and Exhibition (28th EU PVSEC) extends its focus to application- and policy-oriented topics with the inclusion of the related players.
The 28th EU PVSEC will take place from 30 September to 04 October 2013 at Parc des Expositions Paris Nord Villepinte in Paris, France. The five-day Conference is complemented by the three-day Exhibition, held from 01 to 03 October 2013.
By the end of 2012, cumulative global installed photovoltaic capacity exceeded the 100 GW mark (EPIA Market Report 2012). It has the potential to increase 2.5 fold within the next 5 years according to the latest Renewable Energy Midterm Market Outlook of the IEA – International Energy Agency.
Dr. Arnulf Jäger-Waldau, European Commission, DG JRC, and EU PVSEC Technical Programme Chairman: "These findings show that PV is on the right track to become a major electricity source in the coming years. The fact that in some countries the share of PV has now reached up to 30% of electricity generation at certain hours, not only shows the huge potential, but also underlines the urgency to provide cost effective solutions to integrate this PV electricity into the grid and to increase its dispatchability."

www.photovoltaic-conference.com

COWEC 2013: Where the Wind Energy Industry Meets

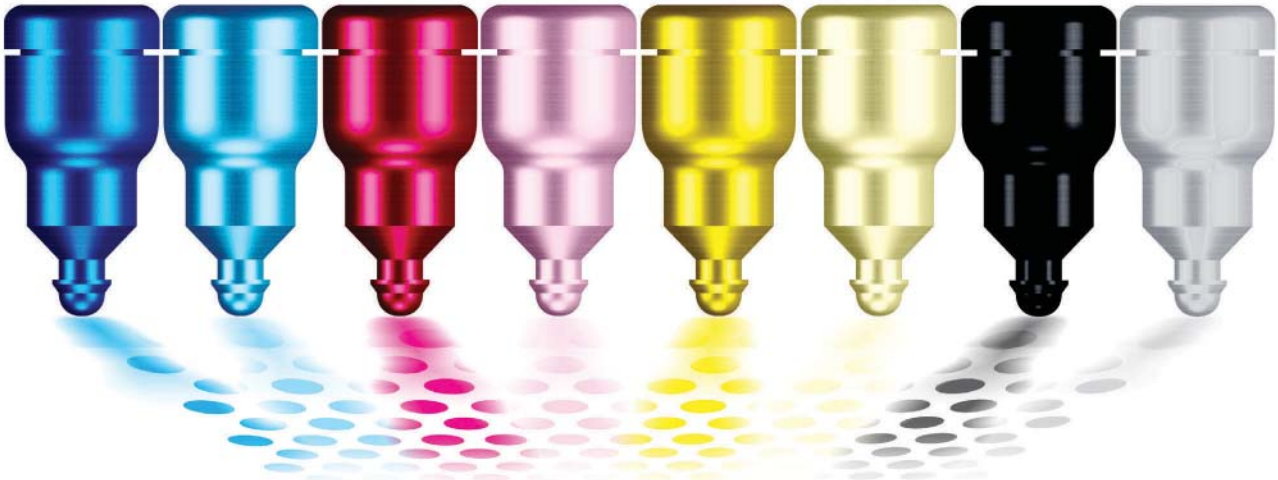
Wind energy is on the advance throughout the world. However there are still a number of hurdles to overcome before widespread large-scale utilization is possible. The international VDI conference COWEC (Conference of the Wind Power Engineering Community) and accompanying industrial exhibition on 18th and 19th June 2013 in Berlin, Germany, will discuss all relevant aspects of the wind energy industry. Wind energy installation operators, component manufacturers as well as energy suppliers and research institutes of international repute will present the full range of topics in technical developments. Organizer of the event is VDI Wissensforum GmbH.
With Prof. Dr.-Ing. Andreas Reuter of the Fraunhofer Institute for Wind Energy and Energy System Technology (IWES) and Dr. Andrew Garrad of GL Garrad Hassan as technical co-directors of the conference, more than 80 speakers from 20 countries will share deep insights into all technical aspects of the wind energy industry. Garrad opens the conference with his paper on the subject of "Wind energy: short-term turbulence, long term growth".
This event in five parallel sessions covers topics which include gearbox types, rotor blade designs, maintenance, damages and damage analysis as well as vibrations and the international wind power market. "The main attraction of COWEC is its technically ambitious program", says Reuter. From the point of view of an energy supply and wind-farm operator with a presence throughout Europe, Dirk Simons of RWE Innogy in his keynote presentation describes how the future of renewable energies can be secured by market integration. In his keynote presentation, Lars Thaaning Pedersen of Dong Energy Wind Power addresses the topic of reducing energy costs in offshore wind power installations.

www.cowec.de

World's First Nationwide EV Charging Network

Estonia is first country to operate a nationwide EV charging network of 165 DC fast chargers
Zurich, Switzerland, Feb. 20, 2013 – Estonia has become the world's first country to launch a nationwide fast-charging network for electric vehicles, using technology provided by ABB, the leading power and automation technology group.
The network of 165 web-connected direct current (DC) fast chargers, supplied and built by ABB, was officially opened on Wednesday. The chargers are installed in urban areas with more than 5,000 inhabitants, and on major roads throughout the country, creating the highest concentration of DC chargers in Europe. On highways, the chargers are never more than 60km apart, making it possible for electric vehicles to travel anywhere within the Baltic state without running out of power.
"ABB is delighted to have built the world's first nationwide electric fast-charging network in Estonia," said Ulrich Spiesshofer, head of ABB's Discrete Automation and Motion division. "Having a nationwide fast-charging network will encourage motorists to switch to electric vehicles and it will motivate other countries to invest in their own charging infrastructure."
Unlike conventional residential power outlets, which take up to eight hours to charge an electric vehicle, ABB's Terra 51 DC fast chargers need only 15-30 minutes to do the job. The fast-charging stations comply with the CHAdeMO charging standard and can be used for charging vehicles with DC of up to 50 kilowatts (kW) as well as with alternating current (AC) of up to 22kW. The methods can be used simultaneously, if necessary.

www.abb.com



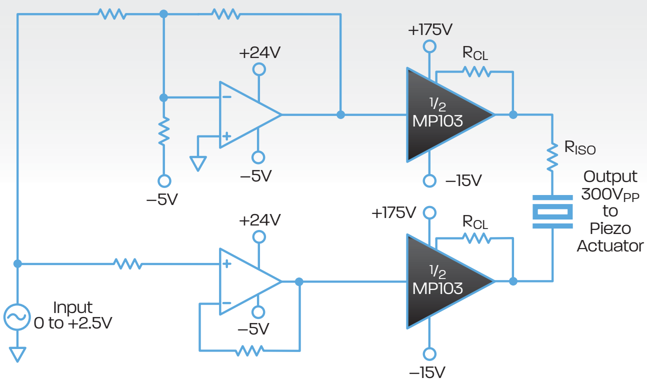
Space Saver. Cost Saver.

MP103FC Power Amplifier: Dual-Channel Design Delivers Space Savings, Cost Savings

DRIVE MULTIPLE PIEZOELECTRIC LOADS WITH SPEED, CURRENT AND VOLTAGE

The MP103FC from Apex Microtechnology is a dual-channel power amplifier that is designed to drive multiple loads with a single device. With full power bandwidth rated for 230 kHz, the MP103FC is optimized for industrial applications requiring piezoelectric loads with more than one driver. This thermally enhanced module also features output current of up to 15 A PEAK per channel and a 30 V to 200 V power supply. A single MP103FC delivers high current, high voltage and high speed at a per unit cost savings that makes it the option of choice versus single amplifier solutions and discrete designs.

- Print head electronic drives for industrial ink jet printers



BRIDGE MODE PIEZOELECTRIC DRIVER
(For Design Discussion Purposes Only)

FC MODULAR 42-PIN DIP

Open Frame Product Technology
(actual footprint 65.1mm X 42.5mm)

Power up at www.apexanalog.com/bodosmp103

apexanalog.com/bodosmp103

APEX™ MICROTECHNOLOGY

ISO9001

EU Representatives Discussed Directions at ISS Europe 2013

At the International Semiconductor Strategy Symposium (ISS Europe), the European semiconductor industry affirmed its ability to innovate. More than 170 top industry representatives agreed on a number of joint steps and strategic measures to strengthen their competitiveness and sustainability. The controversial question whether the best way to attack future challenges will be "More Moore" or "More than Moore", ended in an expected compromise, namely that the industry should pursue both strategies concurrently, the high-calibre participants of a panel expressed. Whilst the More than Moore sector is traditionally strong in Europe, going on with More Moore is important for two to three device makers in Europe and in particular for the European equipment suppliers which export 80% of their products.
In a global scale, the semiconductor industry is approaching the move to 450mm wafer processing technology – a step that promises to greatly boost the productivity of semiconductor manufacturers. However, since the investment to build a 450mm fab easily exceeds the 10 billion dollar mark, this move is regarded as risky and, for this reason, reserved to only the very largest enterprises. In the past, this perspective divided the European industry into two camps - the "More Moore" group that advocates taking on the 450mm challenge, and the "More than Moore" group which shunned this risky investment and preferred to rely on application-oriented differentiation instead.
At the event SEMI Europe, an industry association embracing enterprises that represent the entire value chain and organizer of the ISS Europe, set up a high-ranking panel discussion on options and choices of a single European semiconductor strategy. The panel proved that entrepreneurial spirit is well alive among Europe's chipmakers, technology suppliers and researchers.
Time is ripe to close the ranks and take on the challenges, as the speakers in the panel pointed out. Judged on the basis of its expertise and abilities, the European semiconductor and equipment industry has remarkable strengths, the experts said unanimously. "We have to think in European terms," said Luc Van den hove, CEO of the Belgian research centre Imec. "Talking in a common voice allows the European Commission to act and support this industry".

www.semi.org/eu

EPIC Represents Photonics Industry at European Commission

EPIC represents the photonics industry at the inaugural meeting of the European Commission Key Enabling Technologies High Level Commission expert group. The group was launched today to assist the European Commission in the implementation of the strategy to boost the industrial production of KETs-based products in Europe. The global market in Key Enabling Technologies (KET) is forecast to grow from about 650 billion euro in 2008 to over one trillion euro in 2015. World leading industries in the fields of automotive, communication, aeronautics, defence, health and energy are all intensive users of KETs.

Representing the European photonics industry, EPIC President Drew Nelson, CEO and President of epitaxial wafer supplier IQE, has been appointed as a member of the new High Level Group as technology representative for the Photonics KET. "I will be a vigorous supporter and promoter of KETs at regional, national, and European level and take every opportunity to help design and implement policies to help the competitiveness of Europe through the rapid deployment of KETs" Drew Nelson stated, "I expect from the KET high level group that it is able to persuade the European Commission through evidence based examples and debate to adapt EU policies throughout each Directorate General that fully support KETs implementation throughout Europe."

EPIC
European Photonics Industry Consortium

www.epic-assoc.com

World's First GaN-based High Power Converter

Transphorm Inc. announced at the 2013 ARPA-E Energy Innovation Summit that its novel 600V Gallium Nitride (GaN) module has enabled the world's first GaN-based high power converter.
Transphorm will demonstrate the product built with its customer-partner Yaskawa Electric, Japan at the APEC 2013 industry conference. The announcement underscores the significant technical and commercial progress that Transphorm has made since being awarded ARPA-E funding in 2011 to reduce the vast amount of electric power waste globally.
Yaskawa's product, a 4.5kW PV power conditioner, is powered by Transphorm's 600V GaN half-bridge modules, which have enabled it to achieve several industry firsts: The first high power converter product in the world utilizing GaN technology. The first efficient PV power conditioner to operate at 50KHz. Simultaneous achievement of a 40% reduction in inverter size and 98% efficiency operation, a form and function benefit uniquely enabled by Transphorm's EZ-GaN module technology
Transphorm's patented, high-performance EZ-GaN module technology, combines low switching and conduction losses offering reduced energy loss of over 50% compared to conventional silicon based power conversion designs while simultaneously operating at higher frequency.
"The partnership between Yaskawa, the world leader in inverter solutions, and Transphorm, the world leader in GaN-based power conversion, has produced the world's first high power GaN power converter," said Umesh Mishra, CEO of Transphorm. "This is a disruptive first step which signals the broad adoption of GaN-based power conversion solutions."

www.transphormusa.com

EPSMA Releases Lead-free Soldering Guidelines

Lead-free solder has almost entirely replaced leaded solder in today's electronics due to the Reduction of Hazardous Substances - RoHS requirements. The resulting change of the soldering processes with associated higher soldering temperatures has gradually been accepted by and implemented in the industry during the last decade (2001 - 2010).

The introduction of lead-free soldering has however introduced a number of new issues which have the potential to influence reliability characteristics in a previously reasonably well understood product area. There are still major concerns regarding lead-free soldering and these new issues arising from the use of different materials manufacturing and assembly processes.

The reliability characteristics of concern include Moisture Sensitive Levels (MSL), Electro-migration in solder joints, Tin Whiskers, Dendrites, Conductive Anodic Filaments (CAF) and how metallization on terminals are affecting reliability.

To raise awareness of these not so commonly understood areas, the European Power Supply Manufacturers Association (EPSMA), has published a paper which examines these reliability characteristics in detail and importantly provides recommendations to minimize, and where possible, avoid any degradation of reliability.

www.epsma.org

Top Honor at embedded world 2013

Enpirion received the embedded award 2013 for outstanding technical innovations in embedded technologies. Enpirion developed a magnetic alloy, which enables the miniaturization of passive magnetic components and their assimilation with integrated circuits at wafer level. So-called wafer level magnetics (WLM) will take magnetic components from their 3-dimensional discrete shape to a planar 2-dimensional thin-film form that can be deposited with standard wafer processes on top of CMOS wafers. Enpirion's WLM technology is fully qualified for full-scale mass production and enables the industry's first ever Power System-on-Chip (PowerSoC) based on electroplated wafer level magnetics, the EL711.

The EL711, recognized with the embedded award 2013, delivers lowest cost, low power point-of-load DC-DC conversion at a record-breaking 18 MHz switching frequency. Compared to an LDO, the EL711 improve power conversion efficiency up to 40 points, with efficiency of up to 90 percent. A true PowerSoC, the EL711 monolithically integrates MOSFET switches, controller circuits, compensation, and a tiny silicon inductor. With an ultra-fast transient response, the EL711 meets the demand of high performance digital ASICs, DSPs, and FPGA cores found in a broad range of applications.

www.enpirion.com

AMA Conferences 2013: Program Now Online

The AMA Association for Sensor Technology extends an invitation to visit the AMA Conferences - SENSOR, OPTO, and IRS² from 14 to 16 May 2013 in Nuremberg. Parallel to the SENSOR+TEST 2013 trade fair, representatives from science and industry will present their latest research results from a broad spectrum in sensor and measuring technologies.

The AMA Conferences, SENSOR, OPTO, and IRS², are considered to be international networking platforms in sensor and measuring technology. The up-to-date AMA Conference program for 2013 is now online at http://www.ama-science.org/ama-conferences-2013/. The AMA Conferences 2013 comprise 230 first-rate presentations by international and national specialists from research and development. The latest results from the various disciplines provide international visitors with concentrated technical information. The SENSOR Conferences, under the technical direction of Professors Roland Werthschützky (Technical University of Darmstadt) and Reinhard Lerch (University of Erlangen-Nuremberg), is distinguished this year by an expanded program. Besides physical principles, sensor technologies, sensor electronics, and applications, a special topic on gas sensors will be offered on Thursday.

www.ama-sensorik.de/site/en/447/news.html

Motors with Sensorless, Brushless DC Motor Drivers

Integrated motor drivers accelerate product design by eliminating external components and software development

Texas Instruments introduced two 3-phase, brushless DC (BLDC) motor drivers that allow designers to spin motors in minutes rather than months. Traditional BLDC motor designs require five to 10 components, along with firmware. The sensorless 5-V, 680-mA DRV10866 and the 12-V, 1.5-A DRV11873 cuts this component count to one with no firmware required, significantly reducing board space and system costs, while helping customers speed their time to market. The devices also provide the lowest operating voltage and standby current to reduce power consumption by up to 75 percent. For more information or to place an order, visit www.ti.com/drv10866-pr-eu.

Key features and benefits of the DRV10866 and DRV11873

Highly integrated: Single motor driver eliminates the need for external gate drivers, inverters, position detection and feedback, along with a microcontroller (MCU) and firmware, to cut board space, system cost and development time.

Spins motors in minutes: Utilizes TI InstaSPIN-FAN motor solutions™, a fully protected robust solution with no coding and very few external components needed to get motors spinning.

Reduces power consumption by up to 75 percent: Wide operating voltage range of 1.65 V to 5.5 V and low quiescent current of 5 uA extends the battery life of portable devices, compared to existing solutions.

Flexibility to add advanced control: Can be combined with a TI MSP430™ MCU for designs requiring user interface and closed-loop speed control.

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

Tools and support

In addition to the motor driver, the DRV10866EVM and DRV11873EVM evaluation modules (EVMs) include a simple TLC555 timer, frequency generator output, PWM input and motor connection to enable fast, code-free motor evaluation. Both EVMs ship with schematics and gerber files for a suggested retail price of US$25.

Support is available on the Motor Driver Forum in the TI E2ETM Community, where engineers can ask questions and get answers from TI experts.

Package, availability and pricing

The DRV10866 and DRV11837 are available today in a 3-mm by 3-mm SON package for a suggested retail price of $0.39 and 16-pin TSSOP for suggested retail price of $0.89, respectively, in 1,000-unit quantities.

Learn more about TI's motor control solutions by visiting the links below:

Order samples of the DRV10866: www.ti.com/drv10866-sample-pr
Order samples of the DRV11873: www.ti.com/drv11873-sample-pr.
Buy the DRV10866EVM from the TI eStore: www.ti.com/drv10866evm2-buy-pr.
Buy the DRV11873EVM from the TI eStore: www.ti.com/drv11873evm2-buy-pr.
Download the DRV10866 datasheet: www.ti.com/drv10866-ds-pr.
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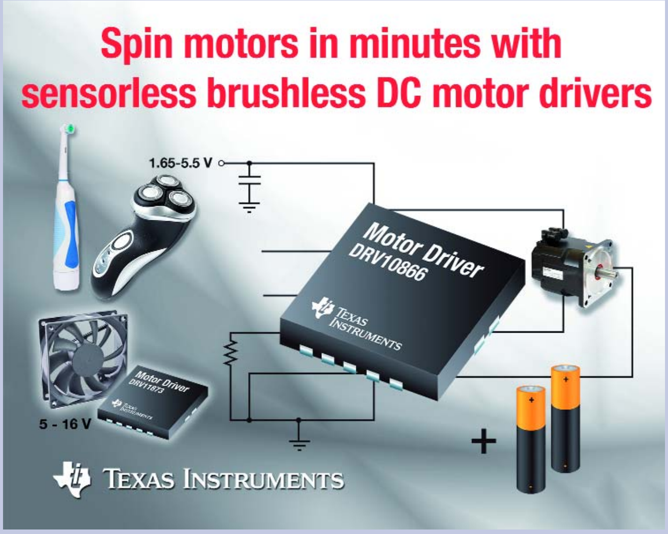
Check out motor drive and control selection guides, training, videos, application notes and block diagrams: www.ti.com/motor-pr.



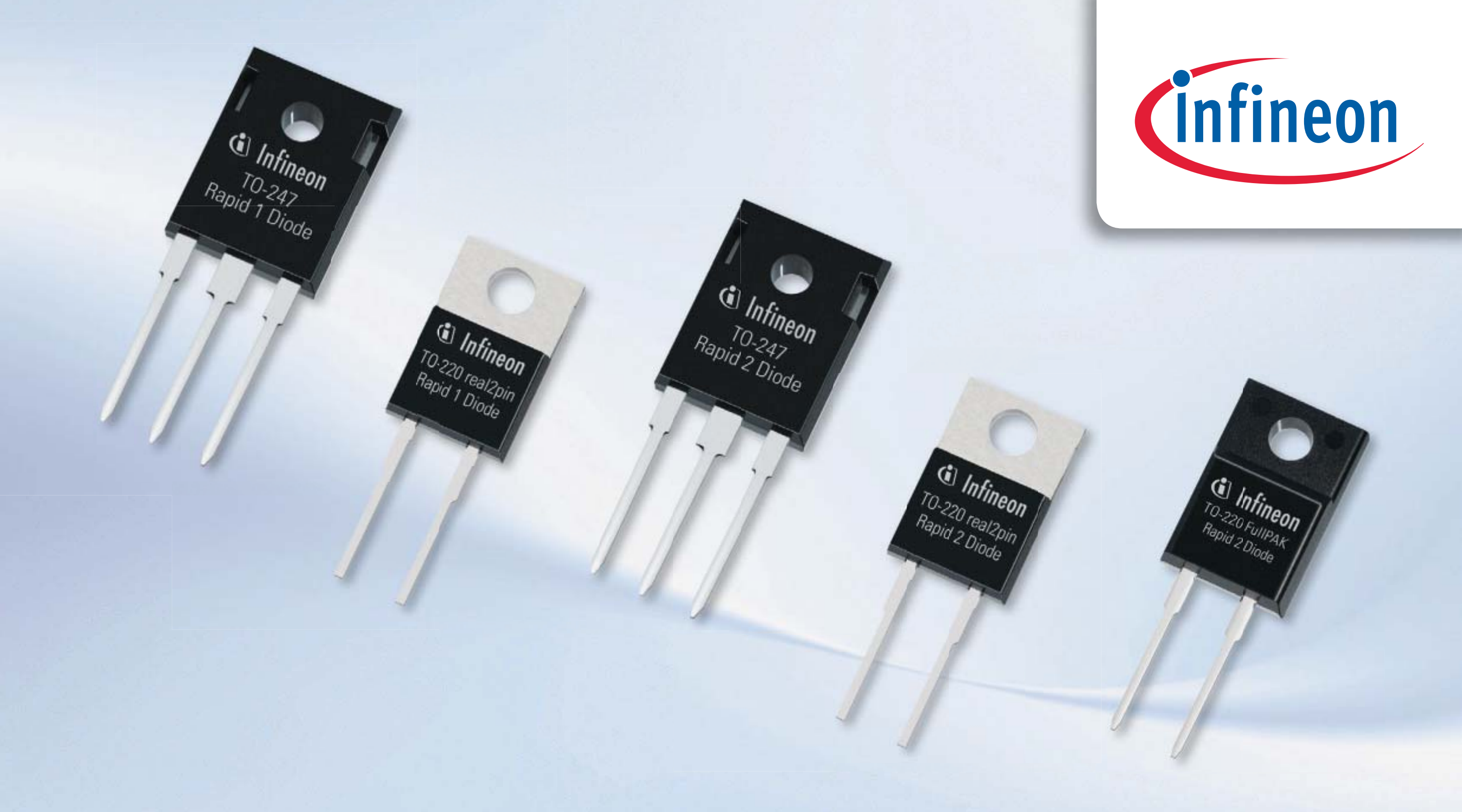
TI spins motors

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

About Texas Instruments

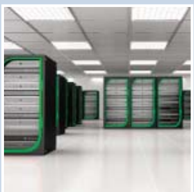
Texas Instruments semiconductor innovations help 80,000 customers unlock the possibilities of the world as it could be – smarter, safer, greener, healthier and more fun. Our commitment to building a better future is ingrained in everything we do – from the responsible manufacturing of our semiconductors, to caring for our employees, to giving back inside our communities. This is just the beginning of our story. Learn more at

www.ti.com



New 650V Rapid 1 and Rapid 2 Diode Families

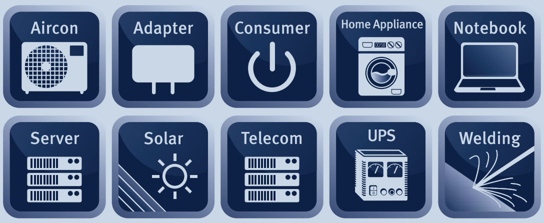
Infineon Enters the Hyperfast Silicon Diode Market



As a perfect partner to CoolMOS™ and discrete IGBTs such as TRENCHSTOP™ 5, the Rapid diode families provide outstanding cost/performance ratio in AC/DC stages, such as PFC stages and free-wheeling diodes in DC/DC stages. Split into two families, the Rapid 1 is V_F optimized for applications switching between 18kHz and 40kHz, whilst the Rapid 2 is Q_{rr} optimized to offer outstanding performance between 40kHz and 100kHz.

Key features and benefits of the new 650V Rapid 1 and Rapid 2 Diode families

- 650V repetitive peak reverse voltage as standard for higher reliability
- Temperature stability of major electrical parameters
- Lowest I_{rrm} for improved E_{on} losses of the boost switch
- S-factor >>1 for outstanding EMI behaviour
- Rapid 1 Diode – V_F of 1.35V, t_{rr} < 100ns
- Rapid 2 Diode – lowest Q_{rr}:V_F, t_{rr} < 50ns



For further information please visit our website:
www.infineon.com/rapiddiodes

Customer Care - Manufacturing Flexibility

By Hans-Dieter Huber, VP Industry, LEM

Servicing valuable customers is not just about pricing and product performance. The advantages of localized manufacturing facilities provide benefits to the customer in terms of logistics, costs and communications.

The power electronics market with its wide spread across different areas such as, drives, solar etc, has seen many changes over past years and is probably one of the most difficult markets to service. It's not just that demand is highly volatile, but also the rate at which new products need to be introduced. Two years ago, in LEM's key market of current sensors, there was a boom which was fuelled by short term demand and we had to cope with the issues of ramping up production and getting the parts out to our customers to meet their delivery challenges. Since then we have seen a spectacular change in that new, higher performance devices are needed with an increasingly shorter design cycle time. On the deliveries the view of future demand has changed to a much shorter delivery time. This is a scenario that faces the whole industry and to remain competitive in this market, a company needs to adjust its processes and logistics just to keep up.

The logistical challenge to manufacture products at a competitive price has in the past made China the favoured choice, but as the popular manufacturing regions are now becoming rather expensive, many Chinese manufacturing facilities are moving out from these centers to the countryside to contain costs. Additionally, transportation costs are increasing which further reduces the competitive edge of using China and other far eastern countries for manufacturing, when the market is in Europe or America. These transportation costs can represent 15% of the total product price to the customer. All of that makes a closer-to-home facility an attractive proposition.

MS Research, now part of IHS Inc. reported that with record growth levels in motor controls, the importance of locating motor controls production closer to consumption is a rising trend resulting in production shifts closer to demand, including China, Brazil, and Eastern Europe. Reports also indicate that production movement from Poland to other Eastern European nations has already begun, and in China, suppliers are locating facilities in more remote areas of Western China or near Mongolia. As suppliers try to maintain local presence while at the same time keeping labour costs down, Southeast Asia and India are expected to see a rise in manufacturing facilities over the next decade. In particular, Poland and Romania are highlighted due to the cost of labour in Eastern Europe and the close proximity to some of the largest machine producing countries, including Germany and Italy. With motor control demand continuing to increase across Europe and in these large markets, additional manufacturing solutions will be necessary for many suppliers.

This is a similar scenario for other big markets such as solar.

Risk management is an important issue. Simply relying on one production facility is not good enough for today's business environment. Production ideally needs to be close to the customer which means that the Chinese business model is not always the best way of serving your customer. Logistical problems often prevail and hinder the service to the customer.

LEM recently announced its intention to open a new production plant in Sofia, Bulgaria with production due to commence from October 2013. The new plant will occupy floor space of 4,500 square metres and will also create 50 new jobs in the first phase. Opening LEM Bulgaria increases production capacity close to LEM's European customer base, while geographically diversifying the company's attractive cost manufacturing base and it will play a major role in future growth as well as increasing competitiveness and significantly growing LEM's presence in the European economy.

In keeping with LEM's strategy of constant innovation, the emerging smart grid presents another potential business for LEM involving the complete energy chain from generation to consumption, through to transportation and distribution. Here current and voltage measurements and smart meters will be needed with specific requirements, with regard to accuracy, special form-factors, dimensions or interfaces. Another key point is that the management of generated power will be subject to energy source fluctuations. Solar and wind power has to be integrated into the grid control and has to be partly responsible for the grid quality. This is now carefully regulated and requires more and better measurement in the generation of renewable power. Additionally, the energy distribution from the power station will need to be bi-directional whereas traditionally it has always been unipolar. This will make the networks more complex and new current, voltage and metering demands will be required.

LEM's Swiss operations will see continued investment both in R&D activities and in marketing, and will concentrate on developing innovative products combining high complexity and high precision, for its markets throughout the world.

www.lem.com

Electronics Industry Digest

By Aubrey Dunford, Europartners

SEMICONDUCTORS

Worldwide semiconductor sales for 2012 reached $ 291.6 billion, the industry's third-highest yearly total ever but a decrease of 2.7 percent from the record total of $ 299.5 billion set in 2011, so the WSTS. Global sales for the month of December 2012 hit $ 24.7 billion, a decline of 3 percent from the previous month. Fourth quarter sales of $ 74.2 billion were 3.8 percent higher than the total of $ 71.5 billion from the fourth quarter of 2011.

The total R&D volume engaged in the ENIAC Joint Undertaking (JU) program reached € 1.8 billion at the end of 2012. 2012 projects sum up to more than 4 times the volume achieved two years before, thanks to ambitious Key Enabling Technologies (KET) pilot line projects and enabled by a strong involvement of the ENIAC member States. The KET pilot line projects summing up to € 730 M strengthen the European 300mm infrastructure (59 percent), support significant developments in diversification technologies on 200mm and smaller diameters (13 percent), and allow the equipment and materials suppliers to prepare for the transition to 450mm generation (28 percent). The projects are carried out by more than 530 participating organizations among which 26 percent are large companies, 41 percent SMEs, and 33 percent Universities and research institutes. The budget available for 2013 allows supporting R&D projects approaching € 1 billion total eligible costs.

AENEAS, the association bringing together European R&D players in nanoelectronics, announced the launch of ENI2, a new initiative designed to create mid-and longterm technology roadmaps for cooperative R&D projects in nanoelectronics. ENI2 (European Nanoelectronics Infrastructure for Innovation) members include academia, research institutes, multinationals and SMEs from 15 European countries. It will help to optimize the efforts, time and funds spent on R&D projects, mainly by aligning the technological needs and roadmaps for nanoelectronics between industrial and academic partners within a longterm perspective. The ENI2 Technology Roadmaps will initially focus on the following 5 areas: Advanced CMOS; Smart Energy; Smart sensors (Internet of things, e-health); Heterogeneous integration to offer greater functionality at lower cost; Novel semiconductor equipment and manufacturing processes. The roadmaps will span over periods of 3 to 9 years.

NXP Semiconductors is planning to cut 700 to 900 jobs worldwide. In France, 80 jobs will be cut at its R&D centre in Colombelles, near Caen.

Raytheon officially opened for business a new silicon carbide manufacturing foundry facility in Glenrothes, Scotland. The application of silicon carbide in electronic systems will place the UK in a leading position to develop next-generation, high-efficiency, smaller, low-weight power conversion products used in harsh environments across the automotive, aerospace, geothermal explorations, oil and gas, and clean energy sectors. The silicon carbide foundry is the first of its kind in the UK and represents the fusion of Raytheon's investment in UK manufacturing technology with university expertise, backed by UK government funding.

Nanoelectronics research centre Imec and Qualcomm announced an extended collaboration agreement to accelerate scaling technologies for logic and memory devices. The first fabless integrated circuit company to become a core partner of Imec, Qualcomm will gain comprehensive insight into all advanced process technologies under investigation at Imec to help shape future product roadmaps.

PASSIVE COMPONENTS

Alps Electric, a Japanese manufacturer of electronic components for mobile devices, home electronics, vehicles and industrial equipment, will cut about 3,000 jobs at home and abroad in fiscal 2013, accounting for about 8 percent of its 36,000 employees. Alps Electric supplies over 40,000 different components to about 2,000 companies all over the world.

Molex has launched a German-language version of its website, providing customers in German speaking countries such as Germany, Austria and Switzerland with access to product information, news and technical resources. It also allows users to search for and order parts in German. The site is in addition to the company's English, Japanese, Korean and Chinese-language websites.

OTHER COMPONENTS

Minebea and Panasonic reached an agreement that Panasonic would promptly transfer all of its shares (40 percent of the capital) in their joint venture of Minebea Motor Manufacturing to Minebea and dissolve their alliance. Minebea Motor had been set up on April 1, 2004, integrating the fan motor, stepping motor, vibration motor, and DC brush motor business of Minebea and Panasonic. On April 1, 2010, businesses for small brushless motors, power brushless motors, and polygon mirror scanner motors had been transferred to Minebea Motor from Panasonic for further business development. For the fiscal year ended in March, 2012, Minebea Motor had sales of JPY 54.4 billion with 7,493 employees.

DISTRIBUTION

CUI, a company focused on the development of electronic components consisting of interconnect, sound, motion control and thermal products, has signed a global distribution agreement with Future Electronics.

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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Power Management Integrated Circuits (PMICs) for Portable Applications

By Richard Ruiz, Analyst, Darnell Group

The growing demand for power required of today's feature rich portable consumer electronics devices is expected to continue fueling demand for Power Management Integrated Circuits (PMICs). PMICs address battery charging and provide multiple system rails in portable products. They manage power flow from various power sources (wall adapters, USB and batteries) to power loads (device systems and the charging battery), while maintaining current limits where required (such as that specified for USB). Regardless of application, the main functions of PMICs in power management are dc-dc conversion, battery charging, selection of power source, voltage fluctuation management and other miscellaneous functions.

The diverse and growing nature of the PMIC market is attracting new competitors with new technologies. At the recent IEEE Applied Power Electronics Conference in Long Beach, California, a new company, Sarda Technologies introduced a GaAs power switch developed to meet the specific demands of low-voltage power conversion. Called a gFET™ the new device is a GaAs pseudomorphic high electronic mobility transistor (pHMET) with low on-resistance, very low device capacitance and sub-nanosecond switching speeds. It can be manufactured at a commercially-attractive cost using existing GaAs foundry processes.

This new device has the potential to reduce the size of point-of-load regulators with current ratings from 1A to 20A by allowing multi-MHz switching speeds with high efficiency and low cost. In addition these devices are particularly well-suited for use in handheld, battery-powered devices where cost, size and efficiency are all critical.

PMIC components vary by application and manufacturer, but generally integrate a battery charger, one or more buck/boost converters and in many cases multiple LDO's to address the various power functions. Some models feature I2C or SPI serial bus communications interface for I/O. PMICs can be applied in everything from consumer electronics such as smart phones, tablets, GPS devices, ultrabooks, digital cameras and others that require both long battery life and efficient power management to stationary applications such as automotive and industrial equipment. As a rule, the more advanced functions offered by the device, the more likely a PMIC solution will be used.

The PMIC often has to generate up to 30 different power supplies to be able to feed different parts of the baseband and applications processor with the right combination of voltage and current. Instead of running at peak speed all of the time, it is possible to save additional energy by providing a lower voltage, which slows down processing. Since the energy consumed is proportional to the voltage, the energy savings can be significant and it's important that each processor or hardware block gets exactly the right voltage. This is why the PMIC needs to be able to generate so many different voltage sources.

Currently smart phones, tablets and ultrabooks are the fastest growing and most popular portable consumer electronics devices. The popularity behind these devices are their slimmer and lighter build, multi-tasking capabilities such as easy availability of social networking sites (Facebook, Twitter), viewing videos, and Internet connectivity among others. Users of these portable devices also expect high-quality end-to-end speech with louder, better-quality speakerphone, high-quality microphones, and high-definition audio playback. Increasingly, the popularity of apps such as social networking and mobile Web access means that users demand ever-more data bandwidth through 3G connections and LTE 4G. Consequently, the importance of power management in these devices increases as these applications can drain out the power in the devices very easily.

These portable applications are where PMICs have taken a particularly strong hold, as the growing adoption of multi-core, high-performance processors, combined with the use of high-resolution displays and high data-rate wireless connectivity has significantly transformed power requirements in new designs. (Screen sizes on today's portable devices range from 5 inches to 15 inches, and with display backlighting often accounting for over 40% of power consumption.)

Also essential to any of today's mobiles devices is the sophistication and performance of internal application processors, which have evolved from the single-core devices, which were considered adequate only a couple of years ago to dual-core and now quad-core implementations to handle the increasingly diverse and high-performance functionality available.

The latest families of multicore application processors also integrate extra peripherals, such as the DRAM controller and a media/graphics co-processor (e.g., the ARM Neon). As a result, power-management functions must be complex enough to handle the increasing number of peripherals and processor cores populating today's mobile platforms.

In addition to new designs, advanced battery technology with increased capabilities and higher voltages are used to maintain longer run times. These new design trends not only present additional challenges to the power management chip industry, they are also expected to re-define the power architecture in modern portable devices, many of which (such as tablets and ultrabooks) are still in their early growth stages.

Since power management requirements can vary significantly, a traditional one-solution-fits-all approach will meet the necessary requirements. On a very high level, the decision between one or two source inputs and one or two outputs has a large impact on solution size and cost. Also, various applications may differ somewhat in terms of the battery capacity and thus in terms of required charge current levels. Other considerations that need to be taken into account include the support of specific industry specifications, use of a wide variety of power sources (USB, ac-dc, wireless and high-voltage), level of system control, adoption of new battery technologies and others.

In a growing number of portable applications, highly-integrated power management chips are used in conjunction with specific application processor and baseband chips with the objective of addressing the majority of power management needs. These power management integrated circuits are typically developed around a specific platform and are designed to work well within the system. In fact, the further incorporation of most required functions on a single chip has a number of significant advantages, with the most important one being the reduction in component count (BOM) and reduction in solution space.

In addition, a high degree of integration may also guarantee a more reliable and effective interaction and co-operation among the different power management blocks, since they can be defined in a controlled manner. The system designs for these portable electronics devices can also vary significantly from one to another. The differences are driven by a number of factors including cost, space, performance and flexibility. Ironically, while multi-channel power management ICs have traditionally benefited portable applications in terms of cost and space savings, in many designs the high-level of integration has become a limiting factor for high-performance operation and demanding industrial designs.

Although the adoption of high channel-count PMIC have proven to be a benefit to a number of applications in terms of space and cost, some of the latest mobile design trends have introduced a number of severe limitations in the system. For example, the charging circuit needs to be located close to the power input, that is, the connector of the mobile device. On the other hand, the main dc-dc regulators benefit by being located close to the CPU. This conflict in design makes the board layout and the corresponding IC location very challenging.

Also, in the case of a small device such as a smart phone, which uses a charging IC as the main component connecting the outside world to the phone, an extra safety feature is required to protect the device and the downstream system. As a result, many charger ICs are required to tolerate high-input voltage levels in case of a non-qualified or faulty external power source. In the case of a high-integration PMIC, adding this high-voltage tolerance may penalize the entire chip in terms of both size and cost.

The thermal behavior of the portable device also plays a large role on system performance and adds critical barriers on the charging functionality. As the processor chips become more power hungry and require higher levels of current, the power dissipation of the PMIC becomes very high and in order to maintain reliable operation, some of the peripheral power functions on the PMIC are suspended or reduced. In a typical system design, the dc-dc regulators for the main components (core, I/O, memory) are required to remain active for the system to keep running and to guarantee that the device continues to work properly. However, during high temperature rises, the battery charger current is reduced to allow the PMIC temperature to fall within acceptable limits.

Further complicating things, as the temperature increases so does the resistances of the power FETs, which further accelerates power dissipation within the device. Temperature rises on a highly-integrated PMIC may also generate localized hot spots, making the thermal problem a serious issue in many cases. Since many of the new portable devices focus on industrial and compact design, the generation of excess heat can become enough of an issue to cancel a project. Separating charging functionality from the main PMICs reduces localized hot spots and enables a more thermally forgiving design.

Despite the design challenges, an increasing number of power management semiconductor companies including Texas Instruments, Freescale, Atmel, Linear Technology, Analogic Tech, Dialog Semiconductor, ST Microsystems, Renesas, ST Ericsson and many others feel that the growing use of portable electronics devices is expected to be a key growth driver of Power Management Integrated Circuits over the coming years.

www.darnell.com

1200V Generation 8 IGBT for Low Frequency Industrial Motor Drive Applications

With the ever increasing demand on energy, governments are now facing the problem of supplying electricity whilst trying to minimize the environmental impacts of pollution.

By Wibawa Chou, Llewellyn Vaughan-Edmunds and Andrea Gorgerino, International Rectifier Corporation, El Segundo, CA

One of the largest utilizers of electricity are electrical motor drives, which consume approximately 45% of all the total global electricity consumption.
Currently the majority of motor drives in the industry run at fixed frequency speed. By moving to a Variable-Speed Drive system, as much as 30% of energy can be saved.
In Europe alone, by transferring to electronic variable speed drive control and energy-efficient motors, Europe's CO2 annual emissions could be reduced by 69 million tons (CEMEP).

Governments around the world have been introducing regulations that require an increase of efficiency in applications such as industrial pumps, fans and various motor drives. In Europe, the regulation is IEC 60034-30 for motors, which divides efficiency levels into 3 classes of efficiency; IE1 (standard), IE2 (high) and IE3 (premium). IE1 and IE2 are very similar to the USA's EPAct NEMA standard and IE3 similar to the NEMA Premium™. Specific motors sold after June 2011 must meet IE2 standards, whilst IE3 will become mandatory from January 2015 (7.5 to 375 kW), or will have to meet the IE2 efficiency and be equipped with a variable speed drive. The same IE3 standard applies in January 2017 to cover the complete power range (0.75 to 375 kW), or again will have to meet the IE2 efficiency and be equipped with a variable speed drive.

With the pressure now on the motor manufacturers and electronic variable speed architecture, reducing power losses are the governing factor to increase efficiency.
In industrial motor drives systems, IGBT modules are commonly used to drive the motor. These modules must be able to deliver excellent performance with the lowest power losses. Typically these motors will switch below 10 kHz, therefore the IGBT silicon within the module must be optimized for this condition. At these lower switching frequencies; conduction losses in the IGBT govern the total power losses, as the switching losses are proportional to the switching frequency.

A New Approach
The recent introduction of Generation 8, 1200V IGBTs from International Rectifier are targeted for industrial motor drive applications. These applications require low voltage drop, low voltage overshoot and robust short circuit capability from the IGBTs. These requirements along with trench gate technology have allowed motor drive designers to increase current density from an existing power module which can potentially increase reliability or reduce cost of the system. In this paper, we will discuss characteristics of Gen 8 1200V IGBT for its static and dynamic behaviors. A simulation is also presented at the conclusion of the paper to highlight the benefits of Gen 8 IGBT for low frequency industrial motor drive applications.

Power Module Applications for Gen 8 IGBT
The majority of industrial motor applications rely on using power modules for its power electronic assembly. These modules are available in various standard configurations such as 3-phase, half bridge, low side chopper, high side chopper and single switch. The half bridge configuration is the most widely used and most versatile since a half bridge forms the basic building block of most power electronic systems.

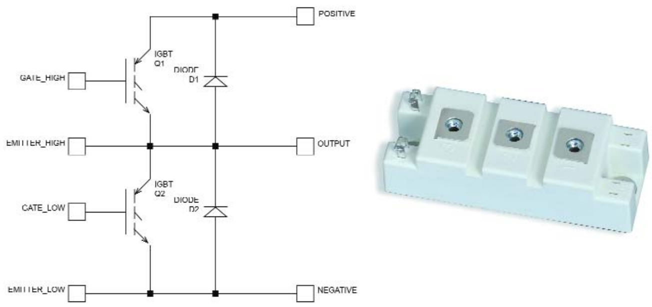

Figure 1 Half Bridge Power Module (a) Schematic Representation and (b) Typical Power Module.

A typical half bridge power module is presented in Figure 1. This module consists of two switches and two anti-parallel diodes in one single package. The power connections (Positive, Output and Negative) are made using screw connections (typically M5 screws). The gate and emitter sense connections of the IGBTs are brought out through soldered terminals. This type of module is commonly referred to as a 34 mm module in reference to its width. With previous IGBT generations, based on planar-gate technologies, a 34 mm module (shown on Figure 1) can only accommodate up to 1200V/150A IGBT dies. With the development of Gen 8 1200V IGBTs, which utilizes Trench Field Stop technology, it is now possible to develop a 1200V/200A half bridge module in the same 34mm package. This achievement is due to Gen 8 IGBTs offering a higher current density than previous generation IGBTs with a much smaller die size. The novel Gen 8 design has also been designed to be highly robust, therefore this reduction in die size does not compromise the Gen 8 short circuit and reverse bias operating capability demanded by industrial motor drive application.

Forward Voltage Drop

One of the requirements for industrial motor drive applications is lowest voltage drop across the IGBTs when they are conducting. Conduction loss is the most dominant loss for motor drive applications operating at 6 kHz or less.

	IR Gen 8 IGBTs	Competitor A	Competitor B
I_{nom}	100 A	100 A	100 A
V_{ceon} at 25°C (terminals)	1.9V	2.2V	1.9V
V_{ceon} at 150°C (terminals)	2.2V	2.9V	2.2V
Die Area	97 mm²	99 mm²	104 mm²

Figure 2: $V_{CE(ON)}$ Comparisons of 1200V/100A, 34mm Half Bridge Power Modules Measured at the Terminals.

Figure 2 shows $V_{CE(ON)}$ comparisons of 34 mm 1200V/100A half bridge power modules using IR Gen 8 IGBT dies and two of the main IGBT competitors in this market. These measurements are observed at the terminals of the power modules. The measurement takes into account the voltage drop across the die, the module substrate, wirebonds and the power terminals. It can be seen that IR Gen 8 IGBT has the lowest voltage drop for a given die area. The $V_{CE(ON)}$ of Gen 8 IGBT at 150°C is 24% lower than Competitor A while the die is 7% smaller than Competitor B.

An important consideration is when the system is running at low load, which means the IGBT is running below its rated current. In this situation, the system will run at a different efficiency due to the characteristics of the IGBT. At lower than rated current, Gen 8 IGBT has consistently lower $V_{CE(ON)}$ compared to Competitor A Figure 3 shows curve tracer plot of all the 34mm IGBT modules at V_{GE} = +15V. Two curves are plotted on each chart with different color intensities for T_j = 25°C (Darker) and T_j = 150°C (Lighter).

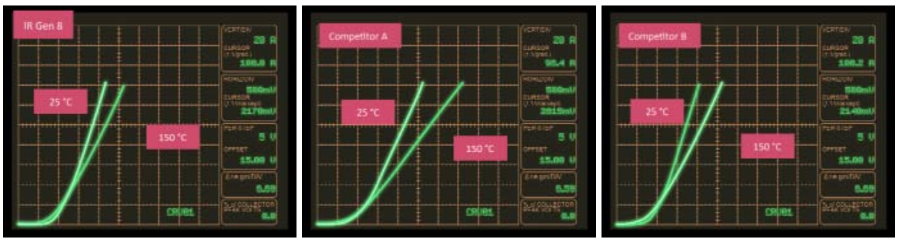

Figure 3: Terminal voltage at T_j = 25°C (Dark) and T_j = 150°C (Light), V_{GE} = +15V. Cursors Show Measurements at I_{CE} = 100A, T_j = 150°C Showing Highest Terminal Voltage Drop for Competitor A.

Switching Characteristics

The other necessary requirement is for the IGBTs to have a low voltage overshoot at turn-off, to minimize conducted and radiated EMI, as well as to prevent IGBT over-voltage failure. Large motor drive systems typically consist of long bus bars with a lot of parasitic inductance which generates unwanted over voltages.
In order to minimize voltage overshoot due to system's parasitic inductance, the IGBTs must have low di/dt during turn-off events.

Switching characteristics of the power modules are measured with bus voltage, $V_{CE(ON)}$ = 600V, at T_j = 150°C with external R_g = 0. Figure 4 shows the turn off characteristics at I_{CE} = 100A.
From these waveforms, it can be seen that Gen 8 IGBT has the lowest overvoltage among the IGBTs tested. The measured overvoltage for Gen 8 IGBT is less than 750V.

Turn on characteristics for the modules are also measured. The turn on behaviors depend on the ability of the IGBT to deliver needed di/dt to recover the anti parallel diodes. The turn on loss of the IGBTs is a combination of IGBT loss and reverse recovery loss of the anti parallel diodes.

Figure 5 shows the turn on characteristics of the IGBTs at I_{CE} = 100A. Gen 8 IGBT is able to deliver higher di/dt than competitor IGBTs and allow it to recover its anti parallel diode much quicker resulting in lower turn on loss. Having high di/dt capability along with high peak current makes Gen 8 IGBT turn on loss linearly increases with collector current. This is a desirable feature since the losses can be managed easily as the device is operated in overload conditions. As it can be seen from Figure 5, Competitor A IGBT cannot deliver high enough peak current and di/dt making its turn on loss much larger than IR or Competitor B IGBTs. This IGBT will have large power loss during overload, therefore increases the case and junction temperatures of the module.

In order to observe the switching loss characteristics over a wide operating range from low load to overload, switching loss measurements are taken between 25A to 200A. Figure 6 shows turn on and turn off energy loss measurement results.

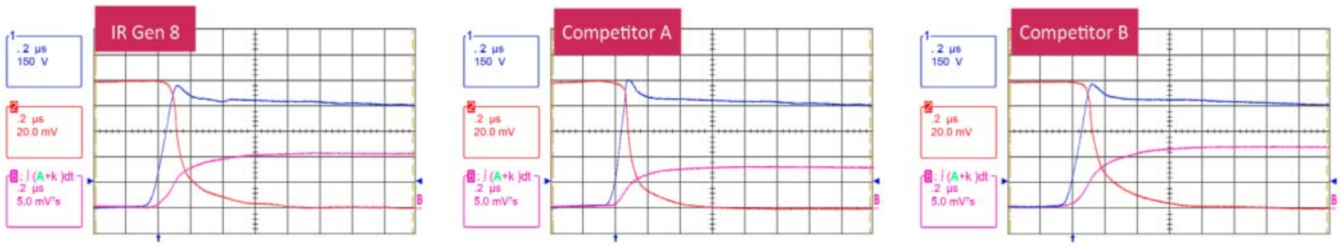

Figure 4: Turn off Characteristics at V_{CE} = 600V, I_{CE} = 100A, T_j = 150°C of IR Gen 8 IGBT, Competitor A and Competitor B.

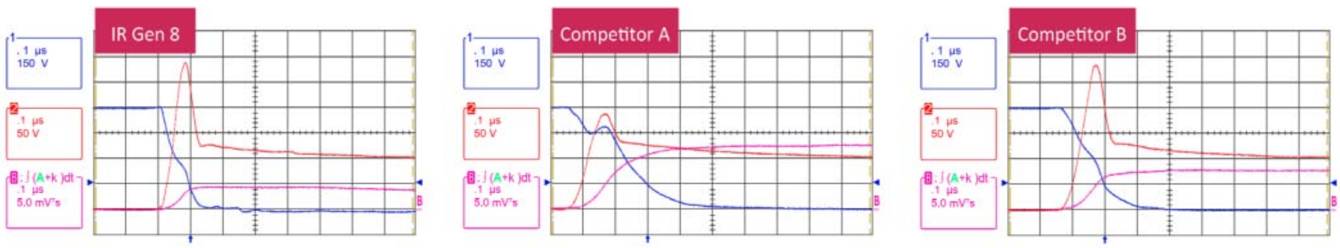

Figure 5: Turn on Characteristics at V_{CE} = 600V, I_{CE} = 100A, T_j = 150°C of IR Gen 8 IGBT, Competitor A and Competitor B

The turn off energy loss of IR Gen 8 IGBT is not as low as that of Competitor A however for low frequency industrial motor drive applications the turn off energy difference will not result in significantly different power loss. The turn on energy loss of Competitor A increases significantly as the collector current is increased past its nominal current of 100A. This was previously explained by the fact that this IGBT does not have high enough di/dt to recover the diode. Competitor A IGBT turn on energy loss increases non linearly which will result in very high turn on power loss during overload conditions.

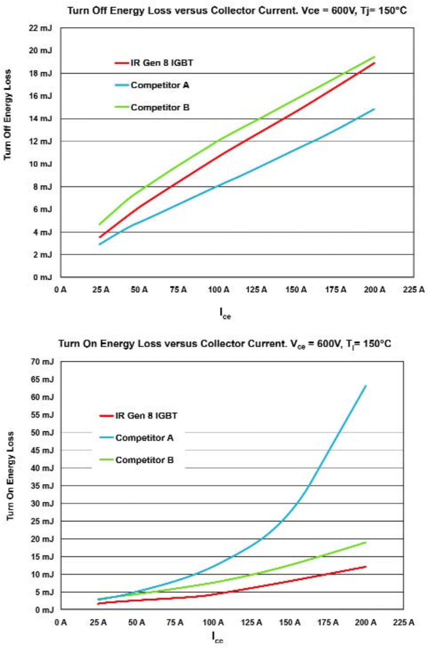

Figure 6: Turn Off and Turn On Energy Loss versus Collector Current.

Short Circuit Characteristics

Short circuit robustness is the main requirement for IGBTs used in industrial motor drive applications. IR Gen 8 IGBT is designed to have a minimum of 10 µsec short circuit withstand time at V_{CE} = 600V with starting T_j = 150°C.

Using the same gate driver board and resistors, all samples of 34 mm power modules are subjected to a minimum of 10 usec short circuit. Figure 7 shows short circuit waveforms of these modules. Channel 1 shows voltage drop across the IGBT at 200V /division. Channel 2 shows short circuit current at 200A/division. IR Gen 8 IGBT has more current overshoot at the beginning due to its higher di/dt capability compared to the competitors. This is consistent with the previous observation of turn on characteristics of Gen 8 which allows higher di/dt and peak reverse recovery current of the anti-parallel diode, which helps in reducing the recovery time of the diode. Competitor A IGBT has a peak current of approximately 300A. This creates a problem in which the IGBT cannot deliver enough current to quickly recover the anti parallel diode resulting in large turn on energy loss as can be seen previously on Figure 6.

It can also be observed that the overvoltage across Gen 8 IGBT when the short circuit current is terminated is one of the smallest at approximately 850V. This is important in order to minimize the need for a separate gate drive voltage or soft shutdown circuitry when a short circuit event occurs.

With the information gathered so far on $V_{CE(ON)}$, turn-on and turn-off energy losses, and short circuit measurements, we are now ready to simulate the performance of these IGBTs under real operating conditions. Using IR proprietary simulation software, the power losses of the 34 mm power modules will be shown in the next section.

Three Phase Motor Drive Design using 34 mm, 1200V/100A Power Modules

A 3 phase motor drive design consisting of three 34 mm, 1200V/100A power modules is simulated to study the power loss of the system at switching frequency of 4 kHz. The simulation is based on measurements taken on the actual power modules. It is assumed that a 1200V/100A power module would be operated on a system with nominal output current of 50 Arms and overload current of 100 Arms.

Figure 8 shows power loss breakdown of the IGBTs due to their conduction, turn on and turn off losses. At 4 kHz switching frequency, conduction loss is a dominant component

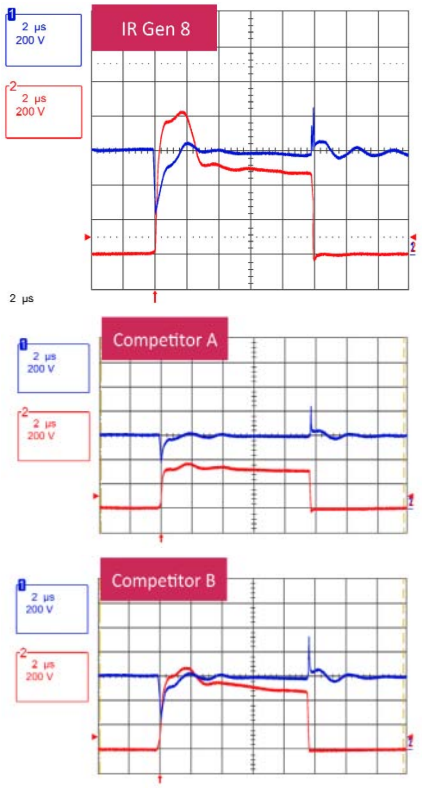

Figure 7: Short Circuit Waveforms of 34mm, 1200V/ 100A Power Modules. V_{CE}= 600V, T_j = 150°C.

of the total loss. Therefore it is preferred to have IGBTs with the lowest voltage drop. At 50 Arms nominal output current, Gen 8 IGBT shows 20% lower power dissipation compared to competitor A. At 100 Arms overload output current, the nonlinear behavior of Competitor A's turn on characteristics result in turn on loss that is significantly higher than IR Gen 8 IGBT.
The total loss of Competitor A at the overload condition is 40% higher than that of Gen 8 IGBT. This makes the design of the cooling requirement of the system using Competitor A power modules to be proportionally larger due to the higher case temperature of the module.

Summary

The design example in this paper using a 34 mm, 1200V/100A half bridge power module, shows that the latest Gen 8 IGBT silicon technology offers the lowest overall losses for motor drive applications operated at 4 kHz both at nominal current and overload conditions.
It also highlights the voltage drop, switching and short circuit characteristics are superior and excellent in industrial applications.
International Rectifier's best-in-class Gen 8 IGBTs have been created to target the industrial motor drives market, where there is a significant potential to reduce power consumption globally.
As demand for electricity rises, we must ensure that it is utilized efficiently.
We must keep our focus on reducing our carbon footprint, whilst understanding how to improve system efficiencies of next generation motor drive systems.

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Figure 8: IGBT Power Loss Calculation at I_{OUT} = 50 Arms (Nominal) and 100Arms (Overload), Respectively.

Improving the Regulation of Multiple Output Flyback Converters

The flyback topology is a good choice for multiple output applications, where several semi-stabilized outputs are required from a single supply. At low power levels the flyback is very attractive in that it is typically the least expensive isolated topology because it uses the fewest number of components.

By Florian Mueller, Texas Instruments

This article addresses some of the challenges of designing a multiple output flyback power supply. The main output is closed loop controlled and is thus fully regulated. The other outputs are only semi-regulated and could provide line and load regulation in the order of +-6%. Problems can appear if the power of the main output is low compared to the semi-regulated outputs. Low main output current could make it very difficult to maintain the other outputs in the +-6% tolerance.

Flyback Control Method

Figure 1 shows the simplified schematic of an isolated flyback converter. The shunt regulator TL431 from Texas Instruments is used in conjunction with an optocoupler to provide feedback loop isolation. A small variation of the output voltage due to line or load changes is sensed by the inverting input of the error amplifier and compared to the internal voltage reference of the TL431. Differences between the divided down output voltage and the voltage reference are gained up and converted into a proportional error current. This error signal is transferred to the primary controller through the optocoupler.

There are two methods for connecting the optocoupler.

The Zener diode D2, the capacitor C2 and the resistor R1 provides the supply for the optocoupler (figure 1). Therefore the optocoupler supply voltage is fixed. This removes any optocoupler dependency on the output voltage and load changes in the ac gain characteristics.

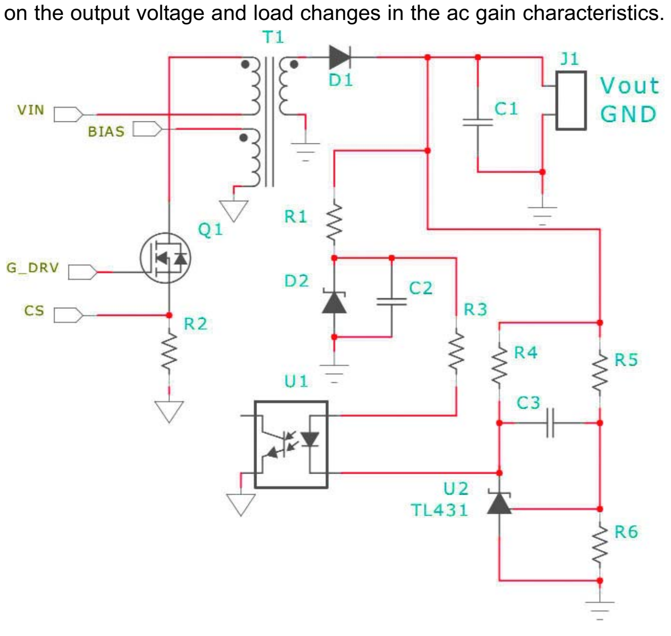

Figure 1: secondary side control method

This independence on the output voltage is the reason that there is only one single feedback path in this circuit. The control loop does not contain an inner loop. Figure 2 shows the block diagram of the transferfunctions.

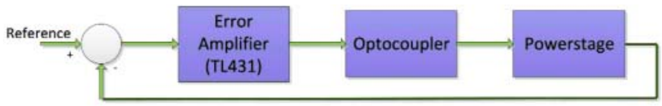

Figure 2: Block Diagramm (without inner loop)

The total open loop is simple the product of all transfer functions.

$$G_{total_{without\ inner\ loop}}(s) = G_{EA}(s) \times G_{PS\_Opto}(s)$$

$$G_{PS\_Opto}(s) = G_{Powerstage}(s) \times G_{Optocoupler}(s)$$

Supplying the optocoupler with the regulated output voltage is an alternative method. Therefore the zener diode D2 and the capacitor C2 must be removed. The optocoupler current depends now on the difference between the optocoupler supply voltage (Vout) and the error voltage and a second inner loop is introduced (see block diagram figure 3).

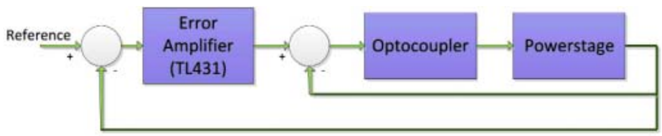

Figure 3: Block Diagram (inner loop included)

The total open loop is now the product of the error amplifier transfer function and the closed loop of the Powerstage and optocoupler transfer function.

$$G_{total_{with\ inner\ loop}}(s) = G_{EA}(s) \times G_{PS\_Opto_{closed}}(s)$$

$$G_{PS\_Opto_{closed}}(s) = \frac{G_{PS\_Opto}(s)}{G_{PS\_Opto}(s)+1} \qquad \text{equation 1}$$

The effect of closing the inner loop can be seen in the bode plot of the powerstage-optocoupler transferfunction (figure 4). Because of equation 1 the gain is reduced to near 0dB at lower frequencies and it tracks the open loop gain at higher frequencies. Adding an inner loop by connecting the optocoupler to the regulated output voltage has an effect on the gain.

The advantage of the inner loop is that there is a reduction of the output impedance and an improvement of the transient response behaviour. The system is faster because the information must not go through the error amplifier.

Compensating the closed inner loop is done by using a typ I or typ II network. For a more elaborate analysis, see Ref [2].

Multiple Output Flyback Design

Flyback converters are often used in power supplies requiring several output voltages. Each additional output only requires another transformer winding, rectifier and output capacitor.

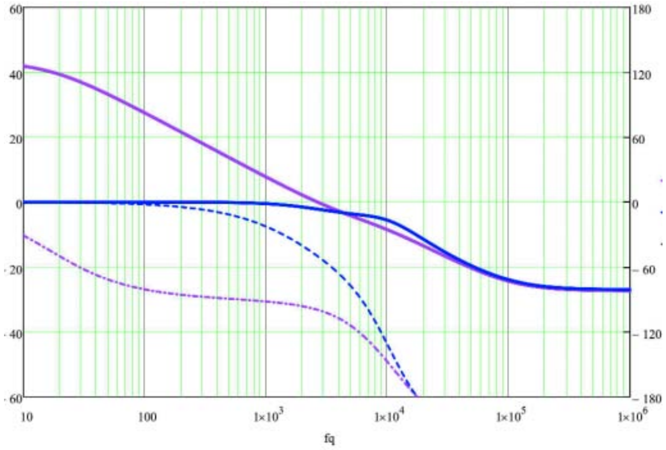

Figure 4: Bode Plot G_(PS_Opto)
Red: without inner loop (solid line: gain, dashed line: phase)
Blue: with inner loop (solid line: gain, dashed line: phase)

Only one output is tightly regulated while the others are controlled via less accurate transformer actions. If perfect coupling between windings was possible, the output voltage would be defined by the winding ratio of the transformer. Unfortunately, perfect winding coupling is impossible, which often results in poor cross-regulation. There are two critical states.

First, the light load operation of the auxiliary windings while the main output is fully loaded. Due to transformer leakage inductance and parasitic capacitance, the secondary voltage tends to ring. If the auxiliary output is fully loaded, this ringing is clamped. If not, this ringing will charge up the output capacitor. This results in a much higher auxiliary output voltage. Solution of this problem can be the use of a minimum load, a post regulator or a Zener diode to clamp the voltage.

The other critical state occurs, if the load of the regulated output is very low. This condition can be the reason for fully unregulated auxiliary outputs.

Figure 5 shows an example of a multiple output Flyback Design.

Problems can occur if the maximum output power of the regulated output (Vout1) is small compared to the total output power. The auxiliary output (Vout2) can be unregulated if the current from the regulated output is low. Decreasing the gain of the compensation network to achieve a very slow system sometimes doesn't help to regulate Vout2. Disconnecting the optocoupler from Vout1 and supplying it with a constant voltage in order to remove the inner loop, usually does not lead to success also.

There is another method to get the design working. The inner loop must be taken from the semi-regulated output. Therefore the optocoupler is connected to the output Vout2. Vout1 is regulated from the outer voltage loop and Vout2 is regulated from the inner loop (see Figure 5). The combined signal contains the error information of the two outputs and the optocoupler transfers it to the primary. This signal sets the power switch duty cycle and therefore the primary side current.

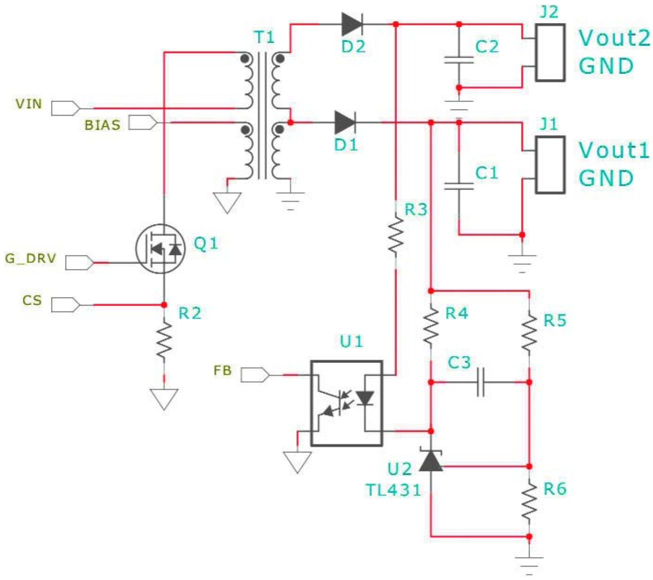

Figure 5: Multiple Output Flyback Converter

TI offers a Quasi Resonant pulse width modulation controller which contains all of the features needed to implement a highly efficient offline power supply (for example UCC28600). There are also current mode controllers with very low standby power available, for more details please visit www.ti.com.

Conclusion

Flyback switch mode converters are very popular due to their low cost and simplicity. Unfortunately the regulation of the auxiliary outputs can be bad in some applications. There are techniques to tighten the output regulation. The secondary windings or the output can be stacked or the feedbacks can be combined. Sometimes this results in better cross regulation. The above described way to connect the inner loop gives an additional possibility to improve the performance of the auxiliary outputs.

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[2] "Closing the Loop with a Popular Shunt Regulator", Robert Kollmann, John Betten, Texas Instruments, www.powerelectronics.com

For more information on the used parts and technologies described here please visit http://www.ti.com.

http://www.ti.com/powerlab

Energy Measurement and Security for the Smart Grid -Too Long Overlooked

As smart meter rollouts continue globally, consumers, design engineers, utilities discuss how the smart grid will transform the entire energy industry. Smart meters already allow utilities to save money by accessing meter data without sending someone to physically read the meter. Utilities, factories, and consumers are now pushing for more conservation and alternative fuels.

By Dave Andeen, Strategic Segment Manager for Energy, Maxim Integrated

New business models encourage peak demand reduction through incentives such as time-of-use pricing to reduce consumption during maximum demand periods. Distributed resources, such as electric vehicles and various forms of solar and wind generation, are maximizing renewable resources and leveraging the available resources to accommodate peak demand. All of these developments will also lead to more big data analysis within smart grid. With smart meters, utilities go from one or fewer meter reads per month to six to 96 meter reads per day. All of the data generated from smart meters offers the opportunity to better understand usage patterns, waste, and other factors that utilities have yet to uncover.

But in the end, smart meters and grid management alone will not ensure the success of the smart grid. To completely optimize this technology, smart grid designs must focus on energy measurement and security.

Energy Measurement Actually Saves Energy

Unfortunately, with so much emphasis today on the future management of smart grid technology and its roots in telecom infrastructure (for more on this, see the sidebar below), one can easily forget that energy measurement and security are essential to the system's success. After all, a network concerned with electricity management must both measure its critical commodity **and** also protect the valuable infrastructure that delivers it. Enter energy measurement.

Smart meters measure industrial and consumer energy consumption with a feature called "metrology," utility-grade energy measurement. These smart meters are already part of a massive machine-to-machine utility network in several locations including Italy, California, and parts of Scandinavia. But, are utilities the only ones with a keen interest in measuring energy consumption? Of course not. The benefits of broad-based energy measurement can extend to the vast number of users and providers on the grid.

As a personal example, last year my electricity bill progressively increased over the course of October, November, and December. In late December, my electric dryer broke down. Fortunately, my wife and I were able to immediately purchase a new one, which was critical in the middle of winter. In retrospect, the dryer motor burnout caused excessive energy consumption, which explained my higher monthly electricity usage, the resulting bill, and eventually the financial burden of immediately purchasing a new unit.

Energy measurement can assist in situations such as mine. Applying energy measurement to a variety of applications, such as consumer devices and industrial motors, offers tremendous benefits: reduced electricity consumption; usage patterns that signal maintenance requirements or even the replacement of critical assets; and better educated users or systems operators who can make more informed decisions about consumption and system performance. In the case of my dryer, accurate measurement of the motor's electricity consumption would have immediately shown that the device was consuming more energy with time. Like the "check engine" light on your automobile, energy measurement records usage patterns, and thus give an indication of device health and operation well in advance of failure. That usage pattern would have provided enough time for me to repair the clothes dryer or to simply find a new one (on sale!).

The energy consumed, or wasted in the case of my faulty clothes dryer, is small compared to the potential benefits of accurate energy measurement in an industrial setting. Manufacturing environments, where motors account for 54% of electricity use,[1] make for higher-stake situations with uptime requirements and production targets. A 100hp motor with a 2.5% voltage imbalance, for example, will consume an estimated additional $476 in electricity per year.[2] Add to this the additional wear and tear on equipment, which results in additional maintenance and earlier replacement costs. You quickly understand the enormous potential benefits of energy measurement in a smart grid system for industry. Now take the logic a step further. Multiplying the cost of electricity and maintenance across all motors used globally represents a massive opportunity for energy conservation, and savings.

Once you recognize the importance of well-managed energy measurement, you look for solutions to implement it. Here is where a smart energy meter and measurement system become crucial. Maxim Integrated provides several energy-measurement and motor-diagnostic solutions for energy condition monitoring. The 78M6610, 78M6613, 78M6631, and MAX78638 deliver accurate, four-quadrant electricity measurement with custom firmware. They provide valuable measurement data for monitoring and measuring efficient solar-panel inversion, motor-health in an industrial application, and energy consumption in lighting and computing applications. Ultimately, the investment in energy measurement solutions shrinks compared to the savings in preventing equipment failure and ensuring system uptime.

Grid Security—Essential, Yet Not Fully Appreciated
The smart grid also requires complete security 24/7. Most consumers, even industrial and utility operators, underestimate the importance of this. Endpoints such as smart meters, industrial motors, consumer devices, and widely distributed automation equipment all consume **and** control electricity. Meanwhile, applications for grid-connected devices continue to increase as smart grid operators are taking advantage of "smart" networks to correct power factor, optimize voltage, accurately locate faults, and reduce repair time to ensure uptime.

Cyber attacks, theft of IP, disruption to productivity—all these threats are rising in both smart grid and industrial-control systems. Only complete security measures, optimized for a smart grid, can thwart these severe threats and ensure maximum operational uptime, whether a simple home clothes dryer or a sophisticated, distributed industrial complex. Unfortunately in many cases the severity of the security risk is not fully appreciated and only minimal security measures exist. In one conversation, a utility professional told me that "barbed wire, a padlock, and high voltage were the only protections" on his utility's substations. Other less-informed operators trust the innate security measures in hardware and fail to recognize the greater threat posed by cyber attacks through software.

The most effective security solutions secure the entire life cycle of a product through hardware **and** software. Because potential security breaches can happen at all phases of device operation, from purchase to manufacturing to operation to decommissioning, grid security has far-reaching applications.

When purchasing a product that will function on a smart grid, the purchaser must be assured that a reliable channel exists for buying silicon and other critical computation devices. This is essential to avoid counterfeit products. In manufacturing, strong authentication techniques prevent third parties, such as manufacturing contractors, from stealing keys and later using those keys to pirate electricity or infect the grid with a virus. In field use, secure key storage and multiple layers of encryption secure data across communication channels. Secure bootloaders prevent viruses and malware from loading into a system. Hardware techniques monitor physical security, enabling responses to tamper events. Devices and sensors not under constant surveillance explicitly need such comprehensive secure protection.

The most effective security is designed and integrated into the system or grid itself. Maxim offers a complete array of secure products, such as the MAXQ1050, MAX36025, and MAX71637 that meet the security needs of the smart grid. Integrated here are basic authentication for multilayer schemes involving split keys, asymmetric encryption, secure bootloaders, and various physical tamper protection mechanisms.

Summary
It may sound trite, but it is definitely true: the smart grid has the potential to transform the energy industry completely. This is exciting and deserves our engineering attention. But in all this management euphoria, it is easy to overlook the often-hidden, but critical roles of measurement and security for the grid. And that is where quality meter design is proving most valuable. If we continue to focus on energy measurement and security to truly harness this technology, then we must appreciate how smart meters are going to enable the smart grid.

Sidebar: Smart Grid vs. Telecom—A Tale of Two Networks
When we talk about the smart grid, we often focus on its enormous potential to become a self-healing electricity grid that will reduce energy consumption and transform our energy infrastructure. How was such a revolutionary technology designed and created? What was its impetus?

The telecom infrastructure network with its brilliant architecture and technological maturity is the basis for today's smart grid. Conversations on this topic often bring up networking and big data, which provide the ability to aggregate and analyze tremendous amounts of information and make useful decisions with it.

True, telecom and the smart grid share the same core, high speed, and interoperable communication layers. But, there is a hugely important and fundamental difference between these networks: the smart grid is truly a machine-to-machine network. Traditional telecom endpoints result in a human-to-machine interaction, with telephones, computers, and now smartphones. The endpoints of a machine-to-machine network consist of sensors, functional machines, or both. These machines are often not under immediate human control and, therefore, cannot necessarily express or report the status or the health of the network. As an example, industrial sensors often lie in inaccessible places, far removed from the central system, without access to upgrades, and not under any human surveillance. With no human intervention between the system and remote devices, smart grid system designers must deeply consider both the sensing functions and security of such a distributed network.

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A Formula for Higher Power Density: Inside the Power Clip 33 Dual MOSFET

Several things, including the choice of silicon, IC placement, and power loop configuration led to the development of a dual power MOSET that delivers significantly higher power density in a smaller footprint.

By SG Yoon and Arthur Black, Fairchild Semiconductor

In power supplies, finding a way to increase power density -- that is, producing more power per unit volume -- leads to a number of critical design benefits, including smaller size, lower weight, higher efficiency, and lower material costs. It's no surprise, then, that many designers consider power density to be one of the most important metrics when selecting components for a power supply .

In a typical power train, one of the places where designers often look to improve power density is the power MOSFET. Semiconductor companies have made considerable advances in the power density of these devices in recent years, but silicon designers are always trying to improve on what already exists.

Recent work on a new device, the Fairchild FDPC8011S power clip 33 asymmetrical dual MOSFET, shows that there are still ways to make significant improvements in power density. This article looks at some of the things the power clip 33 design team considered in their search for higher efficiency in a smaller footprint.

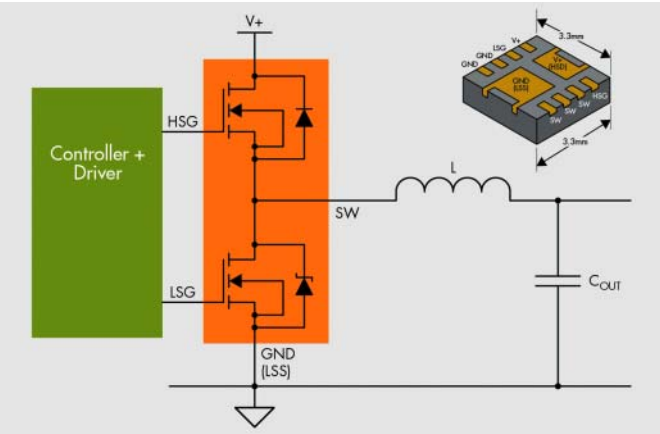

Figure 1: The Power Clip 33 Dual MOSFET

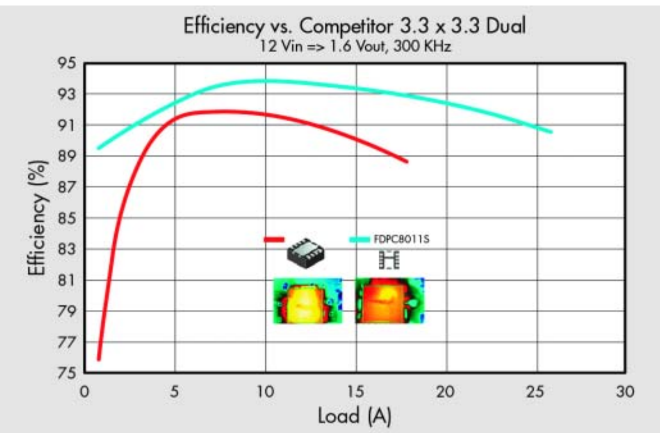

Figure 2: The Power Clip 33 vs. Competing 3.3x3.3 Dual MOSFET

Figure 1 gives a block diagram for the power clip 33 and Figure 2 shows that, compared to a power MOSFET of equivalent size (3.3x3.3mm), the FDPC8011S is able to handle an additional 8A of load with a TJ 6°C cooler.

The Power Clip 33 Package

The power clip 33 is a dual-die package that combines optimized figure-of-merit (FOM) silicon with a thermally optimized, low-inductance copper-clip interconnect package. Figure 3 shows key elements of the package construction.

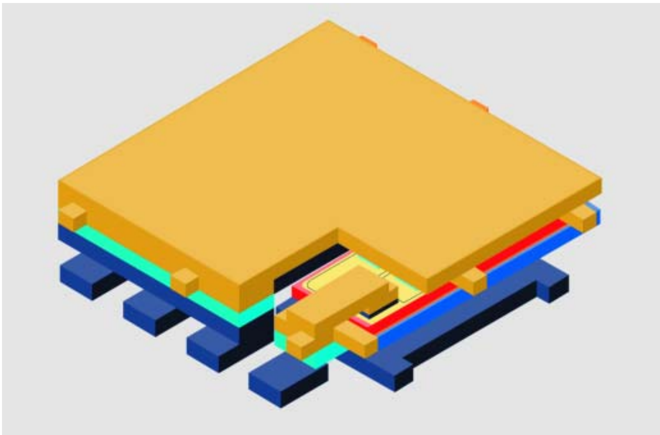

Figure 3: Isometric View of Power Clip Package

The high side (HS) MOSFET is placed drain down. The low side (LS) MOSFET is placed source down. The interconnect from HS source to LS drain is made via a large copper clip.

As shown in Figure 4, the power clip package achieves a dramatic improvement in parasitic resistance and inductance compared to traditional package designs such as the discrete Power 33, Power 56, and Power Stage 56 dual.

Minimized Power Path Parasitics

For a synchronous buck power train to have optimal switching speed, the design must minimize package parasitic inductances in the high frequency (HF) switching path, which goes within the package from the V+ pin to SW to GND. The design must also minimize the physical distance between the V+ / GND input capacitor and the MOSFET package pins. The IC configuration in the power clip achieves these two objectives by using a drain-down HS MOSFET, a die-to-die clip,

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and a source-down LS MOSFET. This enables a minimum impedance switching path, with no bond wires, in the HF power switching path. The only interconnect in the power path is a low-inductance / low-resistance copper clip.

Enhanced Thermal Performance

To increase power density, the thermal performance needs to be optimized. On a typical PCB design, two large regions of board copper act as the power planes for V+ and GND. The drain-down HS and source-down LS power clip design enables large package footprint connections to these two major regions of copper. The copper clip supports excellent die-to-die thermal coupling. This enables a low RÈJA thermal impedance for both die, independent of the power split between them.

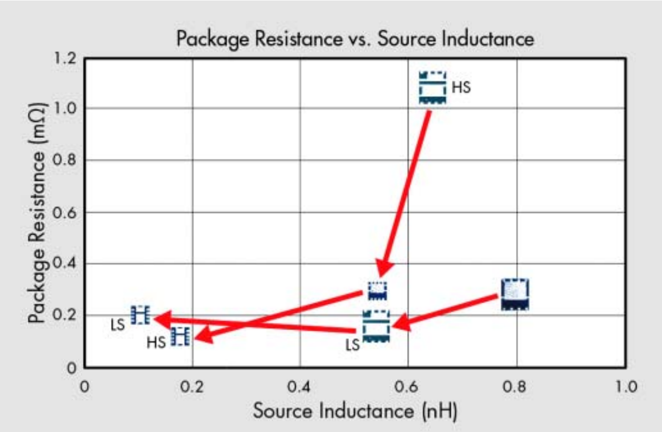

Figure 4: Package Resistance and Source Inductance

Advanced Silicon

The MOSFET technology used in this design is shielded-gate PowerTrench® technology. The HS and LS MOSFETs are both designed with low RSP (m?/unit area) and low gate charge (QGD) silicon. And both are devices with a very low FOM, which is defined as QGD*RSP.

Figure 5 shows Fairchild normalized RSP and normalized FOM (QGD*RSP) improvement over time.

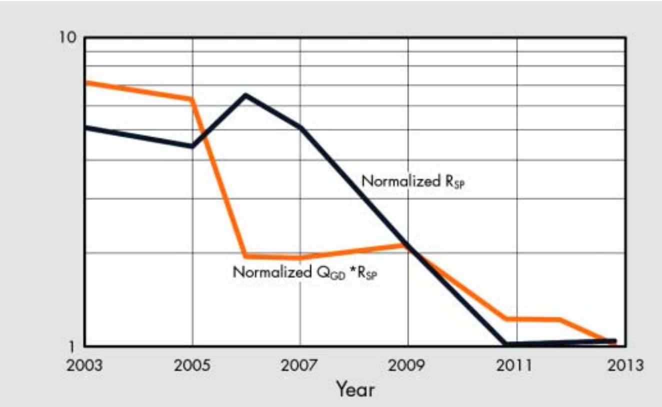

*Figure 5: RSP and FOM (QGD*RSP) Improvement Over Time*

Fairchild has achieved a consistent and significant improvement in both of these parameters over time. Conduction loss is directly proportional to RDS(ON) and switching loss is directly related to QGD. For a given RDS(ON) MOSFET, as its FOM decreases, then QGD and switching loss will decrease. Fairchild's design improvements have reduced both loss factors.

With the reduction in RSP (resistance per unit area), Fairchild is able to design for typical power train levels with a smaller sized die. This reduced die size also results in reduced QG and QGD. The smaller die size also allows usage of a smaller package, leading to reduction in package parasitics. The net result is a design with low switching loss and a small footprint.

Optimized layout for POL converter

Due to the minimized power loop area and board space used, the power clip 33 MOSFET package helps optimize the board layout and improve system efficiency. Figure 6 shows a board layout example with the power clip packaged device.

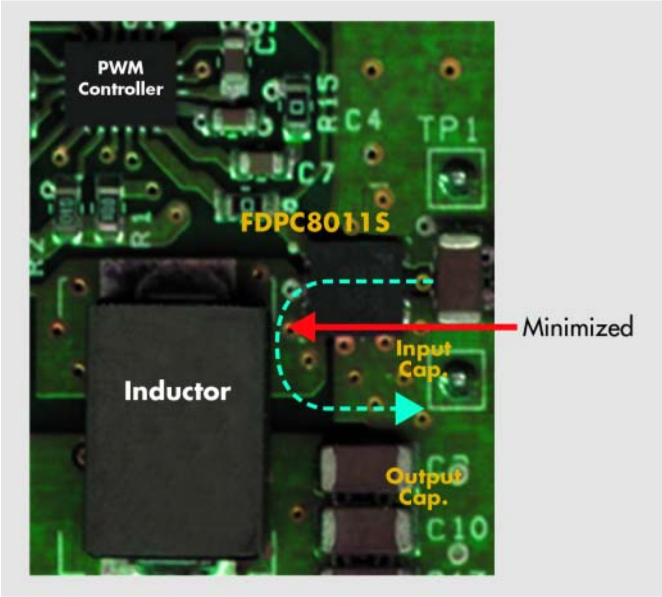

Figure 6: Board Layout with Power Clip 33

This high-efficiency and high-frequency package allows for a very small footprint for the total power train design. MOSFETs, input cap, inductor and output caps all fit into a very small region. The small power train footprint uses a minimum switch-node area, which reduces the risk of electromagnetic interference (EMI) noise radiation from the SW node.

The exposed GND and V+ pads on the bottom of the package create an efficient thermal dissipation path from the MOSFET junction to the board copper and the ambient.

For the package to have minimal parasitics, and the best switching performance, it was critical to have a small loop for the loop formed between the input cap and the package V+ to GND pins. Optimized V+ and GND pin placement on the power clip package allows for the very close placement of input capacitor(s) to minimize the loop area and to reduce parasitic inductances and switching losses.

As shown in Figure 7, the size of the high-frequency switching loop is dramatically reduced with the power clip design. During a switching transition (LS-off to HS-on or HS-off to LS-on), current flow must rapidly shift from one MOSFET to the other. This commutating action occurs in the loop made up of the two power MOSFETs and the input capacitors. The switching transient in this loop is orders of magnitude faster than the ripple frequency of current in the output inductor. Therefore this is the loop that defines switching loss.

With a discrete pair of MOSFETs, the switching current must flow through the full length of the HS and LS packages before returning to the input capacitor. With the power clip package, the current enters and exits on the same face of the package in a very tight loop, separated by a spacing of only two pins. In the discrete pair layout, HF loop size is limited by the package size of the MOSFETs. With the power clip package, loop size is now limited by the size of the input caps.

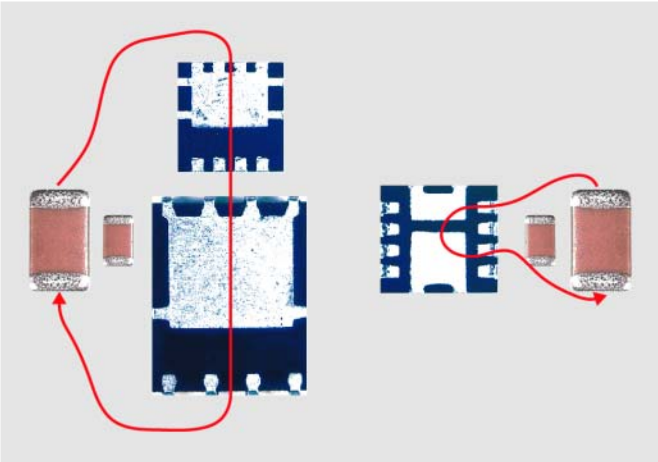

Figure 7: Size Reduction in High-Frequency Switching Loop

Conclusion

The power clip 33 is proof that there are still gains to be made in power density. Combining advanced silicon and improved packaging technology, the power clip 33 significantly reduces package parastitics and significantly surpasses the power density (A/mm2) performance of earlier discretes, including Power33/Power56 and Power Stage 56 dual combinations.

References

This article is an abbreviated version of a longer article that details lab measurements comparing the power clip 33 to traditional designs for efficiency, power loss, waveforms, temperature, and thermal impedance. To access the longer article, please go to “Power Clip 33 Asymmetrical Dual MOSFET with Increased Switching Frequency Solution in Point-of-Load (POL) Applications”, available in Fairchild Online Seminars.

Arthur Black, “Optimized Footprint Power Devices for Computing Applications”, Fairchild Semiconductor white paper. Paper not currently indexed on Fairchild website. Please contact Art.Black@fairchildsemi.com for copy.

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A Micro-Packaged Linear Current Sensor IC

Primary conductor resistance of only 0.6 mΩ reduces power dissipation

The linear current sensor IC, the ACS711, is housed in a 0.75 mm thick low profile package measuring only 3 mm × 3 mm! It is designed for low-side and less than 100 V sensing applications requiring 5A to 30 A continuous current sensing.

By Shaun Milano, Allegro MicroSystems, Inc.

Traditionally, current sensing has been accomplished with sense resistors or current transformers that can take up large PCB area. Sense resistor values from 10 to 50 mΩ can burn a significant amount of power at higher currents which also lower efficiency and consume larger PCB real estate. Hall-effect sensors have been employed to provide a non-contact method of measuring current in conductors and to provide a voltage signal proportional to current flowing in conductors. A new current sensor IC from Allegro MicroSystems, Inc., the ACS711 (figure 1) resolves the size issue with a truly small, 3 mm by 3 mm footprint with only 0.6 mΩ conductor resistance which lowers power dissipation by an order of magnitude over typical sense resistor op-amp solutions. Full integration of the current sensor IC allows for factory programming at Allegro that delivers a solution that is more accurate while providing the additional benefits of small size and higher efficiency through reduced power loss in the current carrying conductor.

Figure 1: ACS711 QFN package size, in comparison to a US 10-cent coin

Packaging

Hall current sensors with one turn and no magnetic core do not produce a large magnetic field, so placing the Hall sensing-element in close proximity to the sensed current is an attractive approach. The flux surrounding a conductor may be only a hundred gauss (10 mT) or less, and this diminishes rapidly with the distance of the Hall element from the conductor.

To optimize the performance, the ACS711 device employs an Allegro patented flip-chip magnetic field sensing technology, illustrated in figure 2. Flip-chip use allows the active area of the Hall transducer section of the IC (shown as the red square in figure 2) on the surface of the silicon to be placed in the closest proximity to the primary conductor. This allows for excellent signal coupling and can allow sensing to low current levels found in many appliance applications. A full scale measurement current of +/-5 A is possible with proper device gain programming at Allegro. Classic flip-chip technology is employed and also makes the necessary connections to the signal circuit and supports the chip above the current conductor on the leadframe. The primary current path is efficiently channeled to the Hall element via a patented exposed current loop design, with terminations soldered directly to the PCB traces. With such close magnetic coupling to the conductor, signal sensitivity is maximized and the device can produce 90 mV/A and 45 mV/A for sensing 15 A and 31 A full-scale current, and the sensor IC requires only a 3.3 V supply.

Flip-chip technology also allows case molding plastic to fill the small spaces between the primary current carrying conductor and both the die surface and the device signal leads, providing an augmented level of galvanic (voltage) isolation. With the attractive small dimensions of this device, the package provides isolation only to supply voltage values below mains line voltage. The ACS711 has been optimized for low voltage circuits, < 100 V, such as: 48 V solar circuits, communications, and consumer electronics and audio applications. The device is also economical to assemble into finished products and is excellent for low-side sensing applications in residential and commercial white goods appliances and with general-use motor drivers.

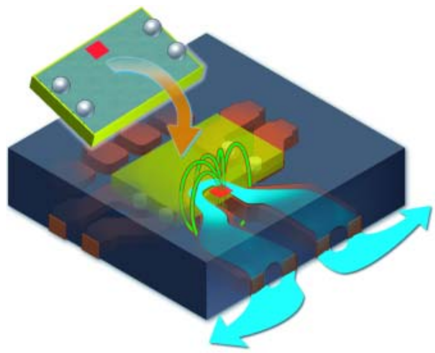

Figure 2: ACS711 Device with QFN Construction: yellow is the IC chip, red is the Hall element, green lines represent magnetic flux, and blue is the sensed current path

Despite its small size, the ACS711 can sense relatively large currents in the QFN package, up to ±31 A. Sense resistor power dissipation is significant at higher current ranges and conducting such current levels in and out of IC packages has been a traditional limitation. The QFN package solves this issue with two large solder pads on the mounting surface and with careful detail to the shape of the primary sensed current conducting loop. The design uses substantial copper conductors within the package to form the sensed current loop, without bond wires. The primary conductor resistance in the QFN is only 0.6 mΩ, an order of magnitude less than most sense resistors employed in low-side sensing configurations. This reduces power consumption, and typical power dissipation at 30 A is only 0.54 W and at 15 A is just 0.135 W. This not only makes a contribution to system efficiency, but also allows the device to stay cool even at elevated currents.

If customers prefer a leaded package for certain applications, a companion package, the SOIC-8, is also available for the ACS711 product. Please refer to the Allegro website at www.allegromicro.com for more linear current sensing ranges available.

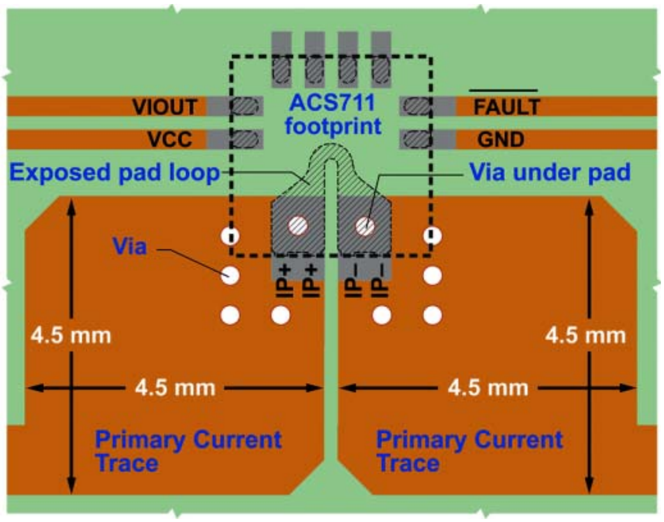

Figure 3: A PCB layout for the QFN Current Sensor (Allegro prototyping board 85-0528)

Soldering and Thermal Characteristics

Notwithstanding the low power dissipation, an even lower thermal resistance to ambient than that inherently provided by the relatively small, 3 mm^2 QFN package is required. Wide, high-current copper traces on the printed circuit board (PCB) are adequate to help cool the device, if designed properly. An example is shown in figure 3, the layout on the ACS711 prototyping board available from Allegro. Note that the two large pad areas, 4.5 mm across, are only slightly larger than the very small QFN package outline. On this board, two layers of 4 oz. copper are used, linked by thermal vias (those under the QFN can be filled or eliminated if necessary) to enhance thermal performance. Further design details and guidance for PCB mounting are available from Allegro.

Using this Allegro PCB, temperature measurements were made across a range of sensed current levels. Figure 4 shows the results. The graph shows that at an ambient temperature of 85°C the sensor IC package can withstand 45 A continuous current before reaching the maximum recommended junction (die) temperature, 165°C. With proper PCB design, the device can be safely used in 30 A continuous-current applications at 85°C ambient temperature, with an approximately 50°C margin of safety before reaching a die temperature of 165°C.

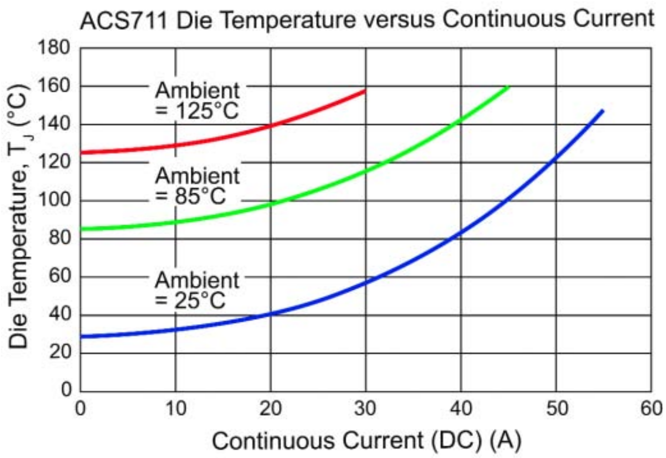

Figure 4: Thermal Performance of the QFN mounted on the PCB

Device Features, Fault Output, and Accuracy

The voltage signal is dependent on the direction of the current flow, enabling measurement of bi-directional current flow, both AC and DC. At a zero-current level, the output voltage signal is half the supply voltage.

The ACS711 sensor IC also integrates a factory-programmed fast response digital fault output that has a 1.3µs response time. It is set at 100% of the maximum current rating of the sensor IC. This fast fault signal can be used to prevent the destruction of IGBTs or other switching devices during short circuit or overcurrent conditions, or as a redundant fault feature in motor control applications.

Another inherent disadvantage of sense resistor with op-amp solutions is a reduction in accuracy with changes in temperature, because the sense resistor value changes. Hall-based sensors are not subject to this error because the magnetic field generated by current flowing in a conductor is not temperature dependent. The Allegro ACS711 provides additional protection, against package thermal stress, through the application of an advanced Bi-CMOS process with built-in chopper circuitry to compensate for Hall element offset voltage changes. The fully integrated architecture of the ACS711 sensor IC further allows adjustment programming at Allegro end-of-line production testing to further reduce errors in gain and offset, delivering a more accurate sensing solution.

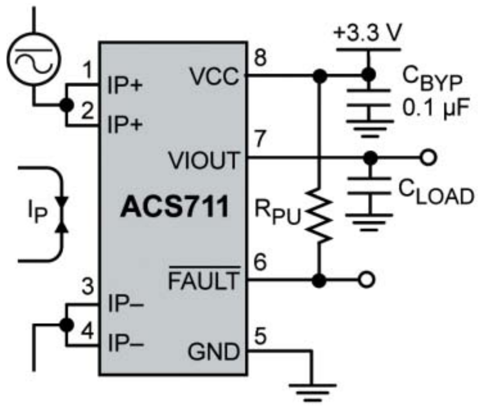

Figure 5: Typical application circuit for the ACS711

Summary

Advanced Allegro patented flip-chip packaging for linear Hall ICs has allowed the creation of a micro-sized, 3 mm × 3 mm fully integrated current sensor device, the Allegro MicroSystems ACS711, which has only 0.6 mΩ internal resistance, produced in a package that can really take the heat. Used with an appropriate PCB design, the device can be used for applications with over 30 A continuous current while reducing power consumption by an order of magnitude in comparison to existing sense resistor solutions.

Factory programming provides high accuracy in this IC, with an integrated fast response fault output. Together these techniques deliver the smallest current sensing footprint available for your application without compromising accuracy.

www.allegromicro.com

Thyristors for High Power Applications

Modern power electronics industry is developing in a lot of directions. Despite the rapid development of fully controlled power semiconductor switches (IGBT, IGCT) usage of high power thyristors with extra load power in many applications is still technically legitimate.

By A.A. Pisarev, A.A. Chernikov, A.V. Stavtsev, A.M. Surma, Proton Electrotex

Recently interest for such thyristors is shifting to the devices produced on the basis of semiconductor elements with 4” - 6” (100-150 mm) diameter.

JSC "Proton-Electrotex" conducted research and development activities in order to manufacture the new generation of thyristors based on 4" (100 mm), have increased reliability, increased safe operating area and improved performance. At present company is completely prepared for series production of such thyristors with blocking voltage from 1800 V up to 6500 V.

General characteristics of thyristors are shown in table 1.

Part Number	I_{TAV}, A	I_{TSM}, kA	V_{DRM} V_{RRM}, V	I_{DRM} I_{RRM}, mA	tq, µs	Max diameter/ contact diameter/ housing height, mm
T193-5000-18 T393-5000-18	5 000 [85 °C] 5 000 [78 °C]	94	1 800	300	400	150/100/26 150/100/35
T193-4000-28 T393-4000-28	4 000 [94 °C] 4 000 [90 °C]	75	2 800	300	500	150/100/26 150/100/35
T193-3600-36 T393-3600-36	3 600 [91 °C] 3 600 [86 °C]	72	3 600	300	630	150/100/26 150/100/35
T193-3200-44 T393-3200-44	3 200 [91 °C] 3 200 [86 °C]	60	4 400	300	800	150/100/26 150/100/35
T193-2500-52 T393-2500-52	2 500 [98 °C] 2 500 [94 °C]	55	5 200	300	800	150/100/26 150/100/35
T193-2000-65 T393-2000-65	2 000 [99 °C] 2 000 [95 °C]	45	6 500	300	800	150/100/26 150/100/35

Table 1: General characteristics of thyristors

For thyristors with large area of semiconductor element one of the problems is guarantee of reliable electrical and thermal contact of silicon wafer with molybdenum disc. There are two ways to dissipate generated heat from silicon wafer:

1. Alloyed structure, when silicon wafer, which has formed diffusion layers, is connected with molybdenum disc.
2. Fully pressure contact structure, when silicon wafer, which has formed diffusion layers and metallization on anode and cathode side, is pressed between two molybdenum discs. And exceptionally mechanical contact between molybdenum and silicon wafer is guaranteed.

Both methods are widely used by various manufacturers around the world, however both of them have their pros and cons.

Alloyed structure as a benefit has a quality thermal contact of silicon wafer to molybdenum disc from the anode side, which decreases total thermal resistance and improves dissipation of the generated heat.

But as a disadvantage such structure may have bending of semiconductor element with molybdenum disc due to its heating up to high temperatures (650-680 °C) and cooling in alloying process. Moreover, during uneven heating and cooling bending of semiconductor element occurs, which leads to absence electrical and thermal contact in some areas of semiconductor element, even if assembling the thyristor with heat sink. Bending ratio is defined by difference of heat expansion ratio of alloyed parts and absolute value of temperature and thermal profile of alloying process. And the bigger the diameter of the alloyed wafer the higher the bending. On semiconductor elements alloyed with 100 mm diameter of molybdenum disc bending reaches 100-120 µm (figure 1). Bending of the semiconductor element generates residual mechanical strains, which may lead to reduction of load cycle capability and value of surge current. That is why for such thyristor structure quality of connection technology of silicon wafer with molybdenum disc is extremely important. This technology should guarantee absence of localization of mechanical strains over the interface of molybdenum disc and silicon wafer – only in this case a high quality thermal contact between semiconductor element and housing is possible.

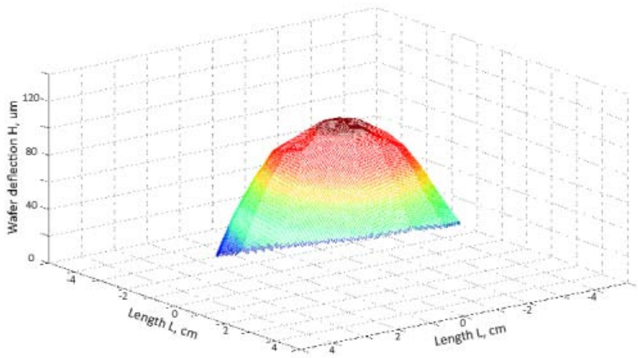

Figure 1: Bending of semiconductor element with molybdenum disc after alloying process

Absence of above described bending is one of the advantages of pressure contact structure, since heating up to high temperatures and cooling of semiconductor element are excluded, which allow to achieve high value of surge current and good load cycle capability even with shift from nominal mounting force during assembling of thyristor with heat sink.

Excessive thermal resistance from the anode side in comparison with similar characteristic of alloyed semiconductor elements is one of the disadvantages of such method, which degrades the dissipation of generated heat. It is also important to consider that the area of gate electrode in semiconductor element is not under external pressure during assembling of thyristor with heat sink, because in cathode layer area of gate electrode is open to exclude short circuit failure of cathode and gate electrode. In such a way, pressure contact semiconductor element from the anode side has an area under gate electrode, which is not pressed to molybdenum disc what leads to worsen heat dissipation.

As a result thyristors with fully pressure contact structure have certain limitations of safe operating area. In such a way some situations may occur when a certain sequence of separate safe modes can cause conditions of thyristor failure. For example, during long period operation in on-state with low anode current flowing only through auxiliary thyristor, due to absence of heat dissipation in this area a local heating occurs up to temperature, which do not exceed maximum allowed, and area of main thyristor remains cold. If operating mode anticipates consecutive high rate of rise of anode current up to the level not exceeding maximum allowed, then due to temperature difference of the main and auxiliary areas of thyristor, auxiliary thyristor doesn't turn-off after turn-on of the main one. In addition, level of auxiliary thyristor current will exceed safe limit, which will lead to inadmissible overheat of auxiliary thyristor area and heat breakdown.

As a result of investigations Proton-Electrotex nowadays has a technology of flawless alloying of semiconductor element with molybdenum disc for silicon wafers with diameter up to 100 mm. With help of such technology it is possible to produce semiconductor elements alloyed with molybdenum disc (100mm in diameter) with bending 45 – 55 μm (figure 2), which allows to guarantee good electrical and thermal contact between semiconductor element and housing during assembling of thyristor with heat sink, if all mounting force guidelines are correctly followed (70÷90 kN).

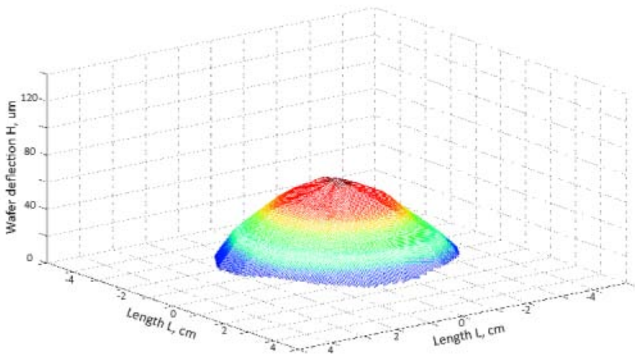

Figure 2: Bending of semiconductor element with molybdenum disc after flawless alloying process

That is why during development of new generation thyristors alloyed structure was used, which allows to guarantee absence of dead spots of safe operating area for the whole range of anode currents including modes with highly nonlinear change of anode current, and also guarantee high load cycle capability and value of surge current.

Technology of alloying of silicon wafer with molybdenum disc, which is used in Proton-Electrotex, is applicable up to 100 mm diameter, and above it alternative methods should be used to joint silicon wafer and molybdenum disc. Nowadays new developments are in progress in terms of new technology of jointing silicon wafer with molybdenum disc known as sintering, when instead of solder alloy nano silver paste is being used. Sintering process is going at relatively low temperatures (200-250 îC) and simultaneous control of external force about 0,6 kN/cm2. As a result minimal bending of semiconductor element is being formed. Such approach includes advantages of both above described methods and aligns disadvantages. Using this technology it is possible to produce semiconductor elements jointed with 100 mm molybdenum disc with bending 25-30 μm (figure 3).

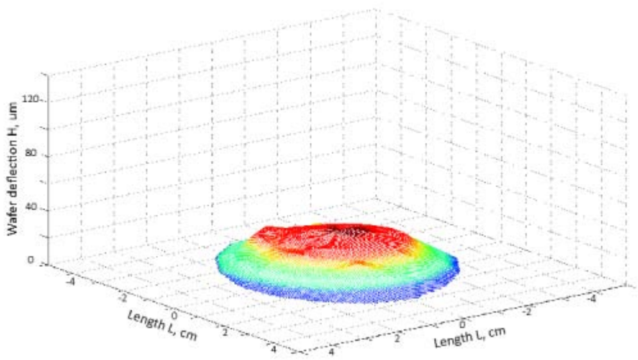

Figure 3: Bending of semiconductor element with molybdenum disc after sintering process

At the moment there are some test samples of thyristors produced using this technology, which are being tested right now. Moreover, some work is in progress to lower costs of semiconductor elements jointed with molybdenum disc using sintering to finally put this technology into series production.

www.proton-electrotex.com

Measuring the Dynamic Conduction of Switching Devices

This helps understanding where losses in power devices occur

The real conduction voltage can also be used to determine the junction temperature of transistors and SiC diodes. Modern switching devices as diodes, MOSFETS, IGBTs and GaN transistors have gener-ally a small conduction voltage compared to the blocking voltage. For example, a 400 V MOSFET shows a conduction voltage drop of only 200 mV, giving a ratio of 2000:1. This high ratio is difficult to measure, but an exact measurement allows better insight into the conduction losses and possibly reveals how to improve the gate drive signal for the component. By direct measurement within the circuit, the junction temperature of devices including full-pack devices can be evaluated.

By Nigel Springett

Measuring the conduction voltage drop of switching power devices as they are switching very high voltages is not easy. Looking for a conduction voltage of V_{cond} = 200 mV within a full range of a blocking voltage of V_{block} = 400 V combined with switching edges having rise times of a few ns creates problems and requires a very high measurement range. A typical 8 bit digital oscilloscope has a maximum vertical resolution of 0.4 % or 1.6V at 50V/div. Using the high resolution mode can increase this, but one is still far away from being able to measure accurately 200 mV within 400 V or 0.05%. Even a 12 bit oscilloscope with a maximum vertical resolution of 0.024 % can only measure 97.66 mV of the 400 V full range and can obviously not measure these small signals at good precision. A second larger issue is the accuracy of the scope probes. The 3 dB-bandwidth, means an error of 50 % at its bandwidth and tells us nothing about overshoot or undershoot. Even a correctly calibrated scope probe does not have the resolution necessary to be able to measure these small signals accurately. Rather than dealing with a huge dynamic range, the simplest way to measure, is to cut away the unwanted signal range. Therefore, some form of voltage clipper or clamping network is needed. It preferably does not add any errors or does not load the switching components in an undue manner. The recently developed clipper from springburo.de is able to do this. It uses a depletion mode jfet as the active element and has an input capacitance of only 30 pF at 300V, which is much less than the typical power components and so is not significantly loading the device under test (DUT).

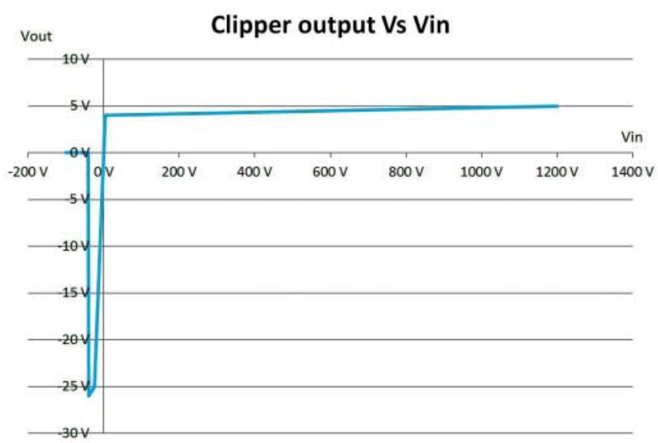

Figure 1: Clipper between DUT and scope

The clipper can measure voltages in both directions and so can be used to measure diode conduction voltage as well and transistor con

The clipper limits positive voltages to about 5V. Negative voltages are conducted, but the output is clamped to 25; higher voltage will cause permant damage. The maximum voltage is 1200V but will be extended to 1700V.

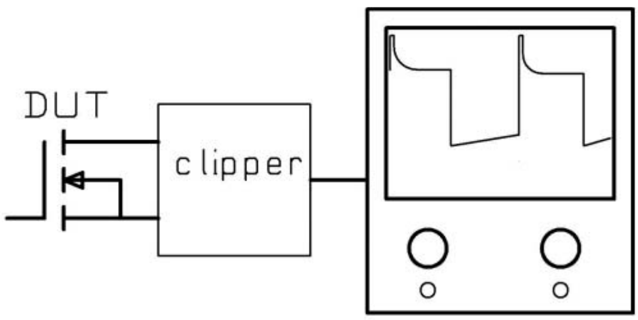

Figure 2 Clipper between DUT and oscilloscope

The input of the clipper is best soldered directly to the package of the DUT and the output connected to a scope probe as shown in Figure 1. We have found using a 10:1 probe gives better results than a 50 Ù-cable as it loads the DUT less. To check the function of the clipper, we developed a pulse generator, with a fast fall time. The generator delivers a 350 V pulse with a fall time of less than 2 ns and minimal undershoot. The 350 V were selected to allow calibration of 10:1 probes. Figure 3 shows the original pulse and the output of the clipper. One can see clearly that within 20 ns the signal starts to become useful and after 50 ns the ringing has been damped.

Measuring on-resistance

Using the maths function available on most modern scopes the dynamic on-resistance can be directly displayed. Figure 4 captures the turn-on of a 1500 V MOSFET (STW9N150, STMicroelectronics) em-ployed in a flyback converter.

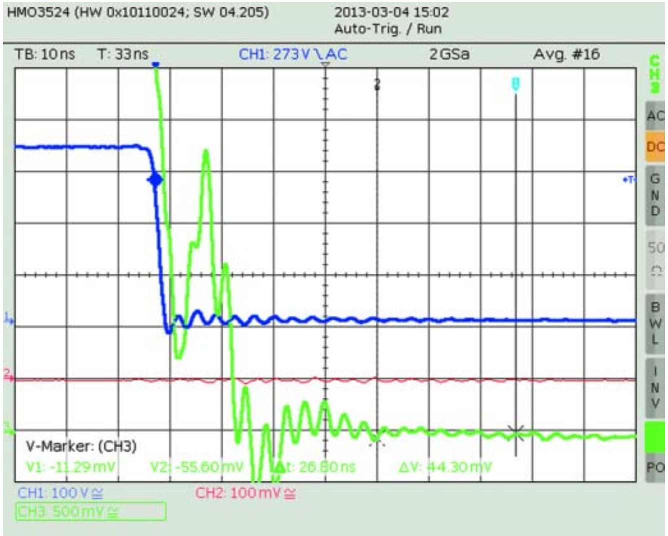

Figure 3: Clipper response: Ch1 – source pulse, Ch3 – clipper output

Ch1 records the clipper voltage, Ch2 the drain voltage and Ch4 the current. The QMA channel (math) displays the clipper voltage divided by the current, giving the on-resistance. The 1.8 Ω measured on the math channel is in good agreement with the manufacturers datasheet.

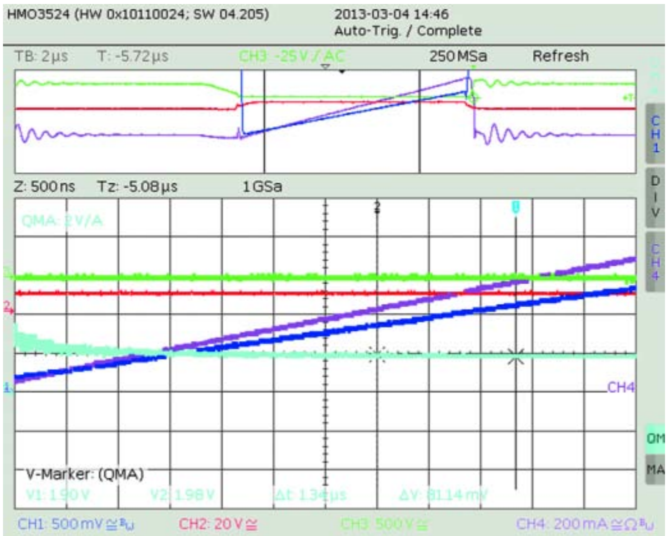

Figure 4: Rdson : Ch1 – clipper output, Ch2 – drain-source voltage, Ch4 – drain current QMA-Rds

In the same way the conduction voltage of an IGBT can be easily measured. Figure 5 captures the turn-on of a 600 V IGBT. Ch1 dis-plays the switched collector voltage, Ch2 the clipper output voltage and Ch4 the collector current. A 4 V plateau lasting for about 100 ns can be seen and after that the voltage gently falls to about 1.8V. Note, the 4 V plateau could be in practice higher, and is being clamped by the clippers gating level of about 4 V.

Estimating Junction Temperature

Normally, the transient thermal impedance curves or SOA data are used to estimate the junction tem-perature, but this is complicated and difficult to verify. The clipper allows junction temperatures to be easily evaluated in the circuit. Most manufacturers supply conduction curves vs junction temperature in the device data sheets. For MOS-FETs, it is $R_{DS(on)}$ or normalised $R_{DS(on)}$ as a function of temperature, with IGBTS, it is often V_{CEsat}. If the conduction voltage is measured and the current either known or measured, the operating point can be compared to the data sheet to arrive at the real junction temperature.

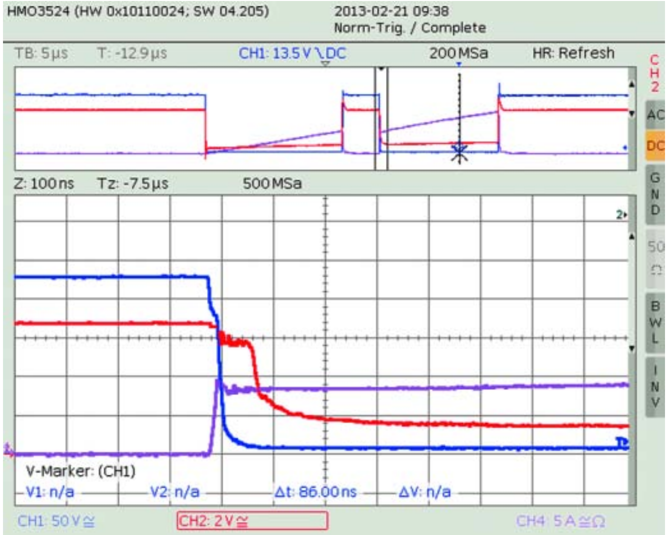

Figure 5: IGBT saturation: Ch1 – IGBT collector voltage, Ch2 – clipper output, Ch4- collector cur-rent

This can then be correlated with calculated values to confirm the total thermal resistance through the thermal interface material and heatsink etc. is as expected. This is especially useful in transient conditions, examples being inrush current limiting, short circuit and start up in LLC and motor drives. In these applications it is known that a single event will cause the junction temperature to rise signifi-cantly. It is also good to be able to confirm the junction temperature in full isolated packages such as the TO-220FP, where the surface temperature is very different to the chip temperature.

Diode forward recovery

Quietly forgotten in the diode sheets, is the forward recovery time, PN junction diodes always exhibit forward recovery due to the con-ductivity modulation at turn-on. The peak and duration of the voltage

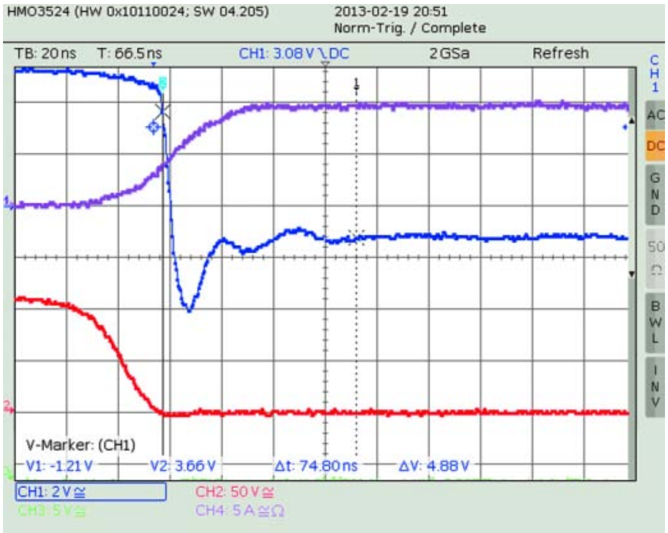

Figure 6: SiC diode forward voltage V_f, 2 V/div Ch1-Clipper, Ch2- Vk-a, Ch4- Idiode)

will be dependent on the current and di/dt. The forward recovery time (Tfr) means that the diode takes some time to turn-on completely and so the forward voltage across them is much higher than the typi-cal forward voltage given in the datasheets for a significant time. In many cases this is not critical as damping components like snubbers or voltage clamps limit the peak voltage and the active switching device is usually operated at a 20% voltage derating, but in some applica-tions it can be important to know. These applications are for example, the application of the diode in parallel to an IGBT or bipolar transistor with a limited reverse voltage rating, or the usage of a high-side driv-er, where the forward voltage can cause an excessive negative volt-age on the high-side switch. With the clipper the dy-namic forward voltage can be easily and very accurately measured.

Figure 6 displays the dynamic forward conduction of a 20 A SiC schottky barrier diode. Part of the voltage overshoot will be due to the inductance in the diode casing, even the slow 250 A/µs will cause a 2 V spike in a 8 nH package inductance. In contrast to that, Figure 7 shows the forward recovery of an ultrafast 1200 V Si diode. Here, the peak forward voltage of over 10 V could start creating problems with high-side drivers, where the common-mode undershoot is often limit-ed to less than 10 V.

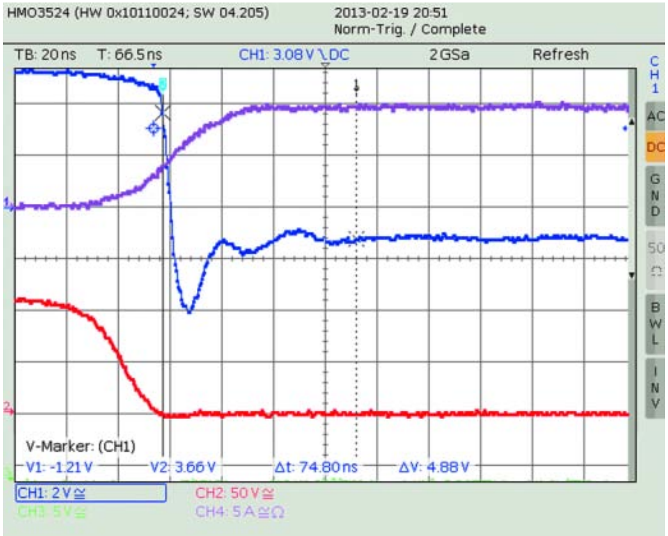

Figure 7: PN diode forward voltage V_f, 5 V/div (Ch1-Clipper, Ch2- Vk-a, Ch4- Idiode)

Hence, for accurate measurements the clipper must be connected as close as possible to the junction. If possible, do not use the standard lead connections on the PCB, but solder directly on the component and use the tab for the cathode connection.

Summary

This article shows that the measurement of conduction voltages directly after switching transitions of several hundred volts is a bit like looking for a needle in a haystack and prone to errors. However, be-ing able to measure conduction voltages offers great advantages, which are:

- The verification of conduction losses.
- The exact estimation of junction temperatures of the DUT from inside the circuit.
- Measurement of diode forward recovery is possible to guarantee the safe operation of high-side drives.

All this can be done using the clipper, which is easy and neither requires special calibration of probes nor external power supplies.

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Reactive or Resistive: Optimising Testing for Offshore Power Generation Supplies

Offshore independent power generation installations often involve complex systems comprising gas turbines, diesel generators, DC battery and UPS arrangements, which support platforms, rigs and floating production, storage and offloading (FPSO) vessels many hundreds of miles offshore. Ensuring the availability of power for production, life support systems and in some cases propulsion is a critical function in such remote and inhospitable conditions.

By Paul Brickman, Crestchic

What is the need for testing?

While some systems have a degree of interdependency, most incorporate various levels of redundancy, which in normal running conditions involves the efficient power management of several duplicate size generators. The correct and comprehensive testing of these systems at the commissioning stage is vital to ensure trouble-free production, efficient power generation and the safety of personnel. The same principle of system testing applies to the commissioning and testing of back-up emergency systems.

Any offshore power generation unit is a complex system, or series of systems, working together to perform several duties at once and at the system's heart is the generator. This could consist of several gas turbines and/or diesel generators. However, various discrete systems and components complete the total package, such as alternators, regulators and switchgear.

Figure 1: 12.5MVA 11kV 50HZ West Azeri

These additional components typically come from various manufacturers, and are usually designed to interface with a number of makes, models, and sizes of generators. As with any other mechanical or electrical components, all are potentially subject to failure, and have varying maintenance needs, at the very least requiring regular testing and servicing. However, individually testing a series of components never answers the most important question of all: "How do you know that your system—and not merely its components—will work when it counts?" In an actual emergency, a platform or FPSO's entire emergency power generation system will be stressed. Unlike in a series of short, component-by-component tests, the system must operate at full power, with all components working together to do their jobs. The stresses introduced by this mode of operation cannot be simulated by discrete tests of a system's numerous individual components: automatic transfer switches, switchgear, load-sharing centres, voltage regulators, alternators, electrical cabling and connectors, ventilation, cooling systems, and fuel systems.

While the generators may have been tested at the factory, the installation variables of the interaction with other parallel-connected power generation units (UPS), load profile, ambient temperature, humidity, fuel, exhaust, and cooling systems can be significantly affected by the installation.

Therefore, a system-wide test is the only way to ensure that the individual components of any power generation system will work together harmoniously, whether for continuous production demands, or in an emergency power outage situation.

The limitations of resistive-only testing

Sometimes commissioning engineers may only consider testing their generator engine(s)/turbine(s), rather than the whole system. The most common form of testing is using a resistive load bank to run the prime mover, connected at the generator's bus. However, this fails to replicate the actual stresses produced during real-world generator operation.

A resistive-only loadbank provides an electrical load (at unity power factor) which when applied to a generator converts and dissipates the resultant generated power as heat. This electrical loading will highlight individual engine/turbine problems. Unfortunately, resistive loads are usually only a small part of any platform's total power consumption. Quite often, the influence of a lagging power factor (pf) <0.8 due to reactive loads is underestimated or even ignored.

Generally the only equipment operating on a resistive-only load are incandescent lights and electric heaters; these units draw a steady supply of electricity from a generator, but do not produce the large block loads that truly test a generator's performance. A resistive load test will verify that a generator's prime mover is working, but it will not identify how well it will actually perform when exposed to the real reactive load pattern.

R+R – the role of resistive and reactive testing

A reactive load test of an installation's power system can accurately simulate the system's response to a changing load pattern, such as would be encountered during a real power failure.

Resistive/reactive combination load banks are used to test the engine/turbine generator set at its rate pf. In most cases this is 0.8 pf. The reactive component of the load will have a current that "lags" the voltage. The resulting power is described in two terms, the kW, or real power, and the kVA or apparent power. The combination of resistive and reactive current in the load will allow for the full kVA rating of the generator windings to be tested. Even though the genset is producing more kVA, it is actually not producing more kW. The "real" power (kW) required from the engine/turbine is essentially the same.

The inductive loads developed during reactive testing illustrate how any given system will handle the voltage drop in its regulator; paramount when paralleling generators. The test will also verify that this regulator is working properly, if not, its magnetic field could collapse, rendering the generator useless and preventing other generators in the system from operating efficiently in parallel. Resistive/reactive testing can also reveal additional stresses (and predict pending failures) of a system's switchgear, alternators, and other systems that resistive-only testing cannot.

It is clear that a procedure involving reactive as well as resistive testing is far more comprehensive and thorough than a resistive-only test, more accurately replicating the conditions likely to be faced in a real power outage, and so more readily identifying any potential source of the problem. Carefully managed reactive/resistive testing is therefore the only way to guarantee the operation of emergency power systems.

Use of loadbanks offshore

Commissioning aside, which is invariably performed onshore, loadbanks do have other uses on production platforms and FPSOs. Permanently installed loadbanks allow for comprehensive testing to be integrated into the maintenance procedures of emergency systems in particular. Oversized generators can be cleared of any carbon build-up with regular sessions of full load application, ensuring reliable performance when called upon for particular production cycles or an emergency.

The role of loadbanks can go beyond just testing. Should an installation suffer a major component failure, such as a large compressor, which would normally provide the turbine-based generators with significant load, a loadbank can be used to provide increased electrical loads to enable the turbine to operate at its optimum efficiency. Often, the loss of load prevents some turbines from operating at levels whereby sufficient heat/steam is produced for other production purposes. While there may be sufficient compressor capacity, other processes may not function properly with the reduced load at the turbine. A loadbank can provide a short-term solution until such time as the component failure is addressed.

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Why Don't We Charge it on the Road?

London cabbies try out wireless charging

Incompatible plug systems are a major obstacle for electromobility, and now the country which used to be famous for hotel rooms with at least three different kinds of power plugs at the wall is getting rid of the problem by attacking its root. Qualcomm initiated the Wireless Electric Vehicle Charging (WEVC) trial in London in a UK and industry-leading initiative. Electric taxis are supposed to receive their charge by means of inductive technology.

By Marisa Robles Consée, Corresponding Editor; Bodo's Power Systems

Anthony Thompson, Vice President Business Development & Marketing of Qualcomm Europe believes that the improved user experience delivered by wireless charging will enhance EV growth: “One of the key criteria is that charging must be effortless”, he says and: “Inductive charging will help the environment because it will break down the barriers to mass market uptake of electric vehicles. By eliminating range anxiety and the inconveniences associated with carrying cables and needing to plug-in to charge, our technology makes electric vehicles a realistic, viable alternative to fuel-powered vehicles. Wireless charging is the ultimate it-piece for EVs.”

The semiconductor manufacturer Qualcomm is specialized on wireless communication technologies. With the acquisition of HaloIPT in November 2011 the company got hold of their technology and other assets and sees itself well positioned to make inductive technology available to third parties for the wireless charging of electric road vehicles. HaloIPT was a leading provider of wireless charging technology for electric road vehicles. In the Qualcomm manager's view, plug-in charging is cumbersome, brings potential health, safety and reliability issues, especially at street level, while public charging equipment is open to damage from the environment, vandalism, and is visually unappealing.

Figure 1: London is hosting one of Europe's first extensive trials of wireless charging. Picture: Qualcomm

Wireless charging is not a new concept; it has had industrial applications for a while. That's why Qualcomm is confident it can hit the ground running with the public trial of its wireless charging system. Anthony Thompson is confident that wireless charging will eventually become the preferred charging method for all EVs: “That is why we are developing our universal wireless charging technology that can be deployed in all geographic areas.” Also, the charging speed will help to make EVs more attractive in the future: The Halo technology now offers a 3hr charge with 7 KWh versions, and even a 1hr charge with the fastest 20 KWh standard.

First WEVC Trial started

In November 2012, Qualcomm started its first large-scale pre-commercial trial of WEVC in the world. Qualcomm's trial scheme – in association with Renault and others – kicks off a two year project in London, UK, to evaluate the feasibility of wireless in comparison to traditional conductive charging. It's based on Qualcomm's Halo technology, which puts special inductive coils in both the road and the chassis underneath the car and, when the two line up, can fire across power with much the same efficiency as a regular cable might deliver.

The objective of the trial is to allow partners, including Chargemaster Plc, Addison Lee, Transport for London (TfL) and the Mayor of London's office, to better understand how WEVC can be deployed in a mega city environment like London and to gain feedback from WEVC drivers on their experience of wireless charging. Initially starting with just a handful of private EV drivers, the plan is to scale up to a trial of as many as 50 taxis. As part of the trial, Qualcomm wireless inductive power transfer technology will be used that allows high efficiency power transfers across a large air gap. A driver just has to park their vehicle in the usual way and the system will automatically align for power transfer.

However, London's busy and convoluted streets are anything but a closed, controlled system, but that's exactly why the city was selected by the Qualcomm-led project, explains Thompson: “It offers a mixture of road conditions, weather types, and usage scenarios.” Also a combination of sedans, taxis, vans, and other vehicles are expected to take part over the two year period.

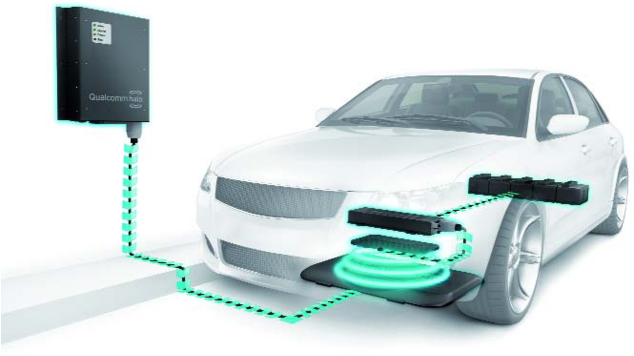


Figure 2: The wireless technique of Qualcomm Halo allows a fast recharging of EV-batteries. Picture: Qualcomm

Charge while in motion

Wireless power though is about to take a huge leap in scale, as kilowatts can now be transferred over an air gap of a couple of centimetres while still maintaining high-energy transfer efficiency. Qualcomm Halo WEVC technology uses magnetic resonance to couple power from the BCU to the VCU that is part of the vehicle charging system. Power is transferred to the VCU pad via magnetic coupling and this energy is used to charge the vehicle’s batteries. A Qualcomm Halo WEVC system can also transfer energy from the electric vehicle battery to the electricity grid, in what is known as Vehicle to Grid (V2G) charging. In terms of safety, the technology has already proven it passes the standard. Using a Base Charging Unit (BCU) fitted to the ground and a Vehicle Charging Unit (VCU) fitted to the car, electricity is only passed to the car when the two are closely aligned.

While WEVC technology is ideally suited to stationary wireless charging, it also opens up the possibility of dynamic wireless charging – charging the electric vehicle battery while the vehicle is being driven. For Thompson one thing is clear: “The adoption of WEVC technology will lead to a shift in charging behaviour. Drivers will charge their electric vehicle little and often and potentially use dynamic charging to complement local stationary charging, removing range anxiety. This means that batteries could be smaller with the resulting reduction in electric vehicle cost and vehicle weight.”

WEVC stationary charging is the near term future with ease and simplicity of electric vehicle charging while DEVC, Dynamic Electric Vehicle Charging, is the medium/long term vision of a "totally no-fuss wireless electric vehicle charging society". Inductive power has been around for over 100 years, and many people today experience the unique physics of magnetic resonance when they charge their electric toothbrush.

Right now, fixed charging points make sense from a cost-of-infrastructure point of view as well as given that most cars stand unused overnight and for several hours during the day. However, Qualcomm also envisions a time when dynamic charging will be used: Halo embedded in continuous strings along the roadway, with EVs constantly being powered as they drive over them. In fact, the current Halo pads support dynamic charging already; right now, though, actually ripping up the road to bury them in place is unfeasible. Qualcomm and others will need to successfully position Halo as a standard, too, in order for the technology to be so broadly adopted that ubiquity makes commercial sense.

High-speed performance with Drayson Racing Technologies

EVs can deliver when it comes to high-speed performance – that’s the key message of Lord Paul Drayson, founder and owner of Drayson Racing Technologies: “Racing drives innovation and leads to new ideas getting developed faster. This will improve the overall performance of electric vehicles.” Lord Paul Drayson believes an all-electric race series can compete for fan interest and show the world what an electric vehicle can do. The Drayson Racing electric prototype B12/69EV, designed with race-car builder Lola, has an 850 horsepower motor and accelerates from zero to 60 miles per hour in less than three seconds. That’s about 300 horsepower more than 2011's Le Mans winner and enough to propel the car from 0 to 100 mph in 5.1 seconds, and give it a top speed of 200 mph.

The B12/69EV is the first ever EV that uses motorsport principles in the design of the chassis, Drayson says. He explains that from the car’s cockpit forward, it’s a standard petrol-fueled Le Mans prototype racer. But from the cockpit back, it’s something completely new: an engine with four electric motors, battery cells, and regenerative dampers that help recharge the battery.

Because of the tremendous amount of energy used to power a race-car, today’s battery technologies cannot power EV races for more than 20 minutes. That's why Formula E will feature 15-minute sprint races. However, the races may not always be short. Wireless EV charging, like Qualcomm's Halo technology, could allow the cars to draw an electric charge from the track without actually touching the road surface – dynamic charging or charging-on-the-move as it may become known. Unfortunately for Drayson Racing, at this time the Halo system can only be used by stationary vehicles. Drayson's vision of charging a race car while it's racing cannot be implemented today.

That’s why both Qualcomm and Drayson have announced that Qualcomm Europe will sponsor Drayson Racing over the next 18 months to promote and develop the Halo WEVC technology during the launch phase of the new FIA Formula E Championship. Qualcomm has additionally appointed Drayson Racing as an Official WEVC Performance Motorsport Development Partner for its WEVC technology in high performance motorsport using both static and game-changing dynamic charge-on-the-move systems. Drayson will promote the adoption of WEVC in motorsport by demonstrating the effectiveness of the technology for charging high performance electric vehicles. Drayson Racing has been evaluating a specially developed, 20kW, high power Qualcomm Halo wireless charging system on the Drayson B12/69EV prototype electric racing car over the past 6 months. The companies will rigorously test the Qualcomm Halo system during high-speed trials and under racing conditions prior to offering the system to Formula E racing teams.

Drayson is a key player in the Federation International de l’Automobile’s plans for Formula E, a soon-to-launch racing championship for zero emission, high-performance electric vehicles (EVs). Both Drayson and the Fédération Internationale de l'Automobile – the international sanctioning organization – hope to see an all-electric race car series debut as early as 2013.

www.qualcommhalo.com

www.draysonracingtechnologies.com

Drop-In Analog Front-End (AFE) Solution for Industrial Sensors

Maxim Integrated Products, Inc. subsystem reference design, a precise drop-in-ready isolated 16-bit analog front-end (AFE). This highly integrated subsystem reference design meets the needs of industrial sensors, process control, and programmable logic controllers (PLCs). Its analog -10 V to +10 V, 0 to 10 V, and 4-20 mA inputs support the ubiquitous analog outputs of industrial sensors. In addition, both power and data are fully isolated. Maxim provides all the hardware design files, example driver code, and test results needed to speed design development.

Industrial control and automation applications often require isolation, high resolution, and a wide range of input voltages. Many industrial sensors have high or wide-ranging analog output voltages. Field-programmable gate arrays (FPGAs) and microcontrollers often cannot accept these high analog voltages directly. The Cupertino design solves this problem by providing an interface solution between the sensor and the controller while also integrating isolated power and data, all in a small 96.52 mm x 20.32 mm form factor. The Cupertino AFE connects directly to FPGA/CPU development kit

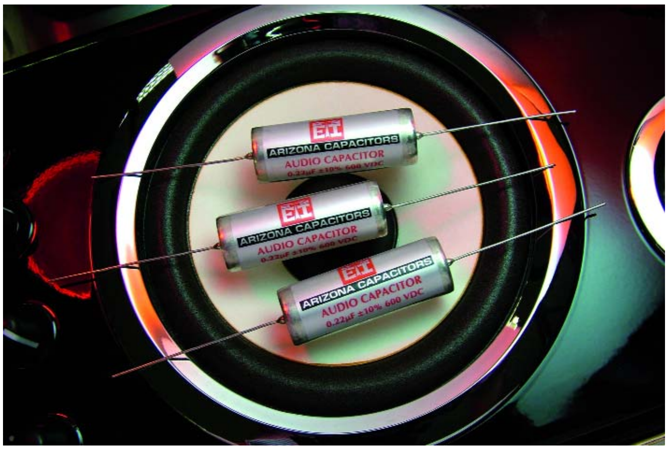
expansion ports that conform to the Pmod™ standard from Digilent.

www.maxim-integrated.com

Arizona's Audio Capacitors for that Vintage Sound

Manufactured in the US by Arizona Capacitors, now part of Electro Technik Industries, the C50309 range of paper and polyester dielectric, oil-filled capacitors is designed for use in audio equipment such as pre-amplifiers, amplifiers and loudspeaker crossover networks. Using well proven, traditional high quality materials and techniques, these capacitors are designed for high performance and long life and feature the finest capacitor grade kraft paper and polyester available. Components in the range are rated for operation at 600V DC and standard capacitance tolerance is +/-10%. Insulation resistance is quoted at 6000 megohm-microfarads minimum, while the dissipation factor is less than 1% measured at 120Hz. The operating temperature covers the full military range from -55 to 125oC at full rated voltage.

A typical capacitor in the range is the C50309-6224K offering a capacitance of 0.22µF +/-10%. The hermetically-sealed tubular brass case diameter is 17mm, and overall length is 47.6mm. The 20awg leads are solder-coated oxygen free solid copper.



www.aspen-electronics.com

LED-Downlight Reference Design Achieves High-Performance Dimming

Power Integrations announced RDR-347, an LED-downlight reference design. The new circuit demonstrates the capabilities of the recently launched LYTSwitch™ IC family, which offers the industry's best high-end dimming performance from a single-stage LED driver–together with all the associated efficiency, space and cost benefits that the single-stage approach brings.

The RDR-347 12 W reference design, based on the LYT4313E, delivers a power factor greater than 0.95 and reduces total harmonic distortion (THD) to less than 10% - easily meeting EN61000-3-2C requirements. Efficiency is greater than 86% at 120 VAC – industry-leading performance for an isolated solution capable of operating with a wide range of dimmers. This performance is possible because LYTSwitch ICs use one combined PFC and CC power conversion stage which minimizes losses and cuts component count, which in turn increases reliability and decreases cost.

TRIAC dimming is challenging, especially deep-dimming where TRIAC asymmetry between half-cycles can have a significant effect. RDR-347 shows that Power Integrations' LYTSwitch driver IC works excellently, even at very low output currents, without any shimmer or flicker. The design also demonstrates system start-up without noticeable hysteresis (so-called "pop-on effect"), even in deep-dimming. The IC features a very fast start-up time (under 500 ms) even when dimmed to 10% output current, achieving the 'instant-on" condition that many customers want, but that many designs in the market cannot provide.

www.powerint.com

Next Generation Amorphous Powder Cores

Magnetics® is entering the next generation of powder alloy materials with the introduction of AmoFlux amorphous powder cores. This alloy starts with low core loss amorphous ribbon that is pulverized into powder and then pressed into a toroid. By converting the amorphous ribbon into a powder form, the resulting AmoFlux cores have the same excellent properties, including soft saturation, as Magnetics other powder core materials: Kool Mu®, MPP, High Flux, and XFlux®. What makes this amorphous powder core material unique is the combination of low core loss and high DC bias. AmoFlux is a new distributed gap material ideal for power factor correction (PFC) and various types of output chokes.

These attributes make AmoFlux an excellent choice for inductors in computer, server, and industrial power supplies that require maximum efficiency at high DC currents.

The core loss density of AmoFlux is significantly lower than High Flux, which allows for a more efficient design with less temperature rise. Magnetics Molypermalloy Powder (MPP) material has the best core loss density of the available powder core materials and AmoFlux is only 20% higher. The DC Bias of AmoFlux is similar to High Flux and superior to both MPP and Kool Mu. Better DC Bias will allow higher current handling in the same size core or a smaller size core to be used to achieve the same target inductance.

www.mag-inc.com

Programmable 1U 750W AC-DC Power Supply Family

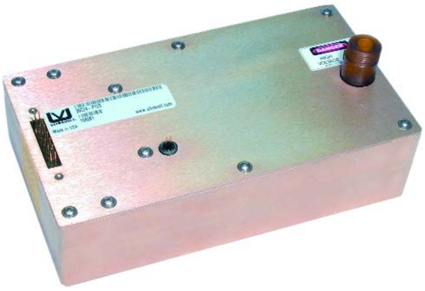
Acopian announced the availability of a new family of programmable AC-DC power supplies. Featuring wide-adjust output voltages from 0V-5V to 0-135V and current capabilities up to 70A, the 1U format single output voltage power supplies offer 750W of output power. These rack and benchtop modules notably provide high power density, low ripple and a user-friendly front panel.

Acopian's programmable switching power supplies with wide-adjust output voltages are suitable for use in a broad range of ATE, OEM and laboratory applications such as component testing, semiconductor burn-in, test and measurement, RF Amplifiers, LED/laser testing, as well as a variety of electromagnetic and electromechanical applications. The power supplies accommodate the universal AC input voltage of 95 to 265VAC, 50/60Hz with active power factor correction

(PFC) of 0.99 single phase to ensure operation in challenging AC environments and compliance with European EMC requirements. For added support, models can be configured with an optional fixed auxiliary output of between 3.3Vdc and 125Vdc, up to 180W.

www.acopian.com/wide-s-1u-m.html

High Power Modules Offered at 250 W



UltraVolt, announced that its High Power 8C-30C Series modules are now being offered at 250 watts of output power. Previously, the maximum output power of the High Power 8C-30C Series was 125 watts. The expansion of this product line to 250 watts of output power will support UltraVolt's customers' who work within existing applications, but who require greater output power or current in their project design. This product line was designed and optimized for a variety of applications including pulsed power, cap-charger, pulse generators, Q-switch and Pockell cell drivers, lasers, and TDR test equipment. The new models are being offered from 8kV to 30kV in either positive or negative polarity.

www.ultravolt.com

Targeting China's Smart Metering Market with Best-in-Class Wireless Transceiver

Silicon Labs introduced a high-performance, ultra-low-power wireless transceiver optimized for China's rapidly growing smart metering market. Silicon Labs' new Si4438 EZRadioPRO® IC is designed to maximize wireless range and battery life while reducing bill of materials (BOM) cost by 30 percent for smart meters. Designed for the 425-525 MHz ISM band, the Si4438 transceiver also provides an ideal sub-GHz wireless solution for in-home energy management systems and other smart grid infrastructure applications such as long-range back-haul communications to utilities.

Silicon Labs engineered the Si4438 transceiver to meet the performance, energy efficiency, system cost and regulatory requirements of smart meters operating in the 470-510 MHz band in China. Featuring an efficient on-chip power amplifier (PA), the Si4438 IC provides extended range and robust communication links for smart metering by leveraging best-in-class specifications in transmit output power (+20 dBm), sensitivity (-124 dBm), link budget (144 dB) and adjacent channel rejection (58 dB). Built-in antenna diversity and support for frequency hopping further extends range and enhances wireless performance. Tightly integrated into the Si4438 transceiver, antenna diversity can improve the system link budget by 8-10 dB, resulting in substantial range increases even under adverse environmental conditions.

www.silabs.com

12 V-Optimized Additions to Cool-Power ZVS Buck Regulator

Vicor Corporation announced the expansion of its award-winning Picor Cool-Power® ZVS Buck Regulator product line for high efficiency point-of-load DC-DC regulation. Optimized for 12 V operation (8 V to 18 Vin), these new PI34XX series buck regulators increase performance for a host of embedded applications in computing, telecommunications, industrial and other environments, delivering over 95% peak efficiency for 12 V to 3.3 V regulation and up to 15 A.

The Picor Cool-Power Zero-Voltage Switching (ZVS) Buck Regulator portfolio has gained acceptance with customers worldwide. The integration of a high performance ZVS topology within a high density (10 mm x 14 mm x 2.6 mm) System-in-Package (SiP) enhances point-of-load

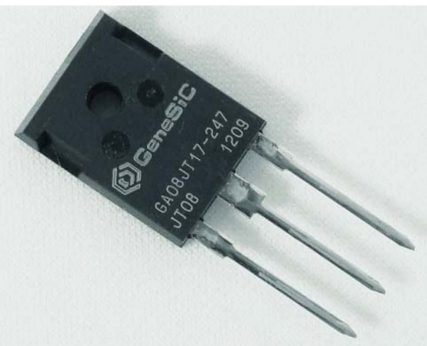
DC-DC regulation by reducing the switching losses associated with conventional hard-switching buck regulators. The reduction of

switching losses enables a higher efficiency and higher density regulator that is also simple to use. PI34XX series buck regulators integrate control circuitry, power semiconductors and support components within the SiP and require only an external inductor with minimal capacitors to form a complete DC-DC switching mode buck regulator.

www.vicorpower.com

GeneSiC Introduces Silicon Carbide Junction Transistors

GeneSiC Semiconductor announced the availability of a family of 1700V and 1200 V SiC Junction Transistors. These devices are targeted for use in a wide variety of applications including server, telecom and networking power supplies, uninterruptable power supplies, solar inverters, industrial motor control systems, and downhole applications.



Junction Transistors offered by GeneSiC exhibit ultra-fast switching capability, a square reverse biased safe operation area (RBSOA), as well as temperature-independent transient energy losses and switching times. These switches are gate-oxide free, normally-off, exhibit positive temperature coefficient of on-resistance, and are capable of being driven by commercial, commonly available 15 V IGBT gate drivers, unlike other SiC switches. While offering compatibility with SiC JFET drivers, Junction Transistors can be easily paralleled because of their matching transient characteristics.

1700 V Junction Transistor Technical Highlights; Three offerings – 110 mOhms (GA16JT17-247); 250 mOhms (GA08JT17-247); and 500 mOhms (GA04JT17-247); Tjmax = 175°C; • Turn On/Off; Rise/Fall Times <50 nanoseconds typical.

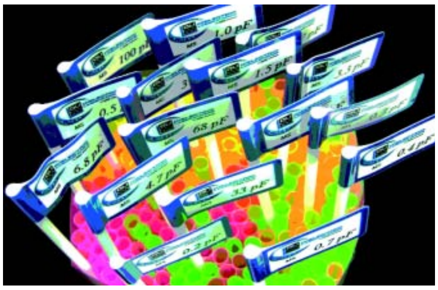
1200 V Junction Transistor Technical Highlights; Two offerings – 220 mOhms (GA06JT12-247); and 460 mOhms (GA03JT12-247); Tjmax = 175°C; Turn On/Off; Rise/Fall Times <50 nanoseconds typical.

All devices are 100% tested to full voltage/current ratings and housed in Halogen-Free, RoHS compliant TO-247 packages.

www.genesicsemi.com

Tuning Rod Kits Aid Capacitor Selection for RF Designs

Just announced by capacitor manufacturer Syfer Technology, is a set of tuning rod kits created specifically to help RF engineers determine more efficiently and precisely the capacitors they need for their next design.
They are classed as design aids and can be supplied free of charge to RF design and test engineers on application. These kits are based on Syfer's Hi-Q range of capacitors and help speed up the selection of the correct surface mount capacitor for any particular circuit or application.
The RF design or test engineer can select a tuning rod, which has attached to it a Syfer High-Q capacitor, from a range of capacitance values, (from 0.1pF to 100pF). Typically, an RF engineer might need to "fine tune" a circuit such that he adds or removes capacitance from his circuit by substitution, or by the use of a variable capacitor (trimmer). This is not always practical for a number of reasons, specifically the effort of soldering and de-soldering devices.



Through trial and error, using tuning rods with a range of different capacitor values around the nominal value, a single Syfer surface mount capacitor of the optimum value can be determined and eventually installed in the application. One of the easiest ways to check what the optimum value should be is to place another capacitor on top of the existing printed circuit board mounted device, effectively running them in parallel, at the combined capacitance value.

www.syfer.com

Industry's Smallest Point-of-Load DC/DC Converters for Harsh Environments

Texas Instruments introduced the industry's smallest monolithic point-of-load (POL) DC/DC converters for harsh environments, including radiation tolerant, geological, heavy industrial, and oil and gas applications. The 6.3-V, 6-A TPS50601 and the 6.3-V, 3-A TPS50301 are synchronous step- down converters optimized for small form factor designs.
The devices' current mode control, high switching frequency, and integration of the high- and low-side MOSFETs slash board space by 50 percent compared to other solutions, reducing the size of equipment needed for tight spaces, such as down-hole drilling.
For more information or to order samples and an evaluation module (EVM), see www.ti.com/tps50601-pr-eu.

Key features and benefits of the TPS50601 and the TPS50301:
Peak efficiency: Best-in-class peak efficiency of up to 95 percent results in lower heat dissipation, compared to competitive devices.
Design flexibility: 100-kHz to 1-MHz switching frequency and optimized compensation scheme enable designers to make trade-offs between size and efficiency.
Reduced board space: High efficiency, optimal layout and dynamic bias reduce the size and number of output capacitors, and improve transient response. This enables more than 12-watts-per-square-inch power, compared to the nearest competitor at 10 watts per square inch. High reliability: The TPS50301 is qualified up to +210 degrees-C for high temperature applications, while the

TPS50601 is qualified up to +125 degrees-C for harsh environments with QMLV/RHA qualifications pending.
Higher-current operation: Designers can use two devices in parallel to double the output current.

www.ti.com/hirel

Mass-Produced SiC MOS Module without a Schottky Diode

ROHM recently announced that they have begun mass-production of 1200V/180A-rated SiC MOS modules for inverters/converters used for industrial equipment, photovoltaic power conditioners and the like. This new product is the first* module to incorporate a power semiconductor comprised of just an SiC MOSFET, increasing the rated current to 180A for broader applicability while contributing to lower power consumption and greater compactness.
In March of 2012 ROHM was the first supplier in the industry to mass produce 1200V/100A 'Full SiC' modules that utilize SiC for all power semiconductor elements. The goal was to balance the need for larger current handling capability with a smaller form factor for industrial equipment and other applications. Normally, increasing current rating entails integrating more MOSFET elements and similar measures. However, this requires diode rectification, which makes it extremely difficult to reduce or even maintain device size.

www.rohm.com/eu

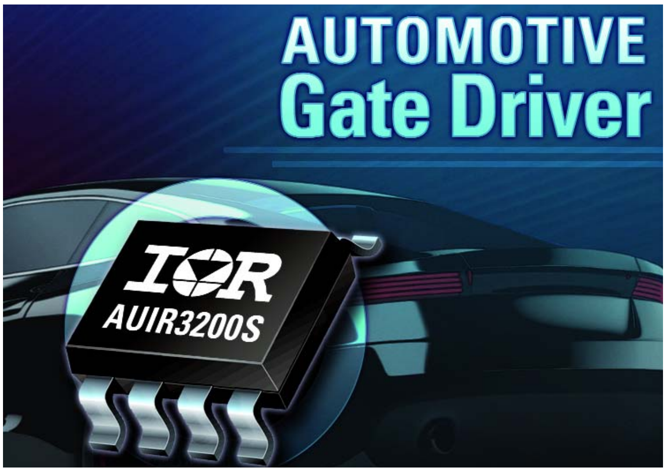
Silicon-On-Insulator Website Resource

Richardson RFPD, Inc. announced the launch of a website resource focused exclusively on Silicon-On-Insulator (SOI). SOI wafer processes use a silicon/insulator/silicon substrate instead of an ordinary silicon substrate. This creates a number of advantages, including better isolation, higher linearity, and lower insertion loss—with the overall result being improved RF performance.

Richardson RFPD supplier Peregrine Semiconductor (Peregrine) is the RF leader in SOI. Their UltraCMOS process is proven and reliable, with over one billion ICs shipped to date for cellular infrastructure, CATV, and aerospace and defense applications. The new Richardson RFPD SOI microsite features a range of Peregrine products, operating from DC to 13.5 GHz, and including digitally tunable capacitors, switches, digital step attenuators, prescalers, mixers, and phase lock loops (PLLs).

www.richardsonrfpd.com

Enhanced Protection and Diagnostics for Automotive Relay Replacements and Battery Switches



International Rectifier has launched the automotive-qualified AUIR3200S MOSFET driver IC with comprehensive protection and diagnostic features offering enhanced reliability for relay replacements and battery switch applications.

Available in an SO8 package, the AUIR3200S features over-current protection and over-temperature protection in addition to a diagnostic feature to report a short on the load. When designed with two AUIRLS3034-7P power MOSFETs, an on-state resistance (Rds(on)) as low as 0.75mohm can be achieved.

The device is qualified according to AEC-Q100 standards, features an environmentally friendly, lead-free and RoHS compliant bill of materials, and is part of IR's automotive quality initiative targeting zero defects.

www.irf.com

Easy Switch from 8-bit to 32-bit with XMC1000 Industrial Microcontroller Family

Infineon Technologies presented samples of its new XMC1000 industrial 32-bit microcontroller family which provides system designers with strong incentive to switch from 8 to 32 bit MCU architecture. With XMC1000, Infineon offers a fully-featured 32-bit alternative for hitherto 8-bit users by combining the ARM® Cortex™-M0 processor core with powerful peripherals, high productivity design tools and costs typical of 8-bit devices based on production using state-of-the-art, 65nm embedded Flash technology on 300mm wafers. With 32-bit performance at 8-bit cost, the XMC1000 family addresses sensor and actuator applications, LED lighting, digital power conversion, such as uninterruptible power supplies, and simple motor drives, such as those used in household appliances, pumps, fans and e-bikes.

“Design of the XMC1000 family started with a deep understanding of the system requirements of 8-bit industrial applications. By aligning the product architecture and peripherals towards the requirements of applications typcally addressed by 8-bit MCUs, developers can use XMC1000 devices to design a better product in a cost-effective way and bring it to market faster,” says Dr. Stephan Zizala, Senior Director, Industrial and Multimarket Microcontrollers at Infineon Technologies AG. “XMC1000 creates a decisive incentive for switching architecture from 8 to 32 bit, with its combination of 32-bit performance at 8-bit prices and the user-friendly, free DAVE development environment.”

Development tools for the XMC1000 family comprise the free DAVE™ development platform of Infineon, boot kits and comprehensive applications kits for LEDs, touch panels and energy efficient motor controls. Numerous development partners also offer compilers, debuggers, software analysis tools and flash programmers, as well as embedded software solutions, training and technical support for the XMC1000 family.

www.infineon.com

Current-Sensing ICs Offered in Ultra-Miniature Package

Allegro’s smallest current sensor linear IC, the ACS711, is now housed in a 0.75 mm thick low-profile QFN package measuring only 3 mm × 3 mm. This new micro-sized device is possibly the smallest fully integrated linear current sensor IC in the world.

With an internal resistance of only 0.6 milliohm, the new package exhibits very low power loss and thermal effects. With proper PCB design, it can be used for applications with over 30 A continuous current while reducing power consumption by an order of magnitude over existing sense-resistor/op-amp solutions.

Factory programming provides for high accuracy in this IC, which also features an integrated fast-response fault output. Together these techniques deliver an exceptionally low current-sensing footprint available without compromising accuracy.

The ACS711 is designed for low-side or high-side sensing at voltages up to 100 V DC, and provides a ratiometric output voltage that is proportional to AC or DC current. Applications include motor and pump control in consumer and industrial equipment, short-circuit and over-power detection in audio and lighting applications, and general power supply monitoring.

www.allegromicro.com

ADVERTISING INDEX