

POWER SEMICONDUCTORS

Comparing N-Channel and P-Channel MOSFETs: *Which is best for your application?*



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News & Features Editor Leslah Garland

Tel: +44 (0)1732 370340
Email: leslah@dfamedia.co.uk

Publisher Ian Atkinson

Tel: +44 (0)1732 370340
Email: ian@dfamedia.co.uk
www.power-mag.com

Production Editor Chris Davis

Tel: +44 (0)1732 370340
Email: chris@dfamedia.co.uk

Financial Manager Joanne Morgan

Tel: +44 (0)1732 370340
Email: accounts@dfamedia.co.uk

Reader/Circulation Enquiries

Perception
Tel: +44 (0) 1825 701520
Email: dfamedia@dmags.co.uk

INTERNATIONAL SALES OFFICES**Mainland Europe:**

Victoria Hufmann
Norbert Hufmann
Tel: +49 911 9397 643
Fax: +49 911 9397 6459
Email: pee@hufmann.info

Eastern US

Ian Atkinson
Tel: +44 (0)1732 370340
Email: ian@dfamedia.co.uk

Western US and Canada

Ian Atkinson
Tel: +44 (0)1732 370340
Email: ian@dfamedia.co.uk

Japan:

Yoshinori Ikeda,
Pacific Business Inc
Tel: 81-(0)3-3661-6138
Fax: 81-(0)3-3661-6139
Email: pbi2010@gol.com

Taiwan

Prisco Ind. Service Corp.
Tel: 886 2 2322 5266 Fax: 886 2 2322 2205

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Comparing N-Channel and P-Channel MOSFETs: Which is best for your application?

This article compares the n-channel and p-channel power MOSFETs, introduces the complete Littelfuse p-channel power MOSFETs portfolio, and explores target applications.

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PCIM Europe 2024: Extensive program provides new highlights



The PCIM Europe will once again turn into a hub for experts from all over the world, working together to drive forward power electronics. The exhibition and conference promise a variety of pioneering products, solutions and presentations.

Power electronics is a key technology for the future, when it comes, for example, to a sustainable energy supply. These growing and changing requirements for the industry results in an increased need for specialist knowledge and exchange between experts. The PCIM Europe exhibition and conference offers the ideal platform for this with a record number of exhibiting companies and presentations.

The top-class presentation program on the four stages in hall 5, 6, 7 and 9 of the exhibition will provide information on current topics in power electronics.

New content standards are being set at the PCIM Europe with the new Smart Power System Integration Stage. This will be the centerpiece of the first-ever focus on power electronics manufacturing and adds another trend topic to the exhibition's extensive supporting program. The stage awaits visitors with presentations on innovative solutions and application examples, including highlights such as "Novel Interconnect and Packaging Technologies for Power Module Manufacturing" (Boschman Technologies B.V.) and "BMS as a Comprehensive System Solution" (STMicroelectronics).

Current and future developments in power electronics products for electromobility and energy storage will be highlighted on the E-Mobility & Energy Storage Stage. In addition, specialized exhibitors will present their

products in depth every day in Live Product Demos.

At the Exhibitor Stage, interested visitors will have the opportunity to learn about new products from exhibiting companies in short presentations, including onsemi, Infineon Technologies AG and Semikron Danfoss Elektronik GmbH & Co. KG.

The Technology Stage program includes presentations and panel discussions on current research and development topics in the industry, such as "Meeting Grid Code Requirements for High Power Electrolyzers: Choosing the Right Power Electronics Topology" and "Double Pulse Testing: How Many Engineers are Turning a Blind Eye".

Products along the entire value chain

On an exhibition area of around 38,000 m², more than 620 exhibiting companies from 33

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DIVE INTO THE WORLD OF POWER ELECTRONICS

Be part of the industry's leading exhibition and discover cutting-edge trends along the entire value chain at firsthand.

From components to intelligent systems, from innovations in E-Mobility and energy storage to smart power system integration: for 45 years, the trade community has been benefiting from the unique meeting of academia and industry at the the PCIM Europe exhibition and conference.

With over 600 exhibitors and a top-class presentation program on four stages, the leading industry event offers you an ideal opportunity to discover new trends and product innovations along the entire value chain, expand your specialist knowledge and exchange ideas with international experts.

Find out more: pcim-europe.com/visitors

countries will be presenting a diverse range of products and services along the entire power electronics value chain. The companies represented include NXP Semiconductors, LEM Europe GmbH, TDK Europe GmbH, Power Integrations GmbH and Würth Elektronik ICS GmbH & Co. KG. An overview of all exhibiting companies can be found in the online exhibitor list.

Conference highlights: innovations in focus

With its accompanying conference, the PCIM Europe offers a unique platform that connects industry and academia. Participants have the opportunity to delve even deeper into the world of power electronics with over 450 first-time publications and to find out first-hand about the latest research results and developments. This efficient imparting of knowledge draws the parameters for the industry to advance further even faster.

The highlights of the conference include exciting sessions such as:

- **Tuesday, 11 June 2024, 11:00 a.m. – 12:00 p.m.: Cycling Reliability**

- **Wednesday, 12 June 2024, 09:50 a.m. – 11:50 a.m.: Power Electronics for E-Mobility**

- **Thursday, 13 June 2024, 09:50 a.m. – 11:15 a.m.: SiC Devices**

In addition to the oral presentations in six conference rooms, the poster presentations offer an ideal platform for discussion. For the first time this year, the poster sessions will take place at two different locations - in the Entrance Foyer NCC Mitte and in Hall 10.1 NCC Mitte.

Networking in a relaxed atmosphere at the After Work BeerOn Wednesday, 12 June 2024, participants of the PCIM Europe exhibition and conference will have the opportunity to round off an eventful day with cool drinks and musical accompaniment at the After Work Beer event. This also offers interested parties the opportunity to exchange ideas with the community and expand their network in a relaxed atmosphere.

Professor Leo Lorenz, General Conference Director of the PCIM Europe Advisory Board, will provide an overview of the five key development areas for power electronics in

2024. In addition, the keynote speech by Gerald Deboy on the topic of "Challenges and solutions to power latest processor generations in hyperscale datacentres" at the conference 2024 will be highlighted in an interview. Future-oriented topics such as sustainability, AI and e-mobility will also be covered.

Complementing the exhibition and conference: PCIM Europe digital

The PCIM Europe digital event platform enables participants to experience the presentations of the conference and exhibition stages independent of time and location and to discover a wide range of information and specialist knowledge. All oral presentations at the conference will be streamed live and will then be available on demand on the digital platform. In addition, the presentations from the Technology, Exhibitor, E-Mobility & Energy Storage and Smart Power System Integration Stages will be made available in the media library. Exhibitors will also present their company and product profiles on the platform.

www.pcim-europe.com

ROHM and Nanjing SemiDrive Technology jointly Develop a Reference Design

ROHM and Nanjing SemiDrive Technology Ltd., claimed to be China's largest SoC manufacturer for smart cockpits, have jointly developed a smart cockpit reference design. The design is primarily based on SemiDrive's X9M and X9E automotive SoCs, and includes PMICs, SerDes ICs, LED driver IC, and other components from ROHM. A reference board based on this design is also available, consisting of three boards: the CoreBoard, the SerDes Board, and the Display Board.

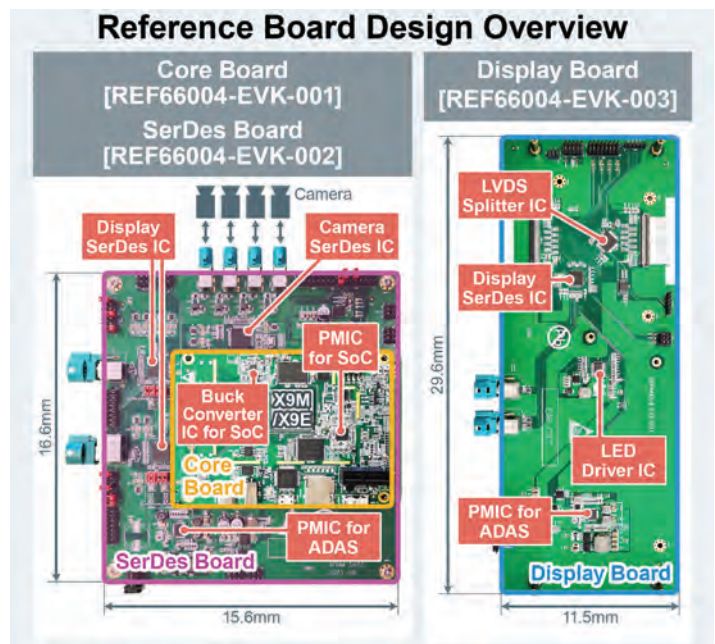
In recent years, the proliferation of smart cockpits and ADAS in vehicles has increased the demand for automotive electronics and components. The performance of PMICs and SerDes ICs, which are at the heart of electronic systems in vehicles, has a direct impact on the stability and efficiency of the entire system. In this context, ROHM PMICs and SerDes ICs potentially achieve a high level of integration in power supply blocks while supporting increased stability during high-speed data transmission.

ROHM and SemiDrive have been exchanging technologies since 2019, particularly in the development of applications for vehicle cockpits. In 2022, the two companies entered into a strategic partnership for the development of advanced technologies in the automotive sector. This resulted in ROHM components such as PMICs and SerDes ICs being integrated into the reference board for SemiDrive's X9H In-Vehicle SoC. The reference board has since been adopted by a number of automakers to provide advanced functionality for cockpits and other vehicle applications.

This time, ROHM and SemiDrive have collaborated on the development of the REF66004 reference design featuring the vehicle-mounted SoCs X9M and X9E. As such, the REF66004 is expected to further expand application line-up, including in popular mass-market models. In addition to the SerDes IC used in the X9H reference board, ROHM also provides the BD96801Q12-C SoC PMIC and BD9SA01F80-C buck converter IC for driving the SoC, as well as the BD39031MUF-C general-purpose PMIC for ADAS that supplies power to the

SerDes IC. This solution supports operation of up to three display projections and four ADAS cameras (Surround-view camera). Going forward, ROHM will continue to develop products for car infotainment systems that contribute to improving automotive safety and comfort.

For more information visit www.rohm.com



ROHM Group Company SiCrystal and STMicroelectronics Expand Silicon Carbide Wafer Supply Agreement



ROHM and STMicroelectronics, a global semiconductor leader serving customers across the spectrum of electronics applications, announced today the expansion of the existing multi-year, long-term 150mm silicon carbide (SiC) substrate wafers supply agreement with SiCrystal, a ROHM group company. The new multi-year agreement

governs the supply of larger volumes of SiC substrate wafers manufactured in Nuremberg, Germany, for a minimum expected value of \$230 million.

[more information can be found at www.st.com](http://www.st.com)

Power Dissipation in Power Entry Modules

Power entry modules (PEMs) consist of a combination of different components for the safe power supply of devices. In addition to the IEC appliance inlet connector, mains switches, fuseholders or circuit breakers and filters can be integrated. The company claims all these components are tested according to their

respective component standard so that the entire component can be certified by the certification bodies.

Each of these components is designed for a specific minimum and maximum ambient temperature. Important: The maximum rated current may only be used at the rated temperature. At higher ambient

temperatures, the current must be reduced accordingly. This is usually specified in the temperature derating on the data sheets.

For ore information visit:
<https://dam.schurter.com/m/41755d8b82d8dbf0/original/White-Paper-Power-Dissipation-PEM.pdf>

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PCIM, powering up for record event in June 2024



The PCIM Europe, the leading international exhibition and conference for power electronics will once again be a hotspot for the industry, showcasing numerous innovations, trends and developments from 11 – 13 June 2024. With over 600 exhibitors and around 500 presentations, the exhibition and conference are due to set new records.

This year, visitors to the exhibition can expect an even more extensive range of products along the entire power electronics value chain. For the first time, more than 600 exhibitors will be presenting their products in four exhibition halls, one more than in 2023, and on an area of over 38,000 m².

Of these, 60% are international and represent a total of 33 countries. Among those present are industry leaders such as Efficient Power Conversion (EPC) Corporation, Fuji Electric Europe, Infineon Technologies, Mitsubishi Electric Europe, onsemi, SEMIKRON Danfoss, ROHM Semiconductor, STMicroelectronics, Volkswagen and Wolfspeed. The exhibition will once again feature numerous new exhibitors: China, Germany, Taiwan and the USA occupy the top for places.

The accompanying conference offers a diverse program with over 500 presentations. First-class speakers will present their findings from a wide range of research areas in this dynamic sector,

giving participants the opportunity to find out about the latest innovations and make valuable contacts.

Stage program as a trend barometer

The program of the four Stages focuses on the latest products, developments and trends in the industry and will feature cutting-edge specialist presentations.

In hall 5, visitors can look forward to the new Smart Power System Integration Stage with innovative solutions and application examples for the challenges in power electronics production – from Smart Power Embedding to Integrated Smart Power Circuits.

The Technology Stage awaits interested parties with scientific presentations and panel discussions from leading research and development departments in the industry. The agenda includes highlights such as the topics “Will SiC Ultimately Hold its Own against GaN?” and “GaN Wide Bandgap, The Future of Power” as well as the session “Technical Working Groups’ Updates: IEC, PECTA, IEEE, CIGRE”.

The latest product innovations and solutions from exhibiting companies, including onsemi and Nexperia, will be highlighted on the Exhibitor Stage.

The presentations on the E-Mobility & Energy Storage Stage will shed light on current and future developments in power electronics for electromobility and energy storage. In addition to the exciting lecture program, a networking area invites visitors to engage in intensive discussions. Interested parties can also find out more in live product demos at the exhibition stands.

PCIM 2024: Innoscience to show that GaN devices are price-comparative with silicon, very reliable and available as discrete, integrated and bi-directional devices

At 10.00am on Thursday 13th June Dr Denis Marcon, General Manager Europe, Innoscience, will address the audience from the Tech Stage (Hall 7-743), on how GaN power devices are revolutionizing the power semiconductor sector. In his talk, ‘GaN power HEMTs: reliable, price-competitive and ready to enhance power conversion solutions,’ Dr Marcon will destroy the myths concerning GaN’s price and reliability; he will showcase how to take advantage of GaN power devices to make power management systems smaller, more efficient and cheaper. He will show that by leveraging

economies of scale and 8-inch wafers, Innoscience is providing price-competitive GaN power devices.

On booth 7-121, Innoscience will showcase its portfolio covering 30V to 700V rated GaN power devices, including discrete (InnoGaN), integrated with driver and protection (SolidGaN), and bi-directional (V-GaN) devices as well as GaN gate drivers.

Innoscience’s booth will also feature several demos that showcase the advances made possible with GaN technology, making power conversion and power management solutions

‘Faster, Smaller & Lighter, Greener / More Efficient & Cheaper.’

Demos will include:

- 200W LED GaN driver that is 50% smaller and thinner than its silicon counterpart
- 140W-200W All GaN AC-DC power converter that features InnoGaN at the primary and at the secondary side
- 1kW inverter for BLDC motors
- 4.2kW PSU that are 50% smaller and more

efficient (80 Titanium) than the silicon counterpart

- 2kW Solar PV microinverter
- 300W ultra high density TV PSU
- 2.4kW bi-directional DC-DC converter
- 1kW 48V-12V DC-DC converter with high power density (70% smaller than in silicon)
- InnoGaN for e-bikes with compact 240W charger and 3-phase motor driver

For more information visit:
www.innoscence.com



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Hall 7 - Stand 121

11 - 13 June 2024, Nuremberg, Germany

We will showcase many demos made with our latest portfolio of 30V-700V e-mode GaN power devices:

- Discrete (InnoGaN)
- Integrated (SolidGaN)
- Bi-directional (VGaN)
- GaN Gate Drivers

Reach us out at: saleseurope@innoscence.com

www.innoscence.com



Rohm - Empowering Growth, Inspiring Innovation

During this year's PCIM Europe – the leading trade fair for power electronics in Nuremberg, Germany (June 11th – 13th) – ROHM will be presenting its new power semiconductor solutions – with a special focus on wide bandgap devices.

ROHM's SiC, Si and GaN portfolio is designed to fulfill the needs of various sectors – focusing on e-mobility and power supply applications.

Following its motto "Empowering Growth, Inspiring Innovation," ROHM demonstrates how it solves social and ecological challenges with its technologies fostering sustainability.

ROHM's product highlights at its booth 304 in hall 9 include:

SiC:

The company will premiere new SiC power modules for automotive applications at PCIM Europe 2024. In addition to this, ROHM will show the conversion of its production to 8-inch SiC wafers and provide an additional outlook regarding its SiC product development.

ROHM's 4th Generation SiC MOSFETs realize top industry levels of low ON

resistance minimizing switching losses and supporting 15V and 18V gate-source voltage

GaN:

ROHM will exhibit their EcoGaN™ family of 150V and 650V class GaN HEMTs in several Evaluation Kits. The power stage IC BM3GxxMUV-LB series – including built-in 650V GaN HEMTs and gate drivers – will be extended by higher integrated PFC and QR (Quasi-Resonant) flyback converters. These devices claim to provide an optimal solution for all electronics systems that require high power density and efficiency. ROHM will display over 10 boards from its EcoGaN™ family – showcasing their contributions inside industrial solutions.

During the fair, ROHM will participate in several panel discussions and conference presentations. Additionally, they will hold poster sessions at the PCIM Europe conference.

More information about ROHM's participation at PCIM 2024:
<https://www.rohm.com/pcim>

Infineon drives decarbonization and digitalization for a greener future with innovative semiconductor solutions

At PCIM Europe 2024, Infineon will showcase how its latest semiconductor, software, and tooling solutions provide answers to today's green and digital transformation challenges. Under the motto "Driving decarbonization and digitalization. Together.", Infineon will demonstrate the industry's broadest power electronics portfolio covering all relevant power technologies in silicon (Si), silicon

carbide (SiC), and gallium nitride (GaN). The company will be demonstrating innovative Si and SiC-based solutions along with their broad GaN portfolio.

Infinion's PCIM 2024 highlights

The products, demonstrations, and design aids on display illustrate how Infineon's product-to-system expertise in power management enables engineers to balance operational specifications with application requirements. Demonstrations will include solutions from the following areas:

- **Wide-bandgap technologies:** Wide-bandgap materials are revolutionizing power electronics and various applications that are driving the green and digital transformation. Infineon will demonstrate the CoolSiC™ MOSFETs 650 V and 1200 V Generation 2, which can be used to improve overall energy efficiency. Additionally, the expanded portfolio of GaN solutions will be showcased, offering a wide range of innovative packages, discrete and integrated solutions.
- **Renewables, energy storage and HVDC:** With its power solutions, Infineon enables the most climate-friendly forms of energy generation from wind and solar accompanied by efficient storage systems. At PCIM, the company will present a wide range of solutions for single-phase and three-phase hybrid solar inverters as well as its
- **In-Field Power Analytics Service** helping to maximize converter uptime and optimize operation in real-time.
- **Industrial automation, motor drives and control:** With advanced power semiconductors, Infineon is paving the way for highly reliable and energy-efficient electric motors and drive solutions in smart factories. This is achieved through a combination of efficient energy management and intelligent motor control solutions, advanced sensor functions, and reliable connectivity components. Furthermore, the company is presenting its growing range of solid-state relays and circuit breakers as well as a stack assembly solution for high-end Press Pack IGBTs.
- **Information and communication technologies:** True to the motto "We power AI", Infineon exhibits innovative technologies that make it possible to meet increasing energy demands while promoting greener AI and paving the way for more efficient AI servers. This includes two-phase power supply modules, integrated point-of-load solutions, and converters. In addition, the company will showcase cutting-edge solutions, including Si, SiC, and GaN power switches, that meet the evolving needs of server technology and telecoms networks, driving efficiency, reliability, and innovation across all industries.

- **eMobility, eTransportation and charging solutions:** With leading power supply solutions for traction inverters, on-board chargers, DC-DC converters, and battery management systems, Infineon supports the efforts of developers and manufacturers, enabling the rapid expansion of eMobility, eTransportation, eCAV, and the corresponding charging infrastructure. Highlights presented in this area include traction inverters with fusion, single-side cooling and discrete concepts, traction inverter systems for commercial vehicles and rail transport, as well as high power fast charging solutions.
- **Smart and connected homes:** Infineon's leading technology portfolio of customized, ready-to-use solutions assists manufacturers in developing innovative system designs for homes that meet the growing demand for smart, connected, and energy-efficient living solutions. Highlights in this area include USB-C charging solutions, portable battery-powered welding solutions, residential heat pumps, as well as air conditioning systems.

Infineon will also contribute to the PCIM conference program and the various forums, including a keynote by Dr. Gerald Deboy, Fellow at Infineon, on the "Challenges and Solutions to Power Latest Processor Generations for Hyper Scale Data Centers" on June 13 at 8:45 am.



RAMPF Advanced Polymers

Tailor-Made for Maximum Performance & Service Life: Electro Casting Resins & Gap Fillers from RAMPF will be on show at PCIM 2024.

One- and two-component electro casting resins reliably and efficiently protect sensitive electrical/electronic components, batteries, motors, power electronics, sensors, and transformers from chemical substances and environmental influences such as heat, cold, and moisture.

The potting systems are listed by leading manufacturers in the automotive and electronics industries, among others. Typical applications: include casting of circuit boards, capacitors, inverters, sensors, inductors, EMC filters, and many more.



For more information visit: www.rampf-group.com

Soft Magnetics

At PCIM Europe, a significant proportion of the technology utilises magnetic forces. Bunting specialises in working with product designers to maximise magnetic performance. With the ongoing demand for greater efficiency and sensitivity of operation, companies turn to Bunting's specialist team of magnetics engineers to design the optimum solution.

Soft Magnetics are those that can be easily magnetised and demagnetised and their primary use is to enhance and/or channel the flux produced by an electric current. The extensive range of soft magnetics includes powder cores (iron and alloy), soft ferrites, strip wound cores (amorphous, nanocrystalline as well as silicon steel and nickel alloys), and wound components.

Bunting's specialist product portfolio and engineered solutions includes permanent magnets (e.g. ceramic ferrite and neodymium iron boron), electromagnets, and soft magnetics.

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The Rising Role of Augmented Reality and Virtual Reality in Industrial Automation

By Eric J. Halvorson, marketing technology manager – automation & control at DigiKey

Over the past couple of decades, we have seen an exponential rise in technological advances for industrial automation. The onset of Industry 4.0 has given rise to more machine-to-machine communication, machine learning, real-time data analysis, predictive maintenance, and more. We have seen the introduction of digital twin technology and the awesome power it wields in plant efficiency.

Another exciting innovation is the incorporation of augmented reality and virtual reality. These aren't just cool gaming experiences anymore. Now, we see these technologies being utilized throughout the industrial automation realm. From training to maintenance, these powerful tools are being deployed to efficiently and effectively provide a hands-on approach to maintain equipment and train new employees.

Since the pandemic, employers have faced an unprecedented worldwide labor shortage. Quality, skilled workers are becoming harder and harder to employ in the factory setting. This has led to unprecedented growth in implementing automated solutions to meet production demands. In many ways, automation has become the key to manufacturers

being successful in this climate. Coupled with environmental concerns, quality demands, and overall consumer demand, manufacturers must walk a very thin line to stay profitable.

While all this is instrumental to progress, it does, in some ways, exacerbate the labor shortage. As some jobs become obsolete, the need for new skilled labor increases. Being able to interact with robotics, troubleshoot cabinets, and perform maintenance on factory lines all become very valuable skills. There will always be a need for the human component in any manufacturing process; however, the expectation of finding workers with the necessary skill sets to do the above and more is no longer sensible. So, in this new workforce climate, how can a manufacturer close the gap? The answer may very well be the adoption of augmented reality and virtual reality.

Recently, I attended a trade show where augmented reality was being employed by a manufacturer to help a worker troubleshoot and repair a control cabinet. The demonstration showed a worker armed with a pair of smart glasses who opened, diagnosed, and repaired the cabinet. Connected to a server, the glasses used a

series of questions to diagnose issues and showed a step-by-step process for repairing the panel. It walked them through the entire process. The program also demonstrated the highest safety concerns for both the worker and the system to avoid damage. It showed the worker how to safely diagnose the problem, de-energize the components, perform lockout-tagout, remove the bad component(s), install new components, and restart the system. While this is still rather new technology, the implications of this being employed in real-world situations are immense.

Employers are also beginning to introduce augmented reality and virtual reality into training applications. Using these tools and platforms, employees are given access to valuable, powerful, and scalable training tools that are capable of meeting company training goals with repetition across their entire organization, regardless of where they are in the world. Employees can interact with virtual equipment and processes they will see in the field, with a greater understanding of safe and efficient operation in their jobs. From new employees to experienced employees, manufacturers can ensure proper training guidelines are accurately met.

The value of augmented reality and virtual reality in industrial automation is incalculable when considering the real-world applications in which it can be employed. Improvements to training programs can lead to fewer safety mishaps, more maintenance processes, efficiencies in production, better inventory management, maximized quality assurance, and more. Manufacturers using this technology can see higher optimization of their workforce and increased life expectancy of their equipment.





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POWER ELECTRONICS EUROPE

Comparing N-Channel and P-Channel MOSFETs: *Which is best for your application?*

This article compares the n-channel and p-channel power MOSFETs, introduces the complete Littelfuse p-channel power MOSFETs portfolio, and explores target applications.



Introduction

Driving a high-side (HS) p-channel MOSFET without an additional voltage source or a charge pump is uncomplicated, resulting in significantly simplified designs, space savings, reduced

part count, and improved cost efficiency.

While n-channel power MOSFETs require a positive gate-source voltage to activate, p-channel MOSFETs need a negative gate-source voltage. Using a cross-sectional view, Figure 1 illustrates the

differences between n-channel and p-channel MOSFETs. Their reverse doping profiles are the key distinction: p-channel MOSFETs rely on holes as the majority charge carriers, generating hole current, while n-channel devices utilize electrons, creating electron current. Due to electrons' superior mobility, approximately two to three times that of holes, moving holes in a p-channel device is more challenging than electrons in an n-channel device. This approach leads to higher area-specific on-state resistance in p-channel MOSFETs compared to n-channel MOSFETs. Consequently, achieving equivalent on-state resistance ($R_{DS(on)}$) performance is impractical for p-channel MOSFETs of the same chip size as n-channel MOSFETs.

In order to achieve a similar on-state resistance $R_{DS(on)}$ as n-channel MOSFETs, p-channel MOSFETs require a two to three-times larger die size. As a result, in more high-current applications, where low conduction losses are critical, the large die p-channel MOSFETs with very low $R_{DS(on)}$ are not the optimal choice. While the p-channel device's larger chip size

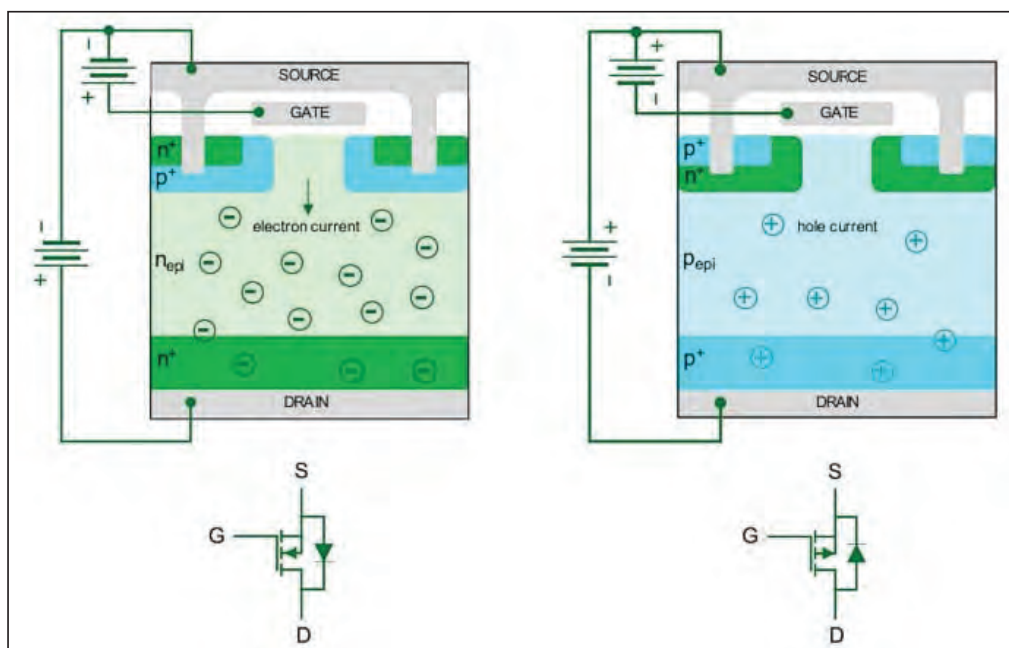


Figure 1. Cross sections comparison of n- and p-channel power MOSFETs

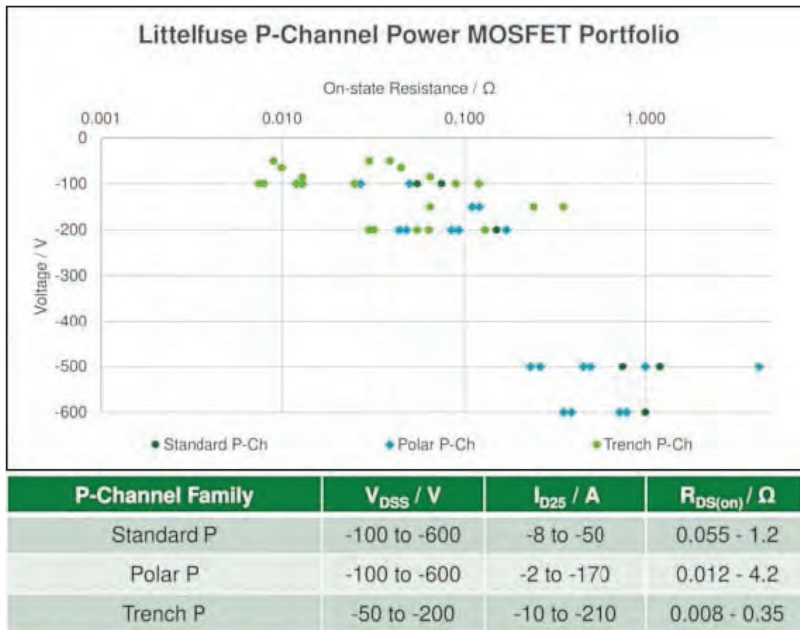


Figure 2. P-channel power MOSFET portfolio available from Littelfuse

offers improved thermal performance, it exhibits higher switching losses and larger intrinsic capacitances. When the system operates at a high switching frequency, this disadvantage significantly impacts overall efficiency, thermal management, and system cost.

In low-frequency applications with significant conduction losses, a p-channel MOSFET should match the R_{DS(on)} of an n-channel MOSFET, requiring a larger chip area. Conversely, in high-frequency applications prioritizing switching losses, a p-channel MOSFET should align with the total gate charges of an n-channel counterpart, often having a similar chip size, but a lower current rating.

Therefore, making the right p-channel MOSFET selection demands careful consideration of the device R_{DS(on)} and gate charge (Q_g) specifications, as well as the thermal performance.

P-Channel Power MOSFETs from Littelfuse

The Littelfuse p-channel power MOSFETs have traditionally served in a limited

range of applications. However, recent increases in demand for low-voltage (LV) applications have created a broader scope for p-channel power MOSFETs. The simplicity of Littelfuse p-channel solutions for HS applications makes them attractive for non-isolated point-of-load and LV inverters (< 120 V) solutions.

Littelfuse offers a range of industrial qualified p-channel power MOSFETs with the highest voltage class rating, lowest RDS(on) and Qg, high avalanche energy rating, excellent switching performance, and superior safe operating area (SOA) with best-in-class performance in both standard industrial and unique isolated packages. Littelfuse p-channel power MOSFETs retain the essential features of comparable n-channel power MOSFETs, such as fast switching, efficient gate-voltage control, and excellent temperature stability.

Figure 2 presents the p-channel power MOSFETs' key highlights offered by Littelfuse, including:

- Standard P and PolarP™ planar devices

have voltage ratings from -100 to -600 V and current ratings from -2 to -170 A.

- PolarP™ offers optimized cell structure with low area-specific on-state resistance and improved switching performance.
- Standard P benefits from a better SOA performance.
- Trench P utilizing a more dense trench gate cell structure offers very low RDS(on), low gate charge, fast body diode, and faster switching with device voltages ranging from -50 V to -200 V and currents from -10 A to -210 A.
- The latest addition to the portfolio, the IXTY2P50PA (-500 V, -2 A, 4.2 Ω), is the first AEC-Q101 automotive-grade p-channel power MOSFET available from Littelfuse.

Littelfuse p-channel MOSFETs drive a broad range of automotive and industrial applications like:

- battery protection,
- reverse polarity protection,
- HS load switches,
- DC-DC converters,
- onboard chargers, and
- LV inverters.

P-Channel MOSFETs in Half-Bridge Applications

Figure 3 illustrates the contrast between circuits using complementary MOSFETs and those using n-channel MOSFETs. N-channel MOSFETs are commonly found in the power stage in half-bridge (HB) applications. However, n-channel HS switches necessitate a bootstrap circuit to generate a gate voltage that is floating with reference to the source of the HS MOSFET or an isolated power supply to turn on, as depicted in Figure 3a. Hence, the advantage of using n-channel devices comes at the cost of increased complexity in gate driver design, leading to more

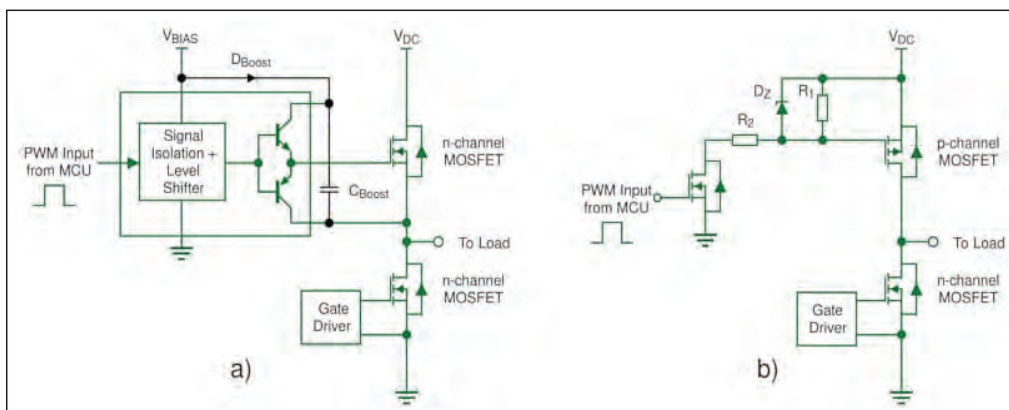
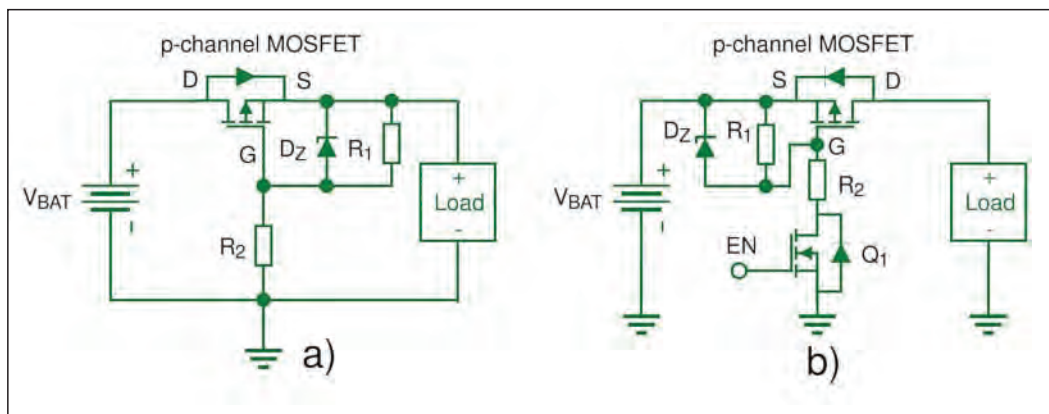


Figure 3. How to simplify the HS driver in HB application from a) N-cT to b) p-channel MOSFET as HS switch.

Figure 4. Using p-channel power MOSFET for a) reverse polarity protection and b) load switching.



design effort and space usage. When a p-channel MOSFET serves as the HS switch in this configuration, as shown in Figure 3b, it can significantly simplify the driver design. The designer could remove the charge pump to drive the HS switch, and the MCU can easily control the p-channel MOSFET through a simple level shifter. This approach reduces design effort and part count, resulting in a cost-efficient design that utilizes space efficiently.

Reverse Polarity Protection

Reverse polarity protection is a system safety measure to prevent potential fire hazards and damage in case of a reversed power source connection. Figure 4a depicts the reverse polarity protection implemented using a p-channel power MOSFET. When the battery is correctly connected, the intrinsic body diode conducts until the MOSFET channel is activated. In the event of a reverse connection of the battery, the body diode

is reverse-biased, with the gate and source at the same potential, thereby turning off the p-channel MOSFET. A Zener diode clamps the gate voltage of the p-channel MOSFET, safeguarding it in case of excessively high voltage levels.

Load Switching

Load switches connect or disconnect a voltage rail to a specific load, offering a cost-effective and straightforward way for a system to manage power efficiently. Figure 4b illustrates a circuit using a p-channel power MOSFET for a load switch. This circuit is driven by a logic enable (EN) signal to control the p-channel load switch via a small-signal n-channel MOSFET Q₁. When EN is low, Q₁ is off, and the p-channel gate is pulled up to V_{BAT}. Conversely, when EN is high, Q₁ activates, grounding the p-channel gate, and turning on the load switch. If V_{BAT} exceeds the p-channel MOSFET's threshold voltage, it can turn on when EN is high, eliminating the need for an additional voltage source to bias the gate, which is necessary for n-channel MOSFETs. The series resistor is needed to limit the current, and a Zener Diode is required in order to clamp the gate voltage to a maximum value.

synchronous buck converter in Figure 5a, using a p-channel device as the HS switch simplifies the circuit and saves space, eliminating the need for external gate driving circuitry. It also reduces the bill-of-materials (BOM), leading to cost efficiency.

Similarly, a P-channel device can replace a diode with low forward voltage as an output synchronous rectifier in synchronous boost converters, as seen in Figure 5b. This approach improves the converter efficiency due to the improved figure-of-merit (FoM = R_{DS(on)} * Q_g) of the p-channel MOSFET.

P-Channel MOSFETs in Low-Voltage Applications

As today's low-voltage (LV) applications advance, the Littelfuse p-channel MOSFETs continue proving their versatility in meeting the evolving needs of tomorrow's power electronics. Employing p-channel MOSFETs enables designers to provide simplified, highly reliable, and optimized circuit design in advanced automotive and industrial applications. Electronics design engineers must evaluate the trade-off between R_{DS(on)} and Q_g when selecting a p-channel MOSFET to achieve optimal performance for specific applications.

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DC-DC Synchronous Buck and Boost Converters

In low-power DC-DC converters like the

This article is co-authored by Sachin Shridhar Paradkar, Raymon Zhou, and José Padilla of Littelfuse, Inc.

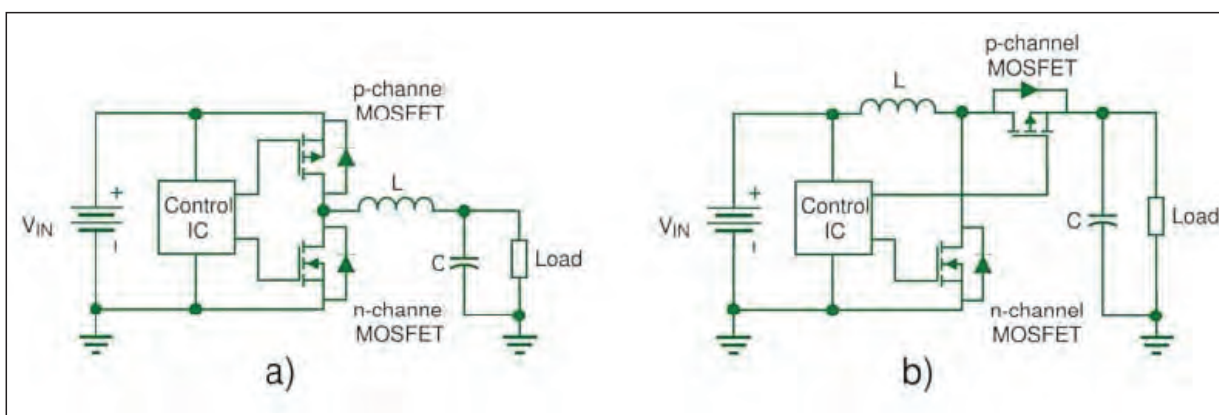


Figure 5. Using complementary MOSFETs for low power a) synchronous buck and b) synchronous boost converter.

How squib and contactor drivers help improve safety and efficiency in HEV/EV battery disconnect systems

Jennifer Jordan – Product Marketing Engineer at Texas Instruments



Power distribution in battery management systems (BMS) for hybrid electric vehicles (HEV) and electric vehicles (EV) delivers power to core functions of the vehicle while also providing mechanisms to safely disconnect high voltage or high current events. Two core components of the

power distribution system, high voltage relays and disconnect fuses, face increasing design challenges from the growing demands of supporting higher voltages, currents, efficiency, and reliability. Figure 1 shows an overview of the high voltage relays and disconnect fuses.

The non-resettable, battery disconnect fuse activates in emergency scenarios to break the connection between the battery and rest of the car. High voltage relays, otherwise known as contactors, connect and disconnect power-supply lines throughout an HEV or EV during normal operation. In this article, I'll discuss emerging technologies in contactor and disconnect fuse drivers that are helping make BMS smarter, safer and more efficient.

Enabling a fast and reliable battery disconnect system

In the event of a collision, power needs to be shut off from downstream systems in order to prevent further complications or damage. The two common solutions today are melting fuses and pyro fuses. Melting fuses trigger based on thermal conditions of an overcurrent event and these fuses

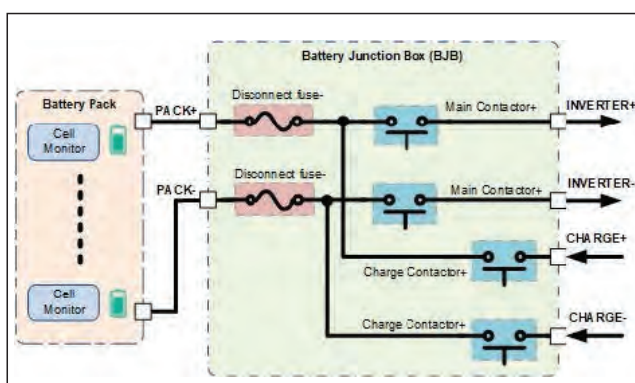


Figure 1. Battery disconnect fuse and high voltage relays in BMW power distribution

come pre-set from the factory. Pyro-fuses require an electronic driver to send a signal to break the connection and are primarily driven by discrete circuits or legacy airbag squib drivers. As HEV and EV systems move toward higher power, pyro-fuses offer higher reliability and faster deployment. But common solutions for driving these pyro-fuses quickly become complex when working to achieve fast reaction times. The need to meet International Organization for Standardization (ISO) requirements, ISO26262, adds increasing complexity to these designs.

In order to achieve a faster response time, the DRV3901-Q1 pyro-fuse driver implements a direct 2-pin hardware interface that can bypass the serial parallel interface (SPI). The DRV3901-Q1 driver has the ability to pair with a voltage, current and resistance (UIR) sensor for an even faster deployment. A UIR sensor, like the BQ79631-Q1 device, can communicate directly to the DRV3901-Q1 driver through the hardware pins, removing the need for an MCU.

One of the most critical functions for the pyro-fuse is disconnecting the battery from the rest of the system in the event of a crash or other critical failure. System designers must ensure the pyro-fuse function is available to activate reliably. DRV3901-Q1's built-in diagnostics monitor the driver status, pyro-fuse health and back-up power availability. To monitor the back-up power supply availability, the reservoir capacitor is measured. This capacitor acts as a back up power source for the pyro-fuse system in the case where the main supply from the battery is no longer available. By periodically checking the discharge voltage of this capacitor, it enables the DRV3901-Q1 driver and the MCU to detect a failure of this back-up

power supply before its needed and alert the vehicle.

It is important for the fuse to deploy when needs to, but it is also just as important that the fuse doesn't misfire. The DRV3901-Q1 driver has integrated safety diagnostics to prevent unintentional pyro-fuse deployment. This is achieved through different functions, including separate high side and low side drivers, redundant pins for the direct hardware firing and cyclic redundancy checking (CRC) protection on the serial peripheral interface.

Improving power distribution throughout the vehicle

The most common connections in the power-supply lines of an HEV or EV are the main contactors that connect the high voltage battery system to the traction inverter. There can be other power rails present, such as AC/DC charge contactors that are the connection from a charging station to the battery and auxiliary contactors that connect other electric loads such as interior lights or heaters.

A contactor is a low voltage solenoid that controls a mechanical relay switch capable of delivering high current at high voltage. Contactors in HEV and EV vehicles are evolving in order to handle higher power systems. The low voltage solenoid element of the contactor is often driven by a control circuit, called an economizer. The economizer circuit has become increasingly important and complex to achieve higher requirements for efficiency, reliability, and safety and to help improve the power efficiency in high-power conditions. These circuits help reduce the current consumption needed to keep the contactor closed. This economizer can either be integrated directly into the contactor or be an externally added. Contactors that require an external

economizer can quickly become complex when trying to achieve system level safety goals.

A fully integrated high-power contactor driver, like the DRV3946-Q1 driver, can replace complex economizer designs. The DRV3946-Q1 driver enables an efficient turn-on and a safe turn-off of the contactor. To achieve a more efficient turn-on, the DRV3946-Q1 driver has a programmable peak and hold current control. Figure 2 shows this feature working in action. More current can be supplied during start-up to make the initial connection. After the connection has been made, the current can be reduced to a lower level in the "hold" phase. The ability to program the integrated peak and hold phases provides a more robust and efficient turn of the contactor.

Turning the contactor off is also critical; having the ability to quickly disconnect a contactor helps to prevent contact welding and provides a first line of defense to the rest of the vehicle systems when something goes wrong. Common solutions for implementing peak and hold current control with quick discharge capability leads to complex circuits. The DRV3946-Q1 driver combines these two functions into a single chip to help reduce system complexity, improve efficiency and safety.

Conclusion

Improving the efficiency and reliability of the contactor helps increase the drivable mileage and enhances safety in the everyday operation of HEVs and EVs. Integrating the pyro-fuse driver into a single-chip solution facilitates smarter and faster decisions on when to break the battery connection. The DRV3901-Q1 pyro-fuse driver and DRV3946-Q1 contactor driver offer system designers options to engineer smarter, safer vehicles.

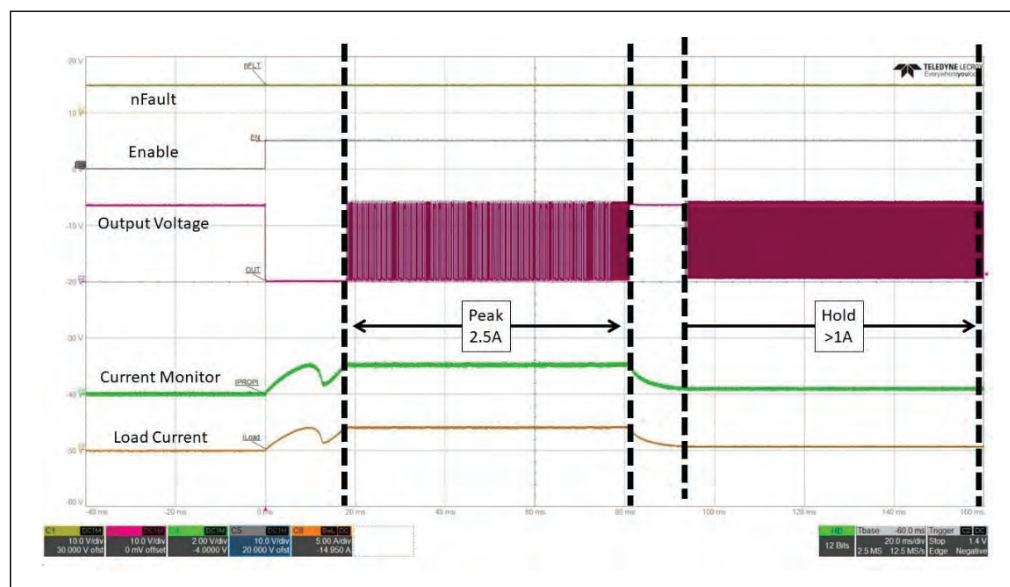
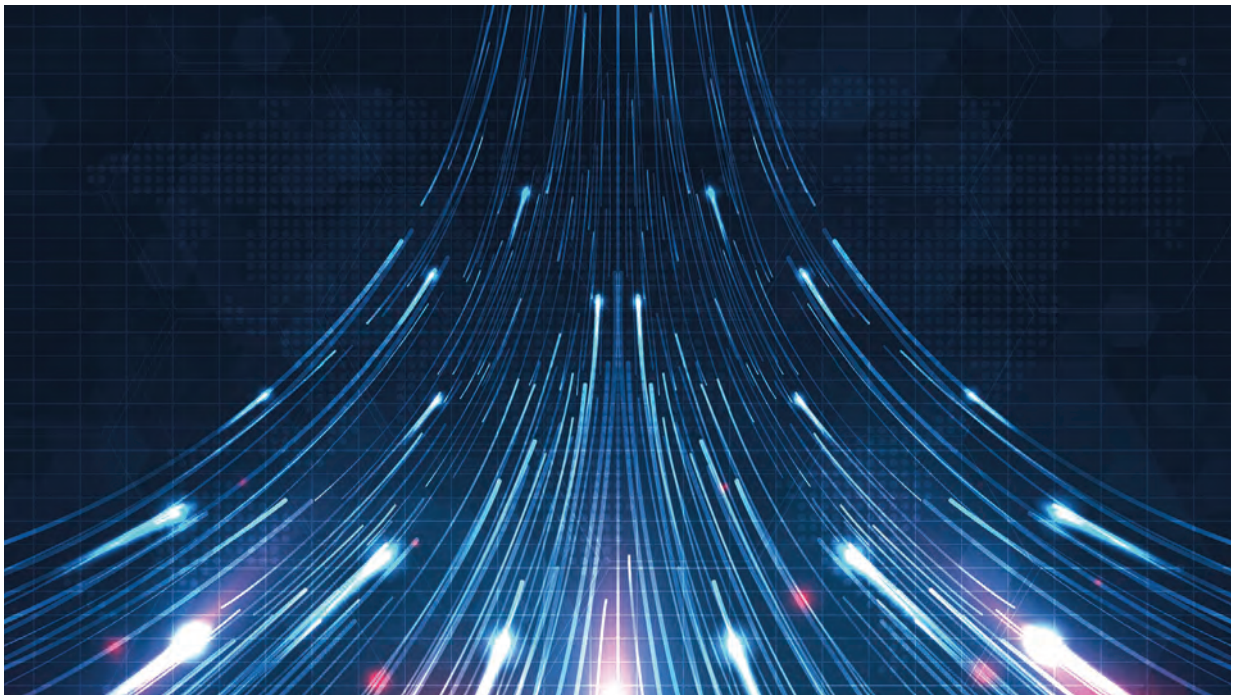


Figure 2. Peak and Hold Current Control in the DRV3946-Q1

Is It Too Soon to Prepare For 6G Connectivity in Electronics Manufacturing?

Move over, 5G. There is a new network connectivity on the block...

by **Phil Simmonds, CEO of EC Electronics.**



Although 6G is still in its infancy, its development promises to usher in unparalleled speed, capacity and connectivity advancements.

Imagine having access to lightning-fast internet speeds of up to 1 terabit per second (TBPS), far surpassing the 20 gigabytes per second (GBPS) offered by 5G. With 6G technology, consumers can expect to experience faster data transfer and streaming, leading to more efficient and effective communication between devices.

Additionally, 6G will support many connected devices, perfect for the rapid development of internet of things (IoT).

The possibilities are endless, but we have a long way to go before 6G becomes a reality. So, how can electronics manufacturers prepare for what lies ahead?

Rethinking networks

Though it is hard to predict what 6G will look like, we can expect new and innovative possibilities – including holographic communications, intelligent

network operations and computing convergence.

As tomorrow's ground-breaking applications (like the metaverse and augmented reality) will require increased connectivity, the utilisation of edge and cloud infrastructure will play a massive role in deploying 6G networks.

The benefits that 5G already offers will also be delivered by 6G, with much higher performance. Beyond that, 6G will enable intelligent, hyperconnected, decentralised and highly secure networks with exceptionally high capacity and coverage. This means that 6G networks will have access to more advanced artificial intelligence (AI) capabilities and enhanced support for sophisticated mobile devices than 5G.

Evolving PCB design

6G's emergence will significantly impact printed circuit board (PCB) design.

With 6G technology expected to operate at frequencies of 100 GHz and above, PCB

manufacturers may need to invest in new tools to create increasingly complex elements and structures suitable for these high rates.

PCB engineers may also need to seek new materials with multilayer capacities that can withstand these high radio frequencies without overheating or hindering performance. Additionally, many PCB designs for 6G-enabled IoT electronics and other devices must include millimetre-wave (mmWave) circuits.

Boosting IoT capabilities

The rollout of 6G will take the IoT to new heights and deliver the bandwidth needed to supercharge the metaverse: the virtual reality network of connected 3D visual worlds. From virtual meeting spaces to 3D-rendered social media pages, the possibilities are endless.

We can expect an influx of new 6G-enabled smart devices, too. With seamless connectivity, businesses can harness data on an unprecedented scale to transform

processes across a range of industries, including electronics manufacturing.

For example, IoT sensors can monitor machinery performance in real-time, predicting possible breakdowns or errors. For manufacturers, this can prevent costly downtime and increase overall equipment effectiveness.

Plus, if an accident occurs, all staff can be alerted, operations can cease and the incident can be resolved. With collected data, IoT technology can also help prevent a repeat occurrence in the future.

Some manufacturers are also starting to introduce wearable

IoT devices among their teams. Wearables can monitor work conditions and alert employees to any missed safety procedures, allowing them to correct their actions and stay protected on the job.

Prioritising cyber security

Launching 6G has the potential to exponentially increase the volume of data transmitted over networks, thereby

expanding the attack surface for potential cyber threats. As such, all 6G participants – from electronics manufacturers to mobile operators and suppliers – must implement new security, testing and training standards...

Firstly, enhancing user awareness and education is a critical defence mechanism against cyber threats. Manufacturers must foster a culture of cyber security awareness, where workers are equipped with the knowledge to

identify potential threats and empowered with best practices for safeguarding their data and devices.

Electronic product designers must also implement cyber security into their devices' software design and development lifecycle – with integrated protections that identify vulnerabilities and help to quickly recover networks in the event of a data breach.

Plus, electronics manufacturers can utilise AI-driven algorithms for real-time threat detection and response. These systems can constantly learn and adapt to new threats, ensuring the network's resilience against evolving cyber-attacks.

Empowering the next generation

To make 6G a reality in the manufacturing industry, a new generation of researchers, product designers and manufacturers must be upskilled.

From training programs and courses to workshops, there are resources electronics manufacturing companies can invest in to equip their staff with the knowledge and skills required to work with 6G technology effectively.

Although no workforce is expected to become experts in the 6G field, understanding 6G network infrastructure, IoT integration, data security and other relevant areas will create a safer, more productive work environment.

There is no doubt: the next generation of wireless communications technology is on its way. So, to ensure we are ready with the right capabilities and infrastructure by 2030, electronics manufacturers must start working now to realise the 6G devices of the future.

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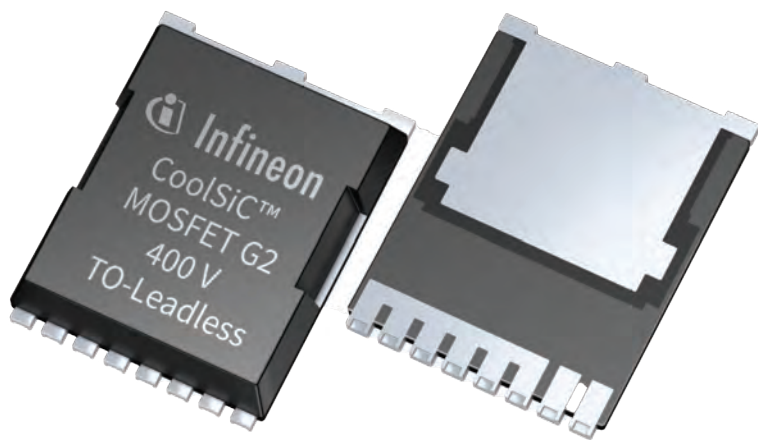
From One Engineer To Another[®]

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New MOSFET redefines power density and efficiency in AI server power supplies

With the increasing power requirements of Artificial Intelligence (AI) processors, server power supplies (PSUs) must deliver more and more power without exceeding the defined dimensions of the server racks. This is driven by a surge in energy demand of high-level GPUs, which could consume 2 kW and more per chip by the end of the decade. These needs, as well as the emergence of increasingly demanding applications and the associated specific customer requirements have prompted Infineon Technologies AG to extend the development of SiC MOSFETs to voltages below 650 V. The company is now launching the new CoolSiC™



MOSFET 400 V family, which is based on the second generation (G2) CoolSiC technology introduced earlier this year. Its claimed new MOSFET portfolio was specially developed for use in the AC/DC stage of AI servers, complementing Infineon's recently announced PSU roadmap. The devices are also ideal for solar and energy storage systems (ESS), inverter motor control, industrial and auxiliary power supplies (SMPS) as well as solid-state circuit breakers for residential buildings.

The new family reportedly features ultra-low conduction and switching losses when compared to existing 650 V SiC and Si MOSFETs. Implemented in a multi-level PFC, the AC/DC stage of the AI Server PSU can attain a power density of more than 100 W/in³ and is proven to reach 99.5 percent efficiency. This is an efficiency improvement of 0.3 percentage points over solutions using 650 V SiC MOSFETs. In addition, the system solution for AI Server PSUs is completed by implementing CoolGaN™ transistors in the DC/DC stage. With this combination of high-performance MOSFETs and transistors, the power supply can potentially deliver more than 8 kW with a claimed increase in power density by a factor of more than 3 compared to current solutions.

The new MOSFET portfolio comprises a total of 10 products: five R_{DS(on)} classes from 11 to 45 mΩ in Kelvin-source TOLL and D²PAK-7 packages with .XT package interconnect technology. The drain-source breakdown voltage of 400 V at T_{vj} = 25°C. makes them ideal for use in 2- and 3-level converters and for synchronous rectification. The components offer high robustness under harsh switching conditions and are 100 percent avalanche tested. The highly robust CoolSiC technology in combination with the .XT interconnect technology enables the devices to cope with power peaks and transients caused by sudden changes in the power requirements of the AI processor. Both the connection technology and a low and positive R_{DS(on)} temperature coefficient enable excellent performance under operating conditions with higher junction temperatures.

www.infineon.com

www.power-mag.com

Offer Low Power, Zero Configuration Upsets, RISC-V Architecture for Space Applications

Developers of spacecraft electronics utilize radiation-tolerant (RT) field programmable gate arrays (FPGAs) to ensure high performance, reliability, power-efficiency and the best-in-class security for emerging space domain threats. To take it a step further and help provide fast, cost-effective software customization, Microchip Technology has introduced the Radiation-Tolerant PolarFire® SoC FPGA. Developed on Microchip's RT PolarFire FPGA, it is the first alleged real-time Linux® capable, RISC-V-based microprocessor subsystem on a flight-proven RT PolarFire FPGA fabric.

Developers can now potentially start designing using the commercially available PolarFire SoC (MPFS460) device and Libero® SoC development tools. Along with the company's extensive Mi-V ecosystem, PolarFire SoC solution stacks, the PolarFire SoC Icicle Kit or the PolarFire SoC Smart Embedded Vision Kit, developing lower power solutions for the challenging thermal environments seen in space can happen today.

Safety-critical systems, control systems, space and security applications need the flexibility of the Linux Operating System (OS) and the determinism of real-time systems to control hardware. RT PolarFire SoC FPGAs feature a multi-core Linux-capable processor that is coherent with the memory subsystem. The RT PolarFire SoC enables central satellite processing capabilities similar to those in single board computers which are common in the space industry for command and data handling, in platform avionics and in payload control. The SoC allows for flexible implementation of highly integrated designs, customization and evolution of function while improving size, weight and power considerations.

For more information visit: www.microchip.com

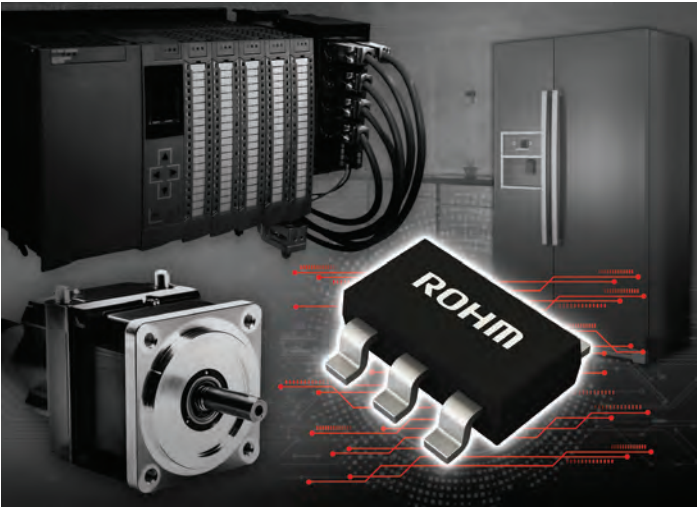


New Energy-Saving DC-DC Converter ICs

ROHM has developed four new compact DC-DC step-down converter ICs suitable for consumer and industrial applications, including refrigerators, washing machines, PLCs, and inverters. ROHM is expanding the lineup which includes the BD9E203FP4-Z, a 2A buck converter with switching frequency of 350kHz.

In recent years, increasing application functionality in consumer devices and industrial equipment is driving the demand to minimize board space, resulting in a rise in the adoption rate of compact DC-DC converter ICs.

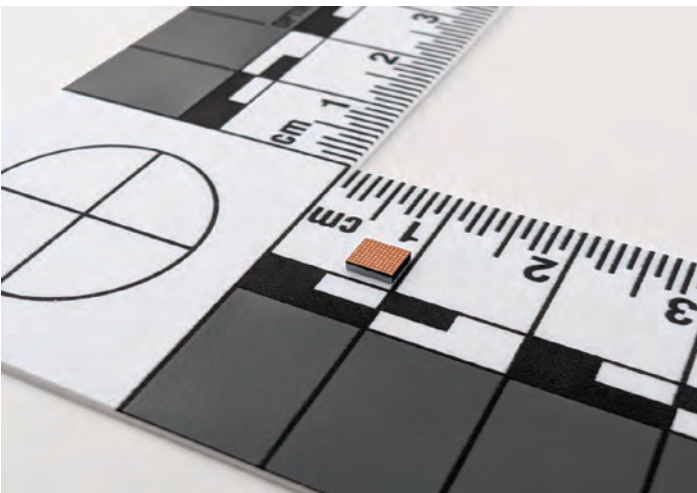
Furthermore, as reducing standby power consumption is becoming a significant challenge, there is a growing need for DC-DC converter ICs to deliver higher efficiency during light load (low power) conditions. To meet



these demands, ROHM developed products that achieve higher efficiency in an even smaller package than existing SOP-J8 (JEDEC standard: SOIC8 equivalent) products.

The new converter ICs deliver an output current of 1A to 3A in the compact TSOT23 package (2.8mm x 2.9mm). This reduces component area by up to 72% compared to the general SOP-J8 package (4.9mm x 6.0mm), contributing to the miniaturization of power supply blocks. On top, adopting a flip chip on lead frame TSOT23 package design enables high-efficiency operation by eliminating bond wire resistance.

Silicon Capacitor suitable for embedding into any SoC substrate or interposer



Empower Semiconductor has unveiled the largest silicon capacitor in its ECAP product family for high frequency decoupling. The new EC1005P is a single 16.6-microfarad (µF) capacitance device suitable for the most demanding power integrity targets as often found in high-performance systems-on-chip (SoCs). It claims to feature ultra-low impedance up to 1GHz in a low profile that can be embedded into the substrate or interposer of any SoC, making it ideal for high-performance computing (HPC) and artificial intelligence (AI) applications.

"The performance of SoCs and other large computing processors are constantly increasing," said Mukund Krishna, senior manager of product marketing, Empower Semiconductor. "It is becoming increasingly difficult to

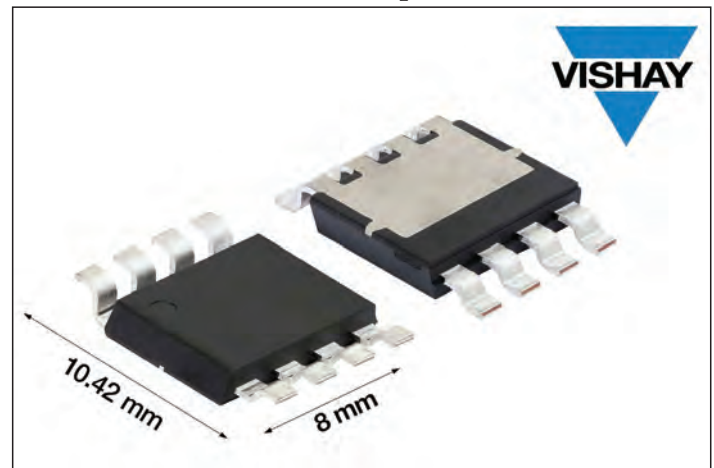
reach the level of power integrity and voltage regulation that these devices require with conventional MLCCs. The EC1005P features close-to-ideal parasitic parameters, allowing these SoCs to operate with reduced voltage margining and ultimately reducing system power."

The EC1005P ECAP claims it leverages Empower's high-performance and high-density silicon capacitor technology to fulfill the 'last inch' decoupling gap from the voltage regulators to the SoC supply pins. This approach substitutes several discrete components with much lower performance and larger footprint, with a single monolithic device that provides optimal electrical performance and simplifies engineering complexity.

They further state that the EC1005P has an ultra-low sub-1-picohenry (pH) equivalent series inductance (ESL) and sub-3-milliohm (mΩ) equivalent series resistance (ESR) and is offered in a compact 3.643 x 3.036-millimeter 120-pad chip-scale package (CSP). The device comes in a standard profile of 784-micron that can be customized for various height requirements. Empower's industry-leading silicon capacitors provide high stability over voltage and temperature and are not subject to derating or aging like traditional multi-layer ceramic capacitors (MLCCs).

For more information visit: www.empowersemi.com.

Fourth-Generation Device Enables Higher Power Ratings and Density Versus D²PAK While Lowering Conduction and Switching Losses to Increase Efficiency



Aimed to provide higher efficiency and power density for telecom, industrial, and computing applications, Vishay has introduced its first fourth-generation 600 V E Series power MOSFET in the new PowerPAK® 8 x 8LR package. Compared to their previous-generation devices, their Siliconix n-channel SiHR080N60E claims to slash on-resistance by 27 % and resistance times gate charge, a key figure of merit (FOM) for 600 V MOSFETs used in power conversion applications, by 60 % while providing higher current in a smaller footprint than devices in the D²PAK package.

The company offers a broad line of MOSFET technologies that support all stages of the power conversion process, from high voltage inputs to the low voltage outputs required to power the latest high tech equipment. With the SiHR080N60E and other devices in the fourth-generation 600 V E Series family, the company is addressing the need for efficiency and power density improvements in two of the first stages of the power system architecture — power factor correction (PFC) and subsequent DC/DC converter blocks. Typical applications will include servers, edge computing, super computers, and data storage; UPS; high intensity discharge (HID) lamps and fluorescent ballast



Talking

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10.00am Tuesday 11th June - Are robots a worthwhile investment for SMEs?

10.00am Tuesday 10th September - Machine safety: what are the latest regulations?

10.00am Tuesday 12th November - How smart maintenance can slash operating costs?

Contact us for more information:

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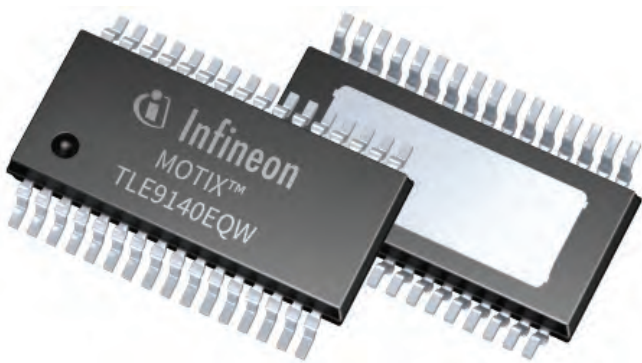
lighting; telecom SMPS; solar inverters; welding equipment; induction heating; motor drives; and battery chargers.

Measuring 10.42 mm by 8 mm by 1.65 mm, the SiHR080N60E's compact PowerPAK 8 x 8LR package features a 50.8 % smaller footprint than the D?PAK while offering a 66 % lower height. Due to its top-side cooling, the package claims a delivery of excellent thermal capability, with an extremely low junction to case (drain) thermal resistance of 0.25 °C/W. This allows for 46 % higher current than the D?PAK at the same on-resistance level, enabling dramatically higher power density. In addition, the package's gullwing leads provide excellent temperature cycle capability.

Built on Vishay's latest energy-efficient E Series superjunction technology, the SiHR080N60E features low typical on-resistance of 0.074 Ω at 10 V and ultra low gate charge down to 42 nC. The resulting FOM is potentially an industry-low 3.1 Ω*nC, which translates into reduced conduction and switching losses to save energy and increase efficiency in power systems > 2 kW. For improved switching performance in hard-switched topologies such as PFC, half-bridge, and two-switch forward designs, the MOSFET released today provides low typical effective output capacitances Co(er) and Co(tr) of 79 pF and 499 pF, respectively. The package also provides a Kelvin connection for improved switching efficiency.

The device is RoHS-compliant and halogen-free, and it is designed to withstand overvoltage transients in avalanche mode with guaranteed limits through 100 % UIS testing.

For more information visit www.vishay.com



New Motor gate driver IC enables easy migration from 12 V to 48 V systems

Their new gate driver IC for brushless DC motors targets the demanding 24/48 V market. The company claims that the TLE9140 is tailored for automotive motor control applications featuring higher voltage requirements from 24 V up to a maximum of 72 V, where higher system reliability and faster switching behavior are necessary. Also claimed as an ideal complement to Infineon's MOTIX MCU TLE987x and TLE989x 32-bit motor control SoC solutions but also suitable as 48 V BLDC driver with common MCUs on the market. Typical applications include pumps and fans, windshield wipers, the HVAC module, or e-compressors. In addition, the TLE9140 is applied as 3-phase motor gate driver for applications in commercial, construction, and agricultural vehicles as well as in light electric vehicles such as eBikes, eScooters or eMotorcycles.

Our new motor gate driver IC allows customers to easily scale their existing 12 V MOTIX TLE987x and TLE989x motor control designs to 24 V or 48 V systems", says Andreas Doll, Senior Vice President, and General Manager Smart Power at Infineon. "The TLE9140EQW enables the reuse of hardware and software designs, allowing our customers to shorten their time-to-market and optimize their development costs when moving to 24/48 V systems."

they go on to say that the gate driver IC offers functional safety according to ISO 26262 ASIL B. It is housed in a small TS-DSO-32 package. The IC offers a high voltage capability up to 110 V, a gate driver capability of ~230 nC/MOSFET up to 20 kHz as well as SPI communication. It has an active low-side (LS) freewheeling function during V SM overvoltage (OV) and a wide range of important diagnostic and protection functions such as time-out-watchdog, drain-source monitoring, overvoltage, undervoltage, cross-current and over-temperature protection as well as off-state diagnostics.

In addition, the TLE9140 includes Infineon's patented gate shaping function, an adaptive MOSFET control that can compensate for fluctuations in the MOSFET parameters in the system. It automatically adjusts the gate current to achieve the desired switching behavior. This allows the system to be optimized in terms of electromagnetic emissions (EMI) by slower slew rates, while minimizing power dissipation through shorter dead times and shorter rise/fall times.

For more information visit: infineon.com

Audible noise 800W and 1000W medical and industrial power supplies

TDK Corporation has announced the introduction of the TDK-Lambda brand CUS800M and CUS1000M AC-DC power supply series in a 6.73 x 3.35 x 1.67" (171 x 85 x 42.5mm) case size. Rated at up to 800W and 1000W, these very compact products also claim the feature of a variable speed fan with typically 30 - 42dBA audible noise. The power supplies can be used in a wide range of applications, including medical, dental, test and measurement, broadcast and industrial equipment.

The series claims to accept an 85 to 265Vac input, delivering full power at 90Vac, and is available with 12V, 24V, 36V and 48V outputs. A 5V 2A standby voltage, remote on/off, remote sense and a power good signal are fitted as standard. With efficiencies of up to 95.5%, internal heating is reduced, allowing reliable operation in the compact package size. The off-load power consumption is typically <0.6W when the supply is put into standby mode. These CUS-M models can operate in -20oC to 70oC ambient temperatures, derating linearly from 40oC to 60% load at 70oC.

The CUS800M and CUS1000M claim to have an input to output isolation of 4000Vac (2 x MoPP), an input to ground isolation of 2000Vac (1 x MoPP), and an output to ground isolation of 1500Vac (1 x MoPP) for B and BF rated medical equipment. The leakage current is <250µA and the maximum operating, transportation and storage altitude is 5000m.

Safety certifications include IEC/EN/ES 60601-1 and IEC/EN/UL 62368-1 with CE/UKCA marking for the Low Voltage, EMC and RoHS Directives. The units also comply with EN 55011-B and EN 55032-B conducted and radiated emissions, and meet the EN 61000-3-2 harmonics, IEC60601-1-2 Edition 4 and IEC 61000-4 immunity standards.

For more information visit: www.tdk.com



New Snap-In Aluminum Electrolytic Capacitors



Kyocera has released two new series of snap-in aluminum electrolytic capacitors: the SNA Series and SNL Series.

SNA and SNL Series snap-in aluminum electrolytic capacitors claim to deliver high-reliability, high-voltage, and high-CV performance over long lifetimes. In addition, both series are lead-free compatible and RoHS compliant, rated for temperatures extending from -25°C to 105°C, and ideal for use in commercial and industrial applications including frequency converters, solar inverters, power inverters, energy storage systems, and power supplies.

The SNA Series snap-in aluminum electrolytic capacitors also claim to exhibit high ripple current capabilities, long lifetime performance, and endurance of 5,000 hours at 105°C. They are currently available with three rated voltages (250, 420, and 450VDC), 24 case sizes spanning 22mm x 25mm to 35mm x 50mm (D x L), and capacitance values extending from 82µF to 1,500µF ±20%.

Likewise the SNL Series snap-in aluminum electrolytic capacitors claim to exhibit endurance of 3,000 hours at 105°C. They are currently available with eight rated voltages (160, 200, 250, 350, 400, 450, 500, and 550VDC), 36 case sizes spanning 22mm x 20mm to 35mm x 60mm (D x L), and capacitance values extending from 68µF to 2,200µF ±20%.

For more information visit: www.kyocera-avx.com

Power supplies for defence and harsh environments

Powerbox has announced the release of its new ruggedized series, the ECD1000A for ground-based defence applications and harsh industrial environments. Housed in a metal IP65 enclosure with baseplate conduction cooling, the ECD1000A series claims it delivers 1000W and can be used with a baseplate operating temperature range of -40 up to 75 degrees C. For extremely demanding applications the ECD1000A is mechanically ruggedized according to the MIL-STD-810H standard and interior boards and components are protected with a conformal coating. The product may be equally well electrically ruggedized to withstand harsh transients and meet demanding EMC performance levels as required for most common defense and the more demanding industrial applications, according to the MIL-STD- 461 CE102 / RE102 and meeting the MIL-STD-1399-300. The power supply operates with a wide universal input range from 85 to 305VAC with power factor correction (PFC). Designed for high availability, short time-to-market and to meet commercial and military off-the-shelf (COTS/MOTS) business models, the ECD1000A is available in a 28VDC output voltage version, however the series also includes 500W and 700W versions with 12VDC and 28VDC output voltages for use in lower power distribution systems.

www.power-mag.com

Many defense applications require power supplies to operate with limited or no ventilation cooling. In this respect, we are referring to those operating in harsh environments where electronic equipment is installed in a sealed box, such as radio communication systems subject to adverse weather conditions, outdoor surveillance and access control, and indoor equipment with very strict audible noise restrictions. In addition to environmental requirements, reliability and cost of maintenance are motivating systems designers not to use fans and blowers, privileging conduction cooling enclosed in a box that offers an ingress protection level of IP65 (Dust tight and protected against water jets).

Conduction cooling requires very specific building practices and the ECD1000A has been designed to guarantee optimal heat transfer from the dissipating components to the baseplate, delivering a high level of performance within an operating temperature of -40 to 75 degrees centigrade at the baseplate. Depending on the assembly method and the overall cooling conditions, a derating may apply as specified in the technical documentation.

For more information Visit www.prbx.com



Tiny, fully shielded SMD power inductors

New from Rutronik the new ICSlxxxxTxSHyST12 series from knitter-inductive expands the Rutronik portfolio of SMD power inductors. The series claims it impresses with a wide inductance range and a high saturation current with an extremely small size. Further advantages are the special inner winding and the fully magnetically shielded design. Furthermore the inductor series claims it works reliably at operating temperatures from -40 °C to 125 °C and is suitable for use in a wide range of applications, e.g. for voltage regulator modules, DC/DC converters, embedded PCs, or switching power supplies. The inductors are available in tape & reel packaging for quick and cost-effective assembly

For more information visit: www.rutronik24.com.

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