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26-i Energy Innovation

650V SiC Schottky diodes offer high efficiency and low figure-of-merit

The DSCxxA065LP silicon carbide (SiC) Schottky diodes from Diodes Incorporated produce low switching and conduction losses, helping to improve conversion efficiency in power-supply and motor-drive systems.

DIODES INCORPORATED

FEATURES

- High surge-current capability
- 8mm x 8mm x 1mm package profile

APPLICATIONS

- Ac-dc and dc-dc converters
- Solar inverters
- AI server and data center power supplies
- Uninterruptible power supplies
- Motor drives

The Diodes DSCxxA065LP series, which consists of six 650V-rated SiC Schottky diodes with forward-current ratings between 4A and 12A, offers a combination of low capacitive charge and a low forward-voltage drop. This combination results in negligible switching losses and reduced conduction loss.

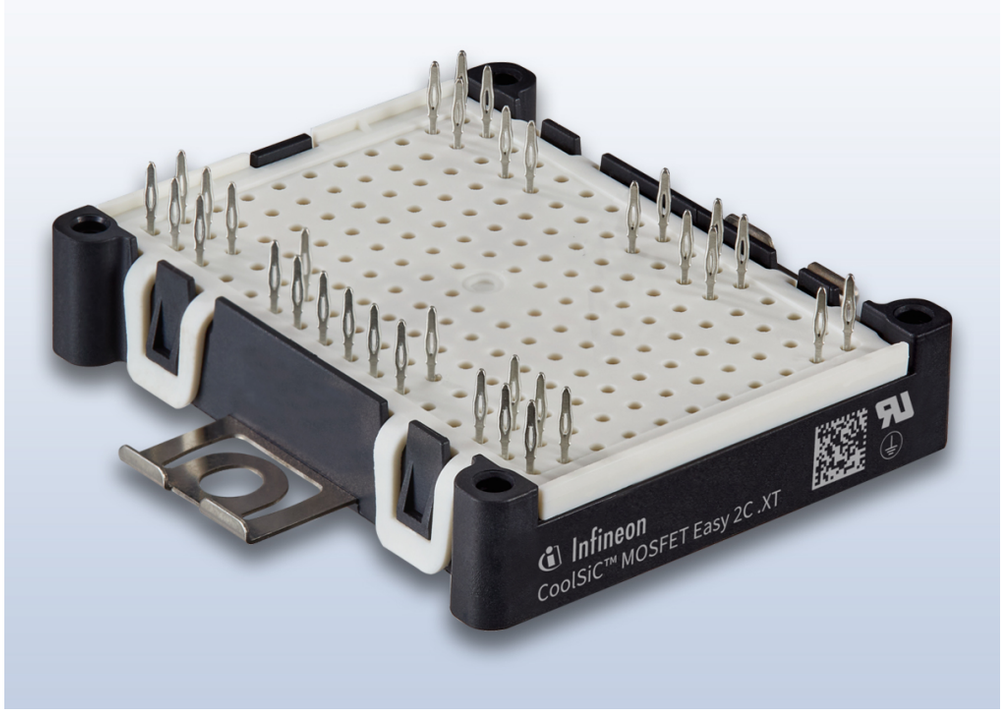
The DSCxxA065LP Schottky diodes are housed in a T-DFN8080-4 surface-mount package which incorporates a large underside heat pad to reduce junction-to-case thermal resistance, supporting compact and thermally efficient layouts. Each diode operates over a junction-temperature range of -55°C to 175°C, and has a positive forward-voltage temperature coefficient to enable parallel configuration of multiple diodes.

The diodes are ideal for use in freewheeling and snubber circuits and as PFC boost diodes, and for reverse-polarity and electrical-stress protection.

Part Number	Forward Voltage	Maximum Forward Current	Maximum Reverse Leakage Current
DSC04A065LP	1.5V	4A	20µA
DSC06A065LP	1.5V	6A	20µA
DSC08A065LP	1.5V	8A	20µA
DSC10A065LP	1.5V	10A	20µA
DSC12A065LP	1.7V	12A	20µA

Rugged new 1,200V SiC power module handles extreme high-power throughputs

The F3L8MXTR12C2M2Q_H11 power module from Infineon, based on the latest silicon-carbide (SiC) trench MOSFET with .XT interconnection technology, has a robust package design and provides efficient thermal pathways, for rugged high-power designs.



Infineon

FEATURES

- Integrated body diode for bidirectional current flow
- High-current PressFIT pin
- Operating-temperature range: -40°C to 175°C
  - 200°C maximum overload temperature

APPLICATIONS

- Dc-dc converters
- Electric vehicle dc chargers
- Uninterruptible power supplies

The Infineon F3L8MXTR12C2M2Q_H11 module contains 12 SiC MOSFETs arranged for efficient operation in high-frequency switching applications including dc-dc converters and chargers. The design switches up to 1,200V, supporting continuous drain current up to 95A at 175°C.

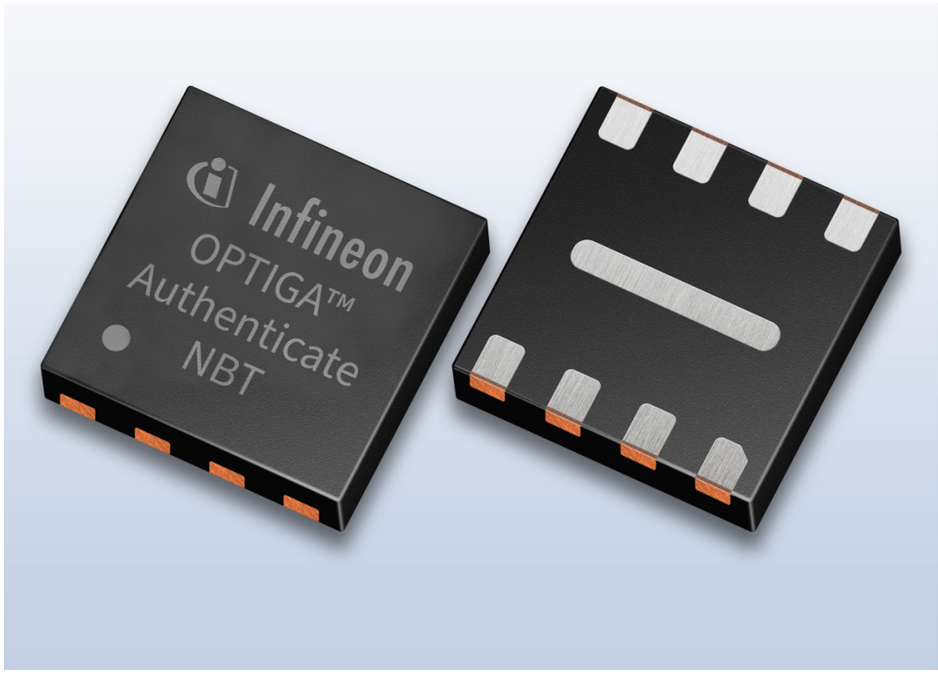
The CoolSiC™ MOSFET structure in the module, which has low on-resistance of 16.8mΩ at 175°C, minimizes conduction losses. Switching losses in high-frequency operation are low thanks to a control scheme which ensures operation in optimized switching conditions with the shortest possible dead times.

The F3L8MXTR12C2M2Q_H11 also benefits from an improved interconnection technology called .XT extended lifetime, which offers more than 20 times better power cycling capability than standard assembly technologies. In addition, the module offers a large reverse-bias safe operating area of 2.5 times the nominal current.

The module is housed in a rugged press-fit enclosure for solder-free mounting, and includes a pre-applied thermal interface material to ensure consistent thermal coupling. Electrical isolation of 3kVrms and a comparative tracking index above 600 support use in high-voltage systems and industrial environments. An integrated NTC element enables thermal monitoring.

NFC I2C bridge tag for contactless authentication and configuration of IoT devices

The Infineon OPTIGA™ Authenticate NBT is an NFC Type 4 tag with an I2C interface, providing a contactless bridge between an NFC reader such as a smartphone and a host microcontroller.



The Infineon OPTIGA Authenticate NBT is a high-performance NFC I2C bridge tag for secure human-machine interfaces (HMIs). The bridge tag enables fast, contactless NFC communication between an IoT device with an I2C interface and a contactless NFC reader such as a smartphone.

A Type 4 Tag certified by the NFC Forum, the OPTIGA Authenticate NBT can be used for single-tap authentication and secure configuration of an IoT device via an app on the user's smartphone. The bridge tag is based on CC EAL 6+ certified hardware and provides

high security, thanks to its acclaimed Integrity Guard 32 security architecture.

The NFC-I2C bridge tag supports both symmetric and asymmetric cryptographic authentication, as well as pass-through and asynchronous data communication modes. These can be used for a variety of applications such as:

- Secured configuration of smart devices without a display
- Activation of shared mobility vehicles
- Passive commissioning of non-powered smart Wi-Fi® or Bluetooth® devices prior to installation
- Data logging on patient health monitors

Featuring an 8kbyte non-volatile memory, the NFC I2C bridge tag offers ample space to store customer- and application-specific configuration information. High on-chip capacitance enables the use of a smaller antenna to lower bill-of-materials cost and reduce board footprint.

Infineon

FEATURES

- Data rates:
  - Up to 848kbits/s contactless (NFC)
  - Up to 1Mbit/s on I2C interface
- Security:
  - ECDSA-based asymmetric cryptography
  - AES-128-based symmetric cryptography
  - 32-bit password-based verification and file access
- 78pF on-chip input capacitance

APPLICATIONS

- Shared mobility products
- Industrial equipment
- Consumer electronics
- Healthcare devices

FREE DEV BOARD

NFC I2C bridge tag evaluation kit includes PSoC™ prototyping board.

Orderable Part Number
NBT2000A8K0T4KITV1TOBO1

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Ranging sensor detects objects accurately across up to 64 zones

The VL53L8CX, a multi-zone direct time-of-flight (ToF) sensor from STMicroelectronics, features an innovative optical design which achieves uniform sensitivity and accurate ranging across the field of view.

The VL53L8CX from STMicroelectronics, an 8×8 multi-zone ToF sensor, offers high-performance features, including high immunity to interference from ambient light, low power consumption, and an eye-safe invisible optical output at 940nm from a vertical-cavity surface-emitting laser (VCSEL). Diffractive optical elements on both transmitter and receiver enable the VL53L8CX to create a square field of view of 45° x 45°, 65° diagonal.

Like previous ST ToF sensors, the VL53L8CX includes firmware running on an integrated microcontroller which produces outputs computed from the raw optical data, such as distance, peak signal amplitude, and reflectance.

The sensor can calculate the distance of objects up to 4m away, across 64 independent zones, at a rate of up to 60 frames per second. The ST multi-zone sensor with two advanced metasurface lenses offers superior performance to competing sensors that have conventional optics, as they support fewer native zones and feature lower sensitivity in the outer areas of the field of view. The VL53L8CX provides uniform sensitivity and accurate ranging across the field of view, with superior range in strong ambient light. Histogram processing and algorithmic compensation minimize the impact of cover glass crosstalk.

The sensor includes a motion indicator for each zone to detect whether targets have moved, and how they have moved.

FEATURES

- Integrated module in 6.4mm x 3.0mm x 1.75mm package
- Pin-compatible with VL53L8CH
- Power supplies:
  - 1.8V core power supply
  - 3.3V analog and VCSEL power supply
  - Optional 1.2V or 1.8V interface voltage levels
- 1MHz I2C or 3MHz serial peripheral interface
- Compatible with many cover glass materials

APPLICATIONS

- Mobile robots
- Camera autofocus
- Industrial bulk storage
- Warehouse equipment
- Drinks makers and dispensers

FREE DEV BOARD

Development kit enables use of dToF sensor in AI applications.

Orderable Part Number
P-NUCLEO-53L8A1

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FREE DEV BOARD

Breakout board easily integrates dToF sensor with MCU kits.

Orderable Part Number
SATEL-VL53L8

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Circuit simulation: what is required to produce accurate outputs?

In this Design Note, Alain Stas, a product engineer at Vishay, describes how well a managed simulation of a network of Vishay PTCCL07 thermistors helps with the optimization of a capacitor pre-charging circuit.

The suggestion that a design engineer should perform electronic circuit simulation can be controversial. It is often argued that the software is too expensive; that simulation times are too long; that simulation does not properly account for parasitic effects such as temperature variations and product tolerances; and that the results simply do not represent very well a very complex reality.

This article tests these objections in the context of a real-world example: the simulation of a pre-charge circuit for automotive battery chargers. The circuit contains a network of Vishay PTCCL07 thermistors/inrush current limiters. The simulation is run on the Qorvos QSPICE software tool.

The pre-charge circuit

Qorvo's QSPICE simulator is free to use without any restrictions: this neutralizes the common objection that simulation software is too expensive.

After installing the software, the engineer will need good models for Vishay's ceramic based PTCCL07 these are available on Hackster.io. Not only are the models available for download, but engineers can also perform a full simulation of the charging of a capacitor by a rectified ac mains network through a network of PTCCL07 devices.

Such a circuit is demonstrated in Figure 1, which shows the rectification of a 50Hz, 1,000V ac voltage with a diode bridge and a 2mF capacitor. The inrush current limiting element is composed of a network of 4x PTCCL07E5R0S108 thermistors, comprised of three parallel branches of four series devices.

For illustration, it is possible to replace the PTCCL network with a fixed equivalent resistor of 333Ω, as three parallel branches of 2 x 500Ω, and simulate the time it takes for the capacitor to reach 95% of its final voltage. As is 4.752s. This value gives us a reference point for our later simulations.

It is also easy to verify that with an ac mains power supply, the capacitor charging time constant of 0.12Ω x 1μFare higher than the dc mains RC constant, 333 x 2 x 10-6 = 0.67s. With an ac mains power supply the time constant for 63% is 1.5τ or equal to 2.5ft x RC = 1.667s.

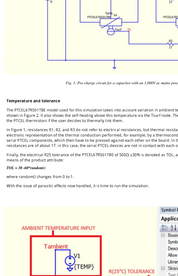


Fig. 1: Pre-charge circuit for a capacitor with a 1,000V ac mains power supply

Temperature and tolerance

The PTCCL07E5R0S108E model used for this simulation takes into account variation in ambient temperature via the Tambient node, shown in Figure 2. It also shows the self-heating above this temperature via the Tsurf node. The last Tcurf pin can be used to connect the PTCCL thermistors if the user decides to thermally link them.

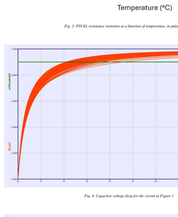
In Figure 1, resistances R1, R2, and R3 do not refer to electrical resistances, but thermal resistances, expressed in °C/kW. This is an electronic representation of the thermal conduction performed, for example, by a thermoconductive silicon paste deposited on the servi PTCCL components, which then have to be pressed against each other on the board. In the schematic shown in Figure 1, these resistances are of about 1T. In this case, the servi PTCCL devices are not in contact with each other.

Finally, the electrical resistance of the PTCCL07E5R0 (T of 500Ω ±30% is denoted as 1Ω), and is evaluated in a random way by means of the product attribute:

PAR = {R_ref*mult}

where rand(mult) changes from 0 to 1.

With the issue of parasitic effects now handled, it is time to run the simulation.



The simulation

The capacitor must be charged at a minimum of 500V within a 4s delay. As already established, with a fixed resistor the charge time would be 4.752s. But as the resistance of the PTCCL decreases when voltage is applied, and as its temperature increases prior to the switch, as shown in Figure 3, the desired result of 4s is still possible.

Pixels are shown for the voltage rising at the capacitor, in Figure 4, the temperature variation of two PTCLL07 thermistors in series in one parallel branch, in Figure 5, and the main current into the circuit, in Figure 6.

A mass SPICE directive is used to compute the time needed for the capacitor voltage to reach 900V from 0V. A total of 100 simulations are made, with the TOL changing randomly for each PTCCL, independently of each other. The results are then plotted in the histogram in Figure 7.

Fig. 3: PTCCL resistance variation as a function of temperature, in pulsed voltage

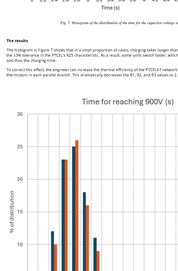


Fig. 4: Capacitor voltage drop for the circuit in Figure 1

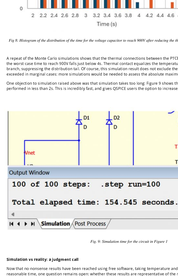


Fig. 5: The temperature change of two PTCCL07 placed in series in one branch

Fig. 6: Variation of the capacitor current over time

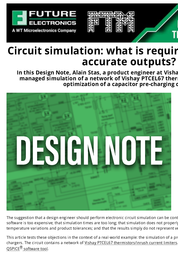


Fig. 7: Histogram of the distribution of the time for the capacitor voltage to reach 900V

The results

The histogram in Figure 7 shows that in a small proportion of cases, charging takes longer than the 4s target. This happens because of the ±3% tolerance in the PTCCL's R25 characteristic. As a result, some units switch faster, which increases the global network resistance and thus the charging time.

To correct this effect, the engineer can increase the thermal efficiency of the PTCCL07 network by thermally connecting both PTCCL07 thermistors in each parallel branch. This dramatically decreases the R1, R2, and R3 values to 2.5°C/W.

Fig 8: Histogram of the distribution of the time for the voltage capacitor to reach 900V after reducing the thermal resistance of the PTCCL07 thermistors

A repeat of the Monte Carlo simulations shows that the thermal connections between the PTCCL units decreases the spread, so that the worst case time to reach 900V falls just below 4s. Thermal contact equalizes the temperature of the PTCCL units in each parallel branch, compressing the distribution tail. Of course, this simulation result does not exclude the possibility that the 4s time will be exceeded in marginal cases: more simulations would be needed to assess the absolute maximum time value.

One objection to simulation raised above was that simulation takes too long. Figure 9 shows that each of the hundred simulations was performed in less than 2s. This is incredibly fast, and gives QSPICE users the option to increase the number of runs.

Fig. 9: Simulation time for the circuit in Figure 1

Simulation vs reality: a judgment call

Now that no monotone results have been reached using free software, lacking temperature and tolerance effects into account, within a reasonable simulation time, engineers can assess whether these results are representative of the real world. This is a decision for each engineer to take for themselves.

My recommendation is to practise the simulation first with a real application, which might be much more complex than the one studied in this article, using Vishay SPICE models and QSPICE software from Qorvo; check whether real-world results match the simulation outputs provided here.

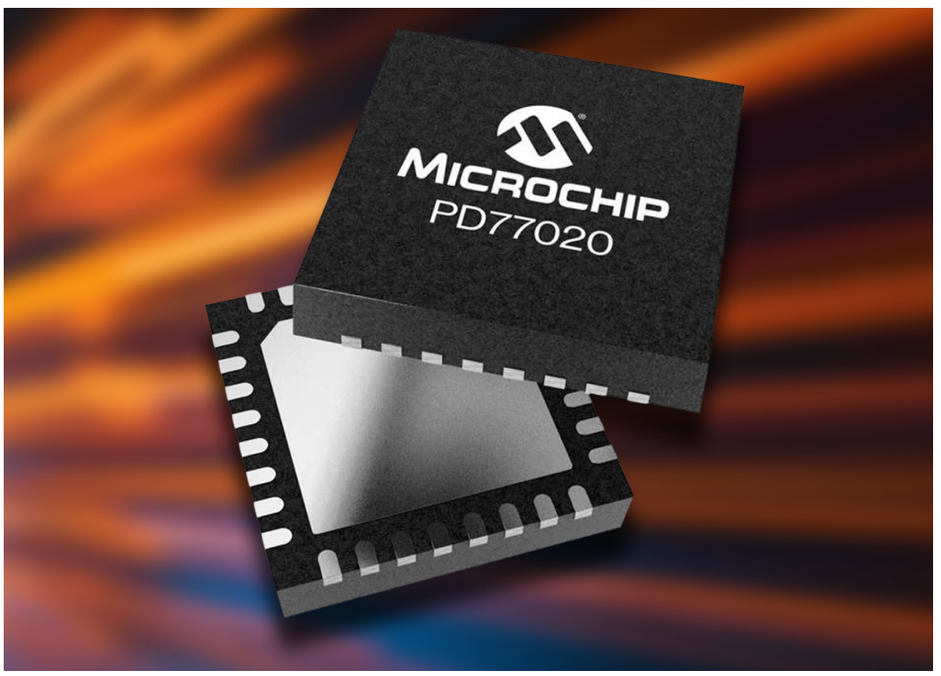
Then make a determination whether the QSPICE software, with Vishay SPICE models from Hackster.io, predict reality. Given the care which was taken in the building of the SPICE models, and the power of QSPICE to achieve accurate results, I have very little doubt that simulation and reality will align.

Video link

How to build a PTCCL07 network for surge current limitation and fast battery pre-charging

Power management ICs provide single-chip solutions for PoE

The PD77020 power controller and PD77728 power manager from Microchip provide highly integrated solutions for power-over-Ethernet (PoE), giving designers an easy way to implement the technology while reducing board footprint.



Part of the seventh generation of Microchip power-sourcing equipment (PSE) technology for PoE applications, the PD77020 is a PSE controller and the PD77728 is a PSE manager.

These power management ICs are highly integrated, energy-efficient and surge-protected designs supplied in a compact form factor. The only external component required is a capacitor, helping PoE system designers to save board space and reduce bill-of-materials costs.

The PD77020 power controller is typically used in conjunction with up to 12 PD77728 power managers to create a complete PSE system, in which the PD77020 provides high-level, sophisticated, and multi-port PoE functions, such as port mapping Port Matrix, port priority, port status, and system power management.

PSE controllers and managers are widely implemented in various Ethernet networking devices, including switches, routers and gateways, as well as in specialized equipment such as digital video recorders and PoE midspans/injectors.

PoE enables the transmission of both power and data over a single Ethernet cable. Networking devices such as Ethernet switches, routers and gateways supply power through a PSE chip embedded within the unit. Devices powered by PoE, such as wireless access points, incorporate a powered device (PD) IC to receive this power. These two components work together to deliver power to connected devices via the Ethernet cable.

Power delivery does not commence until the PD requests it. There are eight power classes and the PD specifies the exact amount of power required, ranging from as little as 4W up to 90W at the source.

On receiving a valid power request, the PSE acknowledges and classifies the requested power before initiating delivery. Both the PSE and PD continuously monitor for faults to protect the devices. If a fault is detected, or if the device no longer requires power, the PSE will terminate power delivery.

MICROCHIP

FEATURES

PD77020 and PD77728

- System- and port-level features include:
  - Detection
  - Classification
  - Inrush
  - Port power-up
  - Real-time protection
  - Support for up to 16 power banks
  - Power management
  - Communication with host

APPLICATIONS

- Switches
- Routers
- Gateways
- Digital video recorders
- PoE midspans/injectors

FREE DEV BOARD

Evaluation board for PoE manager and controller.

Orderable Part Number
EV99F34A

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Offline switcher achieves 92% efficiency in classic flyback topology

The Power Integrations TinySwitch-5 family of integrated offline switcher ICs improves conversion efficiency in low- and mid-power flyback converters with an output of up to 175W.

power integrations™

FEATURES

- Integrated soft start
- Adjustable current limit
- Output short-circuit protection
- Thermal shutdown with large hysteresis

APPLICATIONS

- Utility meters
- Industrial power supplies
- Appliance power supplies
- Consumer products

The TinySwitch-5 dynamically adjusts its switching frequency to maintain high efficiency across varying loads, achieving up to 92% efficiency with standard diode rectification and optocoupler feedback across a wide load range.

The fast switching capability of up to 150kHz, enables power-system designers to reduce transformer size. The TinySwitch-5 offline switchers also provide a highly integrated solution for flyback circuits, combining a 725V power MOSFET, control and protection circuitry into a single package.

The TinySwitch-5 flyback controller can operate in continuous conduction mode (CCM) or discontinuous conduction mode (DCM). This control approach reduces switching losses during low-power operation while maintaining sufficient auxiliary output to support display, communication, or control functions.

The IC supports up to 75W operation without a heat-sink due to improved thermal management in its enhanced package structure. No-load power consumption of less than 30mW at 230V ac helps product manufacturers to comply with strict standby power regulations.

Built-in line under- and over-voltage protection stabilizes operation in regions with variable mains conditions, while frequency jittering reduces EMI without the need for external filtering.

The TinySwitch-5 architecture allows designers to meet high efficiency targets without adopting more complex synchronous rectification or resonant converter topologies, retaining the simplicity of a traditional flyback design.

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Secure MCU's high-quality signal-processing eases design of EV chargers

The PSOC™ Control C3M microcontroller family from Infineon helps developers create high-performance motor-control systems and EV chargers thanks to dedicated hardware features, PSA Certified Level 2 security, and a library of application software in the ModusToolbox™ platform.

The new PSOC Control C3M, a family of Arm® Cortex®-M33-based MCUs from Infineon, allows developers to create motor control and power conversion systems which offer high performance, high efficiency and high security.

The new PSOC Control C3M MCUs enable the control of systems which need to respond to real-time events with minimal delay. The MCUs' Cortex-M33 core operates at up to 180MHz, and is supported by DSP and a floating-point unit. A coordinate rotation digital computer (CORDIC), a hardware accelerator for mathematical functions, speeds up the performance of control loop calculations.

The MCU features are particularly well suited to EV charging applications. The PSOC Control C3 Main Line MCU includes a fast 12Msamples/s ADC, high-resolution PWMs, 64kbytes of SRAM and up to 256kbytes of read-while-write Flash memory. This makes it suitable for use in dc chargers, implementing a topology such as three-level Vienna PFC for the ac-dc stage.

Another potential use case is for the PSOC Control C3 Performance Line in the dc-dc stage of EV chargers which implement a three-phase dual active bridge topology. This MCU offers large Flash and SRAM memory provision, fast ADCs and multiple communication interfaces, all integrated in a 100-pin QFP package.

PSA Certified™ to Level 2/EPC2 security, the PSOC Control C3M MCUs also provide the cyber-protection capabilities required by EV charging stations. Security features include a cryptographic accelerator, a TrustZone execution environment, and secured key storage, providing protection for both IP and firmware updates. PSOC Control C3 MCUs are also equipped with robust safety features such as Class B and SIL 2 safety libraries.

The PSOC Control family is supported by the ModusToolbox unified platform consisting of tools and software solutions. The platform provides a dedicated ecosystem including the Motor Suite software library. The suite provides a seamless graphical user interface which streamlines evaluation and training, and enables real-time monitoring for valuable insights into performance, efficiency, and reliability. Specialized application environments enable engineers to quickly identify problems, optimize designs, and enhance system functionality.

Infineon

FEATURES

PSOC Control C3M5

- 180MHz Cortex-M33 core
- Up to 256kbytes of Flash memory
- 12-bit, 6Msamples/s SAR ADC
- 16-channel sample-and-hold functions
- Feature-rich timer/counter/PWM blocks

APPLICATIONS

- Dc EV chargers
- Dc-dc converters
- Home appliances
- Industrial drives
- Robots
- Light electric vehicles
- HVAC systems

FREE DEV BOARD

Kit provides platform for evaluating PSOC MCU for motor control.

Orderable Part Number
KIT_PSC3M5_EVK

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USB-C protection IC reduces component count in PD controller designs

The STMicroelectronics TCPP03-M20 provides port protection in USB Type-C® Power Delivery (PD) applications, managing protection on provider and consumer paths for a cost-effective implementation of dual-role power systems up to 100W.

FEATURES

- Dual-role power (DRP) operation up to 20V/5A
- 24V voltage rating VBUS and CC pins
- Integrated discharge paths for VBUS and VCONN pins
- Integrated dead battery management
- Over-temperature protection
- I2C interface

APPLICATIONS

- USB PD interfaces
- Embedded systems
- Small consumer electronic devices

The TCPP03-M20 offers a high level of integration, incorporating gate drivers for external N-channel MOSFETs and replacing the discrete protection circuitry typically required to support a dedicated USB PD controller. This means that designs based on the TCPP03-M20 reduce PCB footprint, and enable low-cost microcontrollers to perform full USB Type-C PD negotiation and protection management over I2C.

The controller's internal architecture provides over-voltage and over-current protection on power supply and configuration lines, with ±8kV of contact discharge protection on the CC pins. The IC quickly isolates the power path within 145ns of an over-voltage, and 8µs of an over-current event, protecting the external MOSFETs and the host MCU, and preventing damage from propagating through the system.

Continuous current sensing is available through an analog output for real-time system monitoring.

The TCPP03-M20 is supplied in a 20-lead QFN package measuring 4.0mm x 4.0mm x 0.75mm.

FREE DEV BOARD

Expansion board supports USB PD dual-role power and dual-role data applications.

Orderable Part Number
X-NUCLEO-DRP1M1

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High-voltage automotive fuses maintain stability under vibration and arc stress

The ADO fuses from SCHURTER combine fast response to over-currents with strong mechanical resilience, making them ideal for applications in electric vehicle batteries and chargers.

SCHURTER
ELECTRONIC COMPONENTS

FEATURES

- Low contact resistance
- Ambient-temperature range: -40°C to 125°C
- Standards compatibility:
  - UL 248-20
  - ISO 8820-8
  - GB/T31465.6
  - JASO D622

APPLICATIONS

- Automotive circuits:
  - Battery management systems
  - Onboard chargers
  - Dd-dc converters
  - Air-conditioning compressors
  - Positive temperature coefficient heaters
  - Motor control
  - Electronic control units

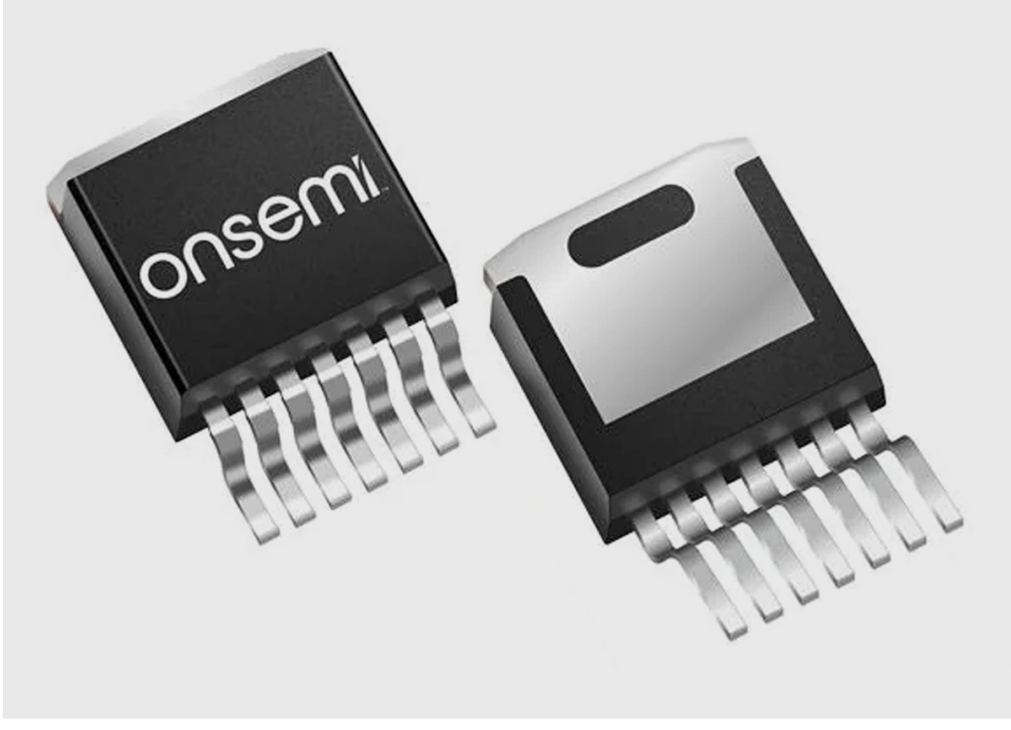
The ADO fuses are available in four mounting formats, one through-hole, and three bolt-on. The versions with screw terminals simplify post-trip replacement, while maintaining low contact resistance and mechanical stability under vibration.

The fuse's compact 10mm x 38mm ceramic body contains a patented filler formulation. Combined with special curing processes, this ensures that arcs are safely extinguished and secondary arcing is prevented.

The fuse maintains isolation integrity at up to 20kA breaking capacity, resulting in a consistent interruption profile across voltage ratings of 500V, 750V, 850V, and 1,000V dc.

650V SiC MOSFET increases efficiency and power density in vehicle systems

The NVBG075N065SC1 from onsemi is a 650V silicon carbide (SiC) MOSFET which features low gate charge and output capacitance, reducing switching losses in high-frequency converter and inverter circuits.



onsemi

FEATURES

- 56mΩ on-resistance
- AEC-Q101 qualified
- 100% avalanche testing
- PPAP capable

APPLICATIONS

- Automotive systems:
  - Dc-dc converters
  - Auxiliary inverters
  - On-board chargers

The onsemi NVBG075N065SC1 SiC MOSFET's low total gate charge of 59nC and low output capacitance of 109pF reduce both switching loss and parasitic inductance in the high-frequency power circuits found in electric vehicle on-board chargers and auxiliary converters.

A dedicated driver-source connection for the gate loop helps to keep transitions predictable. The MOSFET's D2PAK-7L package, which has low thermal resistance between junction and case, assists heat extraction to the PCB or heat-sink, enabling designers to realize compact mechanical designs at high ambient temperatures.

In vehicle power circuits migrating to higher electrification levels, the transistor supports smaller, lighter conversion hardware whilst meeting thermal and reliability constraints. The reverse-conduction and reverse-recovery performance, which benefits from the superior characteristics of SiC material compared to silicon, make the NVBG075N065SC1 particularly well suited to converters which implement hard commutation or synchronous rectification, and allow for the diode-less bridge and totem-pole stages used in modern on-board chargers and dc-dc converters.

FUTURE ELECTRONICS
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NPIs, DESIGN AND TECHNOLOGY NEWS

New MCUs deploy near-threshold chip design to boost power efficiency

The launch of the ultra-low-power STM32U3 series microcontrollers by STMicroelectronics has created new opportunities for IoT device manufacturers to extend the run-time of small batteries without compromising system performance or security.

The new STM32U3 series of microcontrollers from STMicroelectronics implements cutting-edge power-saving innovations which ease the deployment of battery-powered embedded devices, especially in remote locations.

These latest MCUs are aimed at IoT devices that operate for extended periods without maintenance and with the limited energy from a coin cell or ambient solar or thermoelectric source. The MCUs take advantage of innovative techniques such as near-threshold design to cut dynamic power consumption and boost efficiency.

In addition to extreme energy efficiency, the STM32U3 MCUs, which are based on an Arm Cortex -M33 core running at up to 96MHz, meet the needs of IoT devices by providing robust cybersecurity. For instance, the STM32U385 line can confine secret keys permanently in secure memory, eliminating vulnerable CPU fetches. In addition, attestation credentials for each production unit are provisioned by ST before leaving the factory.

The rich set of security capabilities and assets in the STM32U3 series helps device manufacturers to comply with regulations such as the European Union radio equipment directive and the cybersecurity resilience act.

The STM32U3 series gives designers flexibility to optimize board layout, with a choice of nine package options with from 32 to 100 pins, including UFQFPN, WLCSP, LQFP and UFBGA styles.

FEATURES

- Power-saving features:
  - 1.6µA Stop current
  - 117 Coremark score per milliwatt
- Memory:
  - 512kbytes or 1Mbyte of dual-bank Flash memory
  - 256kbytes of SRAM
- Security features:
  - SESIP3 and PSA Level 3 certifiable security assets
  - Cryptographic accelerators on STM32U385 line
  - TrustZone isolation
  - Random number generator
- I3C interface
- FD CAN interface
- Operating-temperature range: -40°C to 105°C

APPLICATIONS

- Utility meters
- Healthcare devices:
  - Glucose meters
  - Insulin pumps
- Animal care monitors
- Industrial sensors:
  - Thermostats
  - Smoke detectors
- Forest fire sensors
- Smart watches
- Wearable devices
- Small audio devices

FREE DEV BOARD

Evaluation board for new ultra-low-power MCU.

Orderable Part Number
NUCLEO-U385RG-Q

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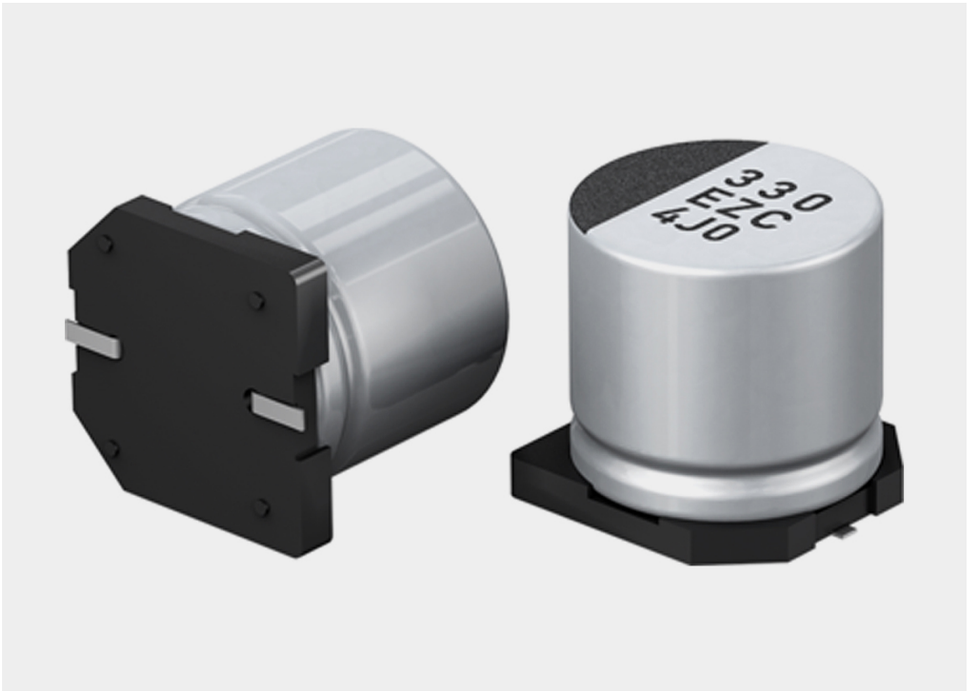
Hybrid capacitors boost efficiency and reliability of battery management systems

Hybrid polymer electrolytic capacitors from Panasonic offer the best features of liquid-electrolyte and conductive polymer capacitors, enabling battery system manufacturers to save space and improve stability.



Panasonic
INDUSTRY

FEATURES

- Voltage ratings up to 80V
- 150°C maximum operating temperature
- Long operating lifetime
- High ripple current up to 6100mA
- Low ESR down to 8mΩ
- Low leakage current

APPLICATIONS

- Automotive BMS
- Industrial BMS

Hybrid polymer electrolytic capacitors from Panasonic, the ZC, ZS, and ZL series, are gaining in popularity among designers of automotive and industrial battery management systems (BMS) and battery disconnect units (BDUs) thanks to their low ESR, high resistance to heat, and high ripple current capability.

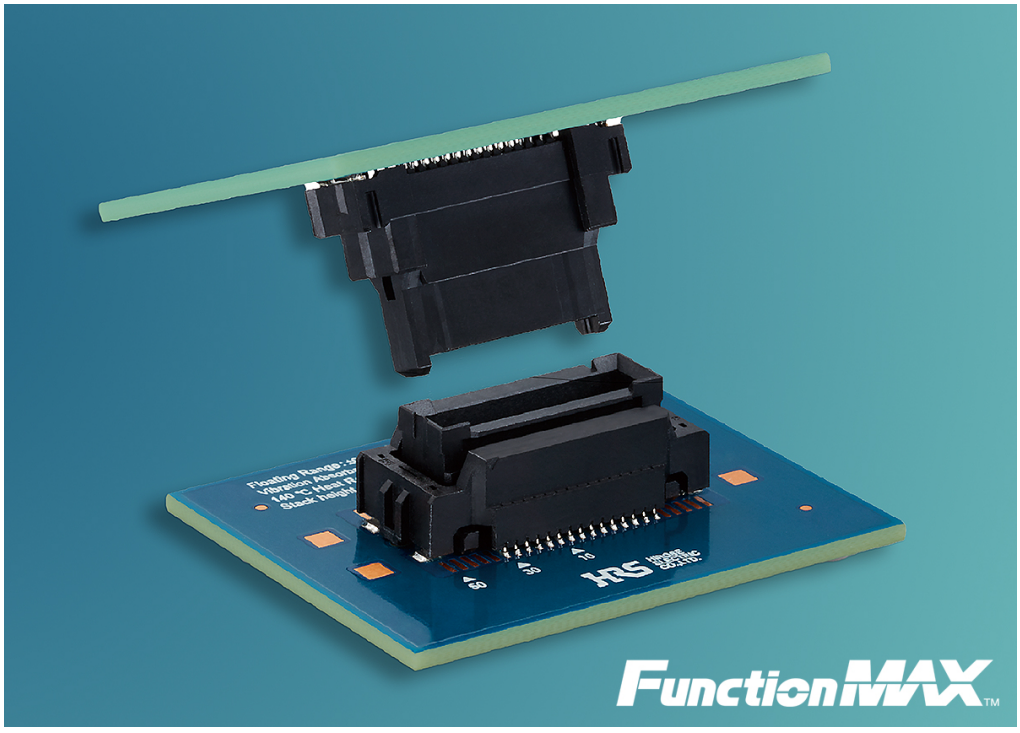
These capacitors are constructed with a conductive polymer and liquid electrolyte. This hybrid structure produces attractive characteristics including low leakage current, and high reliability.

In BMS and BDUs, these features provide a range of benefits including:

- Space saving: the latest hybrid capacitors from Panasonic have taken miniaturization further, with high ripple current and high capacitance in smaller case size, allowing BMS manufacturers to reduce system footprint when replacing standard aluminum electrolytic technology or MLCCs
- High vibration tolerance: Panasonic offers special vibration-resistant hybrid capacitors which can withstand up to 30G of vibration
- Stable electrical operation at high frequency: hybrid capacitors are generally more reliable than aluminum electrolytic capacitors. High stability at high frequency ensures accurate measurements and dependable performance in dynamic environments
- Enhanced ripple capability: high ripple current ratings help to prevent overheating and reduce the risk of failure, contributing to the overall safety and reliability of BMS

140°C floating connector resists vibration and misalignment in vehicle ECUs

The FX26 series from Hirose are board-to-board connectors for high-temperature environments. A floating structure decouples board movement, supporting reliable stacking near heat and vibration sources.



HIROSE ELECTRIC EUROPE B.V.

FEATURES

- 1.0mm contact pitch
- 0.5A rated current
- 125V ac/dc rated voltage
- 10 mating cycles
- Number of contacts: 20, 30, 40, 50, 60

APPLICATIONS

- Automotive systems:
  - Battery, motor, and EPS control units
  - ADAS
  - Powertrain inverters and converters
  - Infotainment systems
  - Heads-up displays
  - Navigation modules

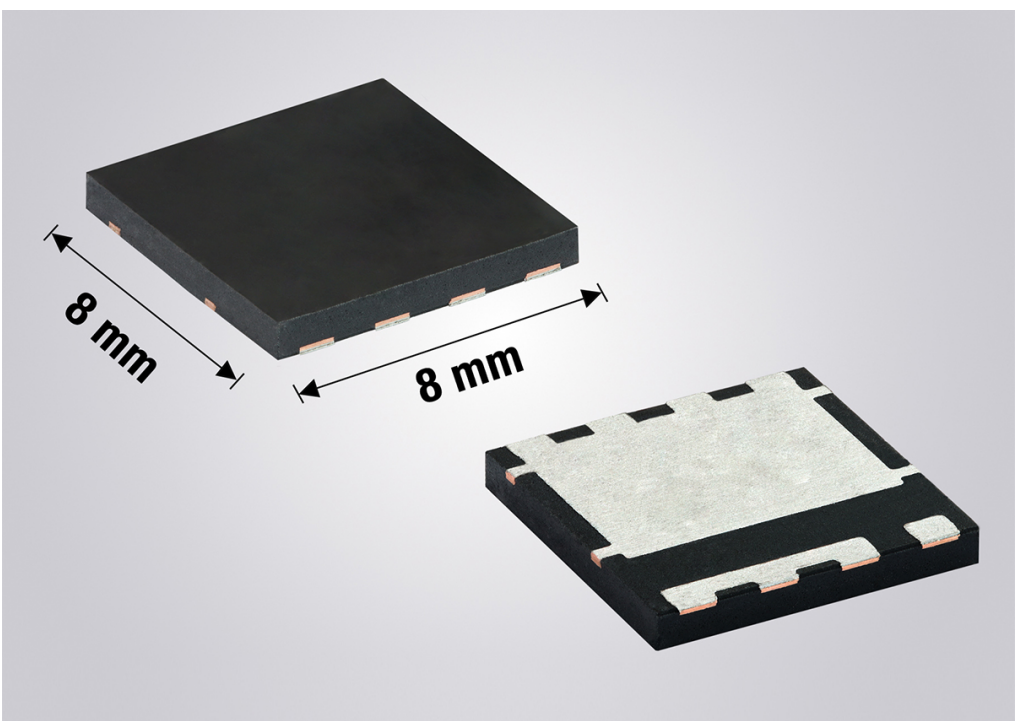
The Hirose FX26 series are floating board-to-board connectors with strong vibration resistance, providing high reliability when used in automotive systems that experience substantial mechanical stress.

The connectors have two-point contacts using materials rated for 140°C operation so that connection is maintained close to hot components. The connectors, with ±0.7mm float in X and Y directions, and ±0.75mm tolerance in the Z direction, provide tolerance for the assembly process on the production line. The design also prevents misalignment during mounting, keeping installation simple, even when visibility is limited.

A range of mated heights and pin counts allows one connector family to serve multiple designs.

80V MOSFET provides space-saving alternative to traditional TO-263 package

The SiEH4800EW from Vishay is an 80V N-channel MOSFET based on fourth-generation TrenchFET technology which is notable for its low on-resistance, low gate charge and a PowerPAK package.



VISHAY
The DNA of tech.

FEATURES

- Wettable flanks for enhanced solderability
- 100% tested for UIS and gate resistance
- 175°C maximum operating temperature
- 2V minimum gate-source threshold voltage
- ±100nA maximum gate-source leakage

APPLICATIONS

- Motor drives
- Battery management systems

The Vishay SiEH4800EW MOSFET, which offers low on-resistance of 0.88mΩ at 10V and junction-to-case thermal resistance of 0.36°C/W, enables the design of systems with tighter power budgets and thermal margins. Featuring a low gate charge of 140nC, the SiEH4800EW is particularly suitable for synchronous rectification and O-ring applications.

Housed in a compact PowerPAK 8mm x 8mm package with a height of just 1.0mm, the SiEH4800EW occupies 50% less PCB space than MOSFETs in a TO-263 package. It features a fused lead design with a source pad solderable area of 3.35mm2, four times larger than typical. This lowers the current density between the MOSFET and the PCB, which reduces the risk of electro-migration and helps to increase reliability.

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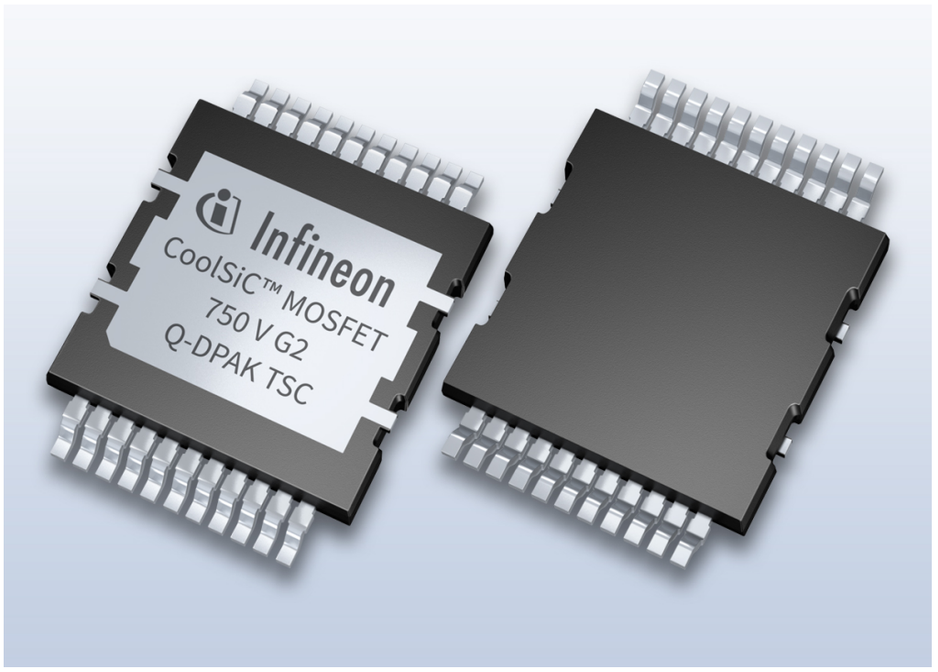
750V SiC MOSFETs increase efficiency in automotive and industrial power systems

The new second generation (G2) 750V CoolSiC™ MOSFETs from Infineon offer high switching efficiency and robust performance, including tolerance of extreme short-circuit and temperature conditions.



Infineon

FEATURES

- Proprietary die attach technology
- Overload operation at junction temperatures up to 200°C
- Withstands short-circuits for up to 2µs
- Driver Source pin available
- 100% avalanche tested

APPLICATIONS

- On-board chargers
- Dc-dc converters
- Auxiliary power supplies
- EV charging stations
- Solar inverters
- Energy storage systems
- Telecoms power supplies
- Switch-mode power supplies

Extending the Infineon CoolSiC silicon carbide (SiC) MOSFET family, the new 750V G2 technology helps power-system designers to improve system efficiency and increase power density in automotive and industrial power-conversion applications.

The 750V G2 technology is particularly notable for its low on-resistance. In the CoolSiC MOSFETs, on-resistance ratings range from 60mΩ for the 30A-rated IMDQ75R060M2H, down to 4mΩ for the 357A-rated automative-grade AIMDQ75R004M2H. This automotive MOSFET is supplied in a top-side cooled Q-DPAK package, which offers excellent thermal performance and reliability, and provides outstanding performance in static-switching applications.

The G2 SiC MOSFETs with the lowest on-resistance are the ideal choice for applications such as eFuses, high-voltage battery disconnect switches, solid-state circuit breakers, and solid-state relays.

The new G2 technology also features excellent figures of merit for on-resistance x output charge, and on-resistance x forward recovery charge, contributing to reduced switching loss in both hard- and soft-switching topologies. The reduced gate charge of Infineon's second-generation SiC trench technology allows for faster switching and reduces gate-drive losses, making the MOSFETs more efficient in high-frequency applications.

A high gate-threshold voltage of 4.5V at 25°C and a low ratio of gate-drain to gate-source charge make the MOSFETs highly resistant to parasitic turn-on. In addition, wide gate-voltage tolerance provides engineers with greater design margins and good compatibility with other devices in the market.

The 750V CoolSiC G2 MOSFETs are qualified to AEC-Q101 standards for automotive-grade parts, and to a JEDEC standard for industrial-grade parts.

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Low-power page EEPROM combines robust data logging and firmware storage

STMicroelectronics has introduced the M95P32 series of EEPROM to provide a faster and lower-power alternative to Flash for non-volatile memory applications. The EEPROM are available in industrial and extended temperature ranges.

The M95P32 series of page-erasable EEPROM memory products from STMicroelectronics provides the high speed, low peak power consumption, and high memory density required for firmware management and data logging in battery-powered applications.

ST's page EEPROM products combine support for EEPROM and serial Flash commands to give high design flexibility. This memory type is notable for its long endurance, while integrated error correction code keeps bit errors to a minimum.

For battery-powered devices, the M95P32 EEPROM products offer peak current limited to 3mA for any SPI operation. This means that designers can avoid the need to over-specify their system battery capacity to cope with high peak loads caused by data logging or other EEPROM operations.

In over-the-air (OTA) firmware updating, high-density non-volatile memory is used to store the firmware package and its back-up. The faster OTA updates can be completed, the shorter the downtime, minimizing disruption to the user.

Thanks to fast block erase and program operations, the M95P32 series can reduce device downtime by a factor of four compared to standard serial Flash memories. Write, program, and erase times include:

- 2ms for byte and page write of 512 bytes including auto-erase and program time
- 1.2ms for page program of 512 bytes
- 1.1ms for page erase
- 1.3ms for sector erase
- 4ms for block erase
- 15ms for chip erase

The M95P32 series also performs fast read operations with a single, dual or quad output and one dummy byte:

- Dual-output data transfer at up to 160Mbits/s
- Quad-output data transfer at up to 320Mbits/s

M95Pxx-E products have an extended operating-temperature range of -40°C to 105°C. M95Pxx-I products have an industrial operating-temperature range of -40°C to 85°C.

The M95P32-E/I has a memory capacity of 32Mbits, the M95P16-E/I is 16Mbits, and the M95P08-E/I is 8Mbits.

The EEPROM are supplied in DFN8, SO8N, and WLCSP8 packages or as an unsawn wafer.

FEATURES

- Byte flexibility
- High page cycling performance
- Clock frequency up to 80MHz
- Page/sector/block erase
- Rated for 500,000 Write cycles
- Supply-voltage range: 1.6V to 3.6V
- 0.6µA operating current in deep power down
- 100-year data retention

APPLICATIONS

- Wearable devices:
  - Smart watches
  - Fitness trackers
- Healthcare equipment:
  - Hearing aids
  - Blood glucose meters
  - Blood pressure monitors
  - Implantable devices
- Asset tracking

FREE DEV BOARD

Evaluation board for low-power EEPROM memory products up to 32Mbits.

Orderable Part Number
X-NUCLEO-PGEEZ1

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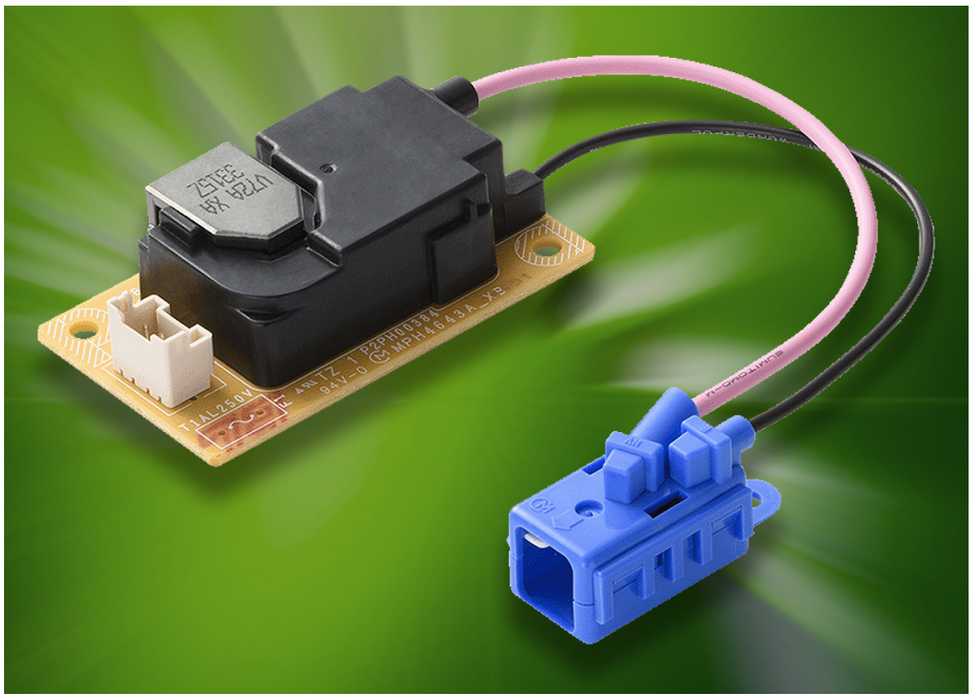
Low-ozone ionizer produces increased negative ion output for ventilation systems

The MHM332 Ionissimo™ ionizer module from Murata provides improved air purification performance compared to the earlier MHM305, without increasing the generation of ozone, which is harmful to human health at elevated levels.



muRata
INNOVATOR IN ELECTRONICS

FEATURES

- 0.7W power consumption
- Operating-temperature range: -10°C to 55°C
- Relative humidity range: 20% to 80%

APPLICATIONS

- Air purifiers and deodorizers
- Air conditioners
- Ventilation fans

The Murata MHM332 ionizer provides a reliable output of negative ions, supporting the air purification function in industrial and consumer ventilation equipment by reducing airborne particles and causing them to cluster and settle. It also uses oxidation to neutralise harmful microbes.

The output of the MHM332 is rated at 8 million pieces per cubic centimetre, some 1.6 times higher than that of the MHM305, while ozone generation is kept at low levels, not exceeding 0.15mg/h, allowing for lower system pressure while keeping airflow the same.

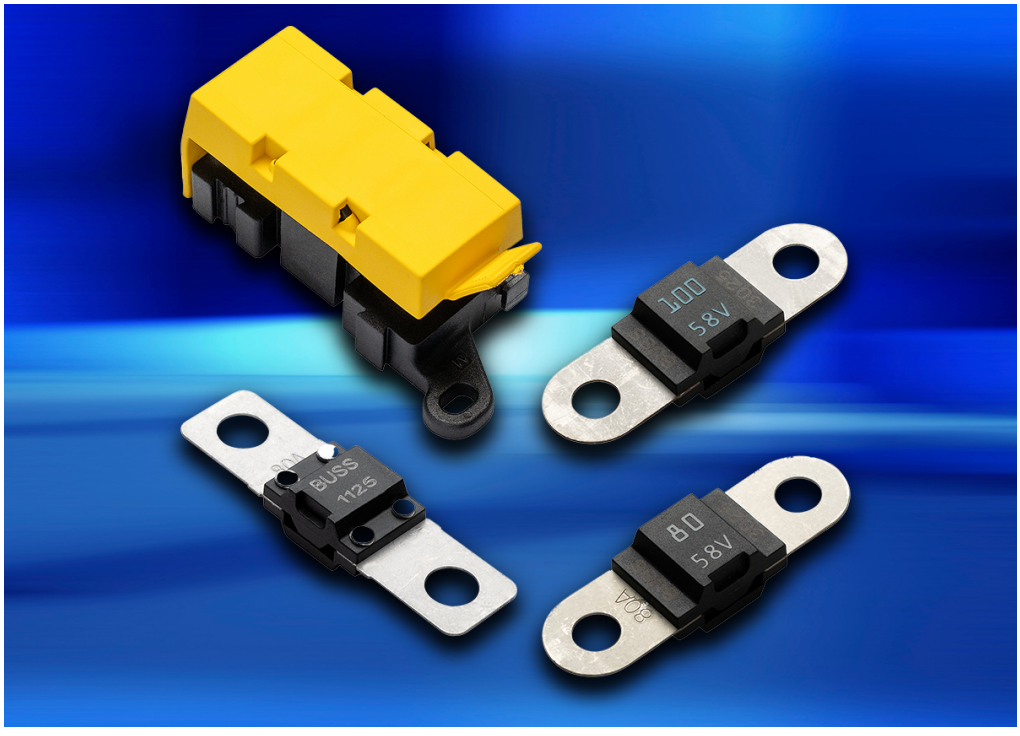
The MHM332 features a split architecture which allows the compact emitter to sit at the intake while the power supply remains on a protected PCB area, permitting straightforward creepage and clearance planning. This reduces compromises around fan placement or enclosure geometry, enabling placement of the Ionissimo directly in air outlets or before the filter for efficiency, even in narrow vents and baffles.

The module features a monitor voltage output supporting simple supervisory logic, so firmware can co-ordinate ionization with fan state or scheduled duty cycles, rather than running continuously.

The MHM332 operates from a standard 12V dc power supply. It is supplied in three versions with a lead of 100mm, 200mm or 300mm.

Industrial fuse features bolt-down terminals for secure installation

The colour-coded BAT1 family of bolt-down fuses from Eaton gives protection of up to 200A in high-power applications, in addition to enabling robust mounting and simple replacement.



EATON
Powering Business Worldwide

FEATURES

- Operating temperature range: -40°C to 125°C
- UL248-1 and ISO 8820-5 certification
- Colour-coding denotes current rating for easy identification
- Voltage drop range: 70mV to 105mV
- 0.30mΩ cold resistance

APPLICATIONS

- Battery-powered power tools
- Energy storage systems
- Battery management systems
- E-mobility devices

The BAT1 family of bolt-down fuses provides reliable and efficient over-current protection for high-power applications, offering current ratings from 30A to 200A to accommodate a wide range of electric power, industrial and transport applications up to 58V. The BAT1 fuses have industry-leading breaking capacity of 2kA at 32V and 1kA at 58V.

The bolt-down design used in conjunction with the HBAT1-101 holder makes installation and maintenance simple while maintaining a secure connection even when exposed to shock or vibration. The compact fuse footprint of 48mm x 12mm enables designers to create space-efficient designs without compromising on protection.

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Intelligent IMU detects low-g and high-g events simultaneously

The ISM6HG256X sensor module from STMicroelectronics can be used to track both slow-motion events, such as the tilting of a display user interface, and fast events such as shock or impact.

The ISM6HG256X is a low-noise and low-power six-axis inertial measurement unit (IMU) containing dual three-axis accelerometer channels dedicated to the measurement of low-g and high-g forces, as well as a three-axis gyroscope with extended selectable scales. Both accelerometer channels record signals at the same time, removing the need to add a second sensor to measure fine motion and shock events simultaneously.

The outputs from the ISM6HG256X are configured in four channels, with dedicated configuration, processing, and filtering circuits for each channel. Channel 1 is for user interface applications, supporting data processing for motion tracking. In this mode, the accelerometer and gyroscope have independent output data rates and full-scale ranges.

Channel 2 is for optical image stabilization. The accelerometer has a full scale of ±2g to ±16g, and the gyroscope, ±250 degrees/s to ±4,000 degrees/s.

Channel 3 is for enhanced electronic image stabilization. Data are available in free-run mode in the output registers, or in a FIFO with dedicated tag and timestamp.

Channel 4 is for high-g applications such as shock detection, here the accelerometer processes motion data across a full-scale range of ±32g to ±256g.

On-sensor intelligence reduces the data processing burden on the host controller. A programmable finite state machine recognizes motion patterns, and a machine-learning core implements algorithms in the sensor itself through a set of configurable parameters and decision trees. Algorithms implementing a pedometer, tilt detection and motion detection are ideal for smart robotics and automation applications.

The sensor can re-tune itself using embedded adaptive self-configuration, switching ranges, bandwidths or functions when conditions change, without intervention from the host. A low-power sensor fusion algorithm enables orientation-aware behavior even when the host is asleep. FIFO data buffering with compression and timestamps batches data so the host wakes only when needed.

FEATURES

- I2C, SPI and MIPI I3C v1.1 serial interface
- Temperature sensor
- Supply-voltage range: 1.71V to 3.6V
- Independent I/O power-supply range: 1.08V to 3.6V
- Sensor hub interfaces to up to four external sensors
- 2.5mm x 3.0mm x 0.83mm LGA package

APPLICATIONS

- Asset tracking
- Robots
- Factory automation
- Condition monitoring of industrial equipment
- Personal protective equipment

FREE DEV BOARD

Kit enables evaluation of IMU ability to sense high-g and low-g events simultaneously.

Orderable Part Number
STEVAL-MKI248KA

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