

23-ii

Embedded Processing & Software



Dual-core microprocessor executes real-time operations at low power

STMicroelectronics supports the STM32MP157F with a wide range of Linux[®], security, software and AI development resources.

The STM32MP157F multi-core microprocessor from STMicroelectronics features high-performance computing and graphics capabilities combined with power-efficient real-time control and multiple integrated features.



The heterogeneous architecture implemented in the STM32MP157F combines a dual-core 800 MHz Arm[®] Cortex[®]-A7 processing unit with a Cortex-M4 microcontroller core. The Cortex-A7 cores are backed by 32 kbytes of L1 cache and 32 kbytes of data cache for each core, and 256 kbytes of unified L2 cache. The processing unit can implement the Arm NEON™ signal processing acceleration technology and TrustZone[®] secure partitioning technology.

The STM32MP157F processor, part of the STM32MP1 series, supports a wide range of external memories, including up to 1 Gbyte of DDR SDRAM, and external Flash via a dual-mode quad serial peripheral interface. The combination of a fast processing unit and generous memory provision ensures that the STM32MP157F can handle ST's mainlined open-source Linux[®] operating system distribution, OpenSTLinux, which contains all the essential building blocks for running software on the application processor cores.

To support development with the high-performance STM32MP1 products, ST provides a broad ecosystem of software packages and support for cutting-edge open-source security initiatives.

The code available from ST for security mechanisms includes the Open Portable Trusted Execution Environment (OP-TEE) and the Trusted Firmware-A (TF-A) projects. This helps developers using the STM32MP1 series processors to address the key elements of information security in their applications: confidentiality, integrity, availability, and authentication.

ST has also introduced software expansion packages tailored for the STM32MP1 which help designers to deploy artificial intelligence (AI) in computer vision projects and to accelerate the development of predictive maintenance applications. These include X-LINUX-AI, an expansion package which contains AI frameworks and application examples for the Linux operating system to help designers to quickly begin implementing computer vision use cases with STM32 evaluation boards and Discovery kits.

To accelerate development of predictive maintenance applications, the X-LINUX-PREDMNT expansion package helps to implement edge gateway features between sensors and cloud services.



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FEATURES

- Security/safety features:
 - Secure boot
 - TrustZone peripherals
 - Active tamper detection
 - Isolation of Cortex-M4 core
- 3D graphics processing unit
- 24-bit LCD-TFT display controller
 - Up to WXGA @ 60 frames/s
 - Up to Full HD @ 30 frames/s
 - Pixel clock up to 90 MHz
 - Two layers with programmable color look-up table
- MIPI[®] DSI interface:
 - Two data lanes up to 1 Gbits/s each
- Two ADCs up to 16-bit resolution
- Temperature sensor
- Two 12-bit DACs
- Digital filter for sigma-delta modulator

APPLICATIONS

- Industrial systems
- Consumer electronics
- Smart home
- Health and wellness devices

FREE DEV BOARD

This Discovery kit includes an ST-LINK embedded debug tool, LEDs, push-buttons, one 1 Gbit/s Ethernet connector, one USB Type-C[®] OTG connector, four USB Type-A Host connectors, one HDMI[®] transceiver, one stereo headset jack with analog microphone, and one microSD[™] connector.

Orderable Part Number
STM32MP157F-DK2

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FREE DEV BOARD

The STM32MP157F-EV1, a full-featured demonstration and development platform, includes an ST-LINK embedded debug tool, LEDs, push-buttons, and one joystick. Connectivity features include 1Gbits/s Ethernet, CAN FD, one USB OTG Micro-AB connector, and four USB Host Type-A connectors.

Orderable Part Number
STM32MP157F-EV1

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TELECOMS

System-on-module combines edge processor with Wi-Fi and Bluetooth wireless connectivity

Summit SOM 8M Plus from Laird Connectivity provides security, graphics, and connectivity features needed in smart, connected devices.

The new Summit SOM 8M Plus system-on-module (SOM) from Laird Connectivity combines an advanced multi-core applications processor with a wireless system-on-chip (SoC) to provide a compact unit which simplifies the design of secure connected products and speeds time to market.



FEATURES

- Memory options:
 - RAM: 512 Mbytes, 1 Gbyte or 2 Gbytes
 - Storage: 8 Gbytes or 16 Gbytes
- Interfaces:
 - 2 x USB 3.0/2.0 dual-role with PHY
 - 2 x Gigabit Ethernet with IEEE 1588, AVB
 - 2 x CAN/CAN FD
 - 4 x UART
 - 6 x I2C
 - 3 x SPI
 - SDIO 3.0/eMMC 5.1
- FCC, IC, CE, RCM, MIC, and Bluetooth SIG approvals
- Operating-temperature range: -30°C to 85°C

APPLICATIONS

- Rugged handheld devices
- Industrial IoT gateways
- IoT vision solutions
- Healthcare devices
- Service robots
- Drones
- Fleet analytics
- Building management systems
- Audio/voice systems

The Summit SOM 8M Plus is based on the NXP Semiconductors i.MX 8M Plus multi-core applications processor and the NXP 88W8997 wireless SoC. The SOM's wireless capability includes dual-band 2x2 Wi-Fi® 5 and Bluetooth® 5.3 radios.

The SOM i.MX 8M Plus applications processor provides a versatile combination of a power-efficient quad-core Arm® Cortex®-A53 processor and a Cortex-M7 microcontroller core, enabling powerful heterogeneous multiprocessing. The Cortex-A53 and Cortex-M7 cores enable concurrent execution of Linux® and real-time operating systems on dedicated sub-systems protected behind firewalls. The quad-core i.MX 8M Plus SoC is powerful enough to run multiple instances of Linux software for various purposes, such as user interfaces and connectivity.

Functions which design engineers can implement with the Summit SOM 8M Plus include hardware acceleration for machine learning, enabled by an integrated high-speed neural processing unit. The SOM also contains a DSP core and graphics processing unit for graphics, video, vision, and audio functions.

The array of interfaces includes support for up to three displays and several options for video out, camera and audio inputs, and general I/Os.

A comprehensive security architecture, ideal for today's connected IoT applications, includes a secure enclave and secure boot. The i.MX 8M Plus processor enables root-of-trust hardware-based software validation, and a high-performance and flexible secure storage system for passwords, certificates, and data storage.

FREE DEV BOARD

The Summit SOM 8M Plus evaluation kit includes reference designs for display, camera, audio, cellular connectivity, GPS, power consumption profiling, Power-over-Ethernet, battery usage, battery charging, USB 3.0 power, and more.

Orderable Part Number
453-00072-K1

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Dual-inductive position sensor provides high accuracy at high speed

NCS32100 from onsemi operates at speeds up to 60,000 rpm and produces 24-bit position and velocity outputs.

The onsemi NCS32100 IC is a dual-inductive position sensor interface which offers the high accuracy at high rotation speed required in servo motors and other industrial applications.



An NCS32100-based position sensor system consists of two PCBs:

- A rotor board featuring two printed inductors, and no soldered components on the rotor
- A stator board featuring printed inductors and the NCS32100 encoder IC

Accuracy is better than ± 50 arcsec for a 38 mm sensor board. The NCS32100 achieves full accuracy at speeds up to 6,000 rpm, and above this can operate at speeds up to 60,000 rpm with reduced accuracy. Incremental motion is tracked with high precision: the NCS32100 resolves single-turn data to 20 bits, and multi-turn outputs to 24 bits.

onsemi has made it as easy as possible for designers to implement systems based on the NCS32100. The IC includes an integrated MCU with firmware, which means that it produces position and velocity outputs rather than raw analog signals. The device can also be easily configured to work with inductive sensor boards of various sizes.

Flexible arrangements for mechanical assembly include alignment tolerance of ± 0.25 mm. Integrated self-calibration accounts for PCB asymmetries, and secondary calibration helps to adjust for mechanical errors.

The NCS32100 inductive sensor system is immune to temperature changes, vibration and contaminants. It can provide position data even when the rotor is not moving.

onsemi supports the NCS32100 chip with a PCB reference design for a 38 mm rotary sensor, firmware, and an evaluation board.

onsemi[™]

FEATURES

- 2.5 MHz UART interface for connection to a half-duplex RS-485 driver
- Supports battery back-up for multi-turn count tracking
- Reports back-up battery voltage with programmable low-battery alert
- Internal temperature monitoring with programmable over-temperature limit
- 3 μ s MCU response time
- 90 mA operating current

APPLICATIONS

- Industrial automation
- Robotics
- Servo motors
- Encoder position sensing modules

FREE DEV BOARD

In the STR-NCS32100-GEVK evaluation kit, the NCS32100 is connected to a fully functional inductive rotary sensor board capable of sensing position with an accuracy of ± 50 arcsec. The board can be connected to a computer running the onsemi Strata application, which provides a user interface for viewing position and velocity data, as well as a number of other auxiliary features.

Orderable Part Number
STR-NCS32100-GEVK

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TELECOMS

Launch of all-in-one power management solution for STM32MP1 MPUs

New STPMIC1 from STMicroelectronics provides the buck and boost converters and LDO regulators required to power complex application processors.

STMicroelectronics has introduced the STPMIC1, a fully integrated power management IC (PMIC) for the STM32MP1 series microprocessors.



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FEATURES

- Input-voltage range: 2.8 V to 5.5 V
- 100 mA/500 mA USB OTG-compliant power switch
- General-purpose 500 mA/1,000 mA power switch
- I²C bus and digital I/O control interface

APPLICATIONS

- Industrial equipment
- Networking and telecoms infrastructure
- Home and office automation
- Medical monitoring equipment
- Portable devices

Fully programmable, the STPMIC1 provides 14 output rails to support the power requirements of application processors. The STPMIC1 can supply power to the processor as well as to external system peripherals such as SD card and Flash memories, and other system devices.

Highly efficient, this PMIC reduces power dissipation and extends battery life in portable applications, and is supported by over-current and over-voltage protection. The device's 14 power rails include four adjustable adaptive constant on-time switching buck converters, and six LDO regulators. A 5.2 V/1.1 A boost dc-dc converter with bypass mode is suitable for a 5 V or battery input. The PMIC also features an LDO which is dedicated to DDR3 DRAM sink-source terminations in bypass mode, giving designers scope to implement low-power DRAM.

The STPMIC1 is available in five different versions: four are factory pre-programmed to meet I/O voltage requirements at 3.3 V or 1.8 V, and one is not pre-programmed. All versions can be easily customized later during the design stage, giving flexibility to engineers. An embedded non-volatile memory can store power sequencing settings and status read-outs.

The STPMIC1 is supplied in a 44-lead WFQFN package measuring 5.0 mm x 6.0 mm x 0.8 mm.

FREE DEV BOARD

The STPMIC1 evaluation board is backed by a design-friendly GUI, the STSW-PMIC1GUI, which can monitor and configure the STPMIC1's main parameters.

Orderable Part Number
STEVAL-PMIC1K1

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TELECOMS

Simpler, cheaper, faster: the case for TSN in factory automation networks grows stronger by the day

Read this to find out about:

- The features of the TSN variant of the Ethernet protocol which make it attractive to the industrial equipment sector
 - The IEEE standards which define the TSN specification
- The reasons for using either discrete or SoC versions of the key TSN components – switches and transceivers



Today, the installed base of networking technologies for factory automation remains dominated by familiar protocols such as Profinet, EtherCAT®, Modbus-TCP and Ethernet/IP, shown in Figure 1. A newer technology, Time-Sensitive Networking, or TSN, has only a small foothold in the industrial sector. But while it is true that technological change occurs at a slower pace in the industrial sector than in consumer electronics, there is no doubt that change is coming.

The adoption of TSN in factory automation networks is now being driven by the strong financial and operational benefits which it offers. In fact, this trend is not restricted to the factory: in cars, trains, buildings and elsewhere, TSN is beginning to take its place as the backbone of all-Ethernet communication.

And as this article will show, the emergence of a comprehensive set of product options for OEMs to choose from when building TSN network interface cards (NICs) and TSN-compatible equipment enables them to meet a wide variety of circuit design requirements.

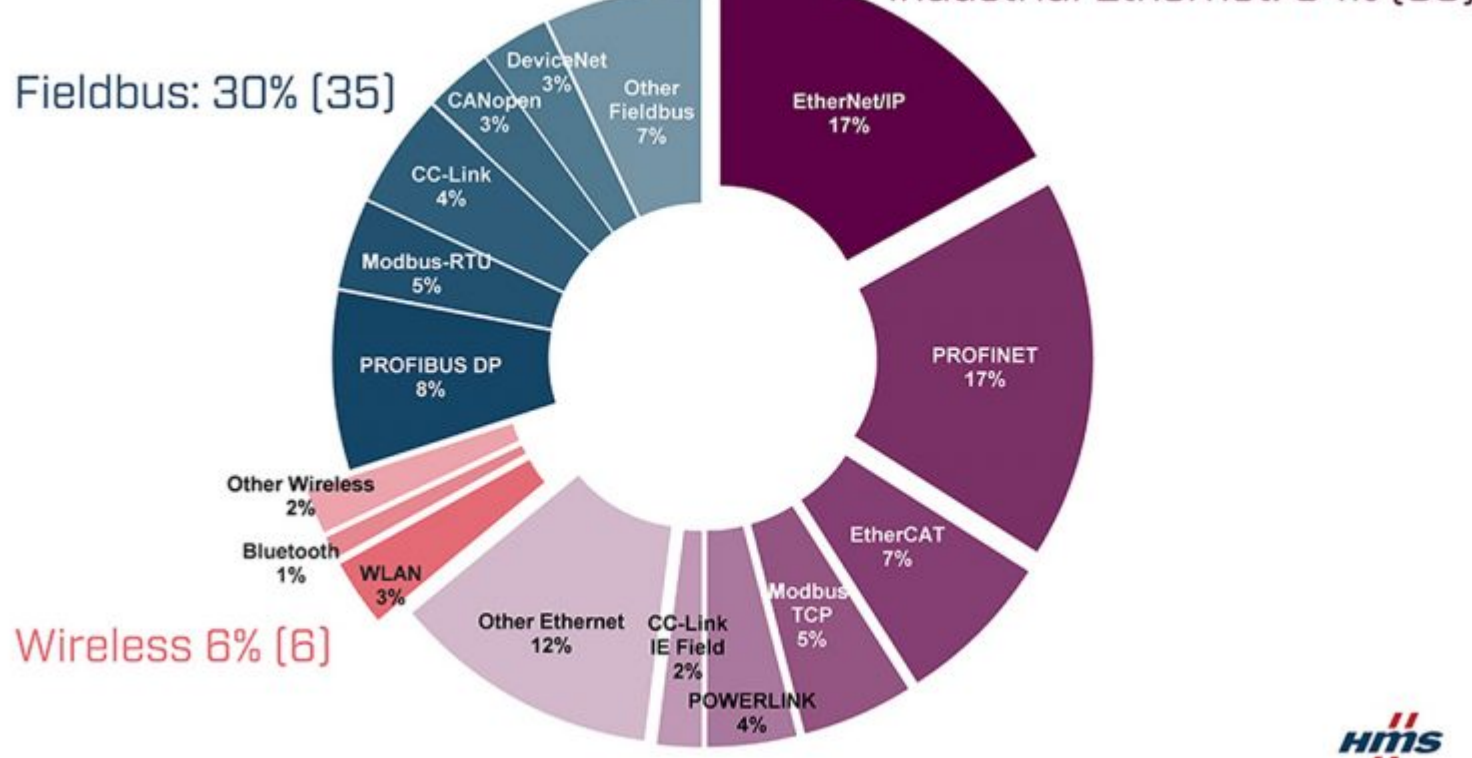


Fig. 1: Share of market for new factory networking installations in 2020 according to research by HMS Networks. (Image credit: HMS Networks, at hms-networks.com.)

Factors driving the move to TSN

The momentum gathering behind the move to TSN in the factory has in fact been growing for many years. The concept of mirroring the familiar Ethernet protocol, a universal feature of wired office networks since the 1990s, in the industrial or automotive environments was first formally declared in 2009 with the founding of the AVNU Alliance, backed by some of the biggest names in industrial and automotive networking technology, including Cisco, Intel, Bosch, General Electric, BMW, General Motors, NXP Semiconductors and Renesas.

This grouping took on the task of developing a robust version of Ethernet called Audio-Video Bridging (AVB). The AVB Task Group formed in 2011 had the goal of developing an Ethernet-based protocol suitable for connecting automotive infotainment devices such as video cameras and displays.

The AVNU Alliance then extended its work to cover factory automation, the term time-sensitive networking emerged in 2012. Under the auspices of the IEEE, the AVNU Alliance set out to develop a set of standards which would define the additional features of a TSN network for operational technology (OT) applications. The standard TSN protocol was to be built on top of the basic Ethernet protocol implemented in information technology (IT) settings. The benefit which the promoters of the TSN standard promised was a combination of simplification, cost reduction and performance improvement.

Today, factories are plagued by:

- The proliferation of incompatible industrial Ethernet and fieldbus protocols, a single factory today often includes two, three or more discrete networks
- Separate cabling for each discrete service provided by a networked system, such as audio, control, diagnostics, and multimedia

This results in duplication of network cabling, and hence duplication of both materials and installation costs.

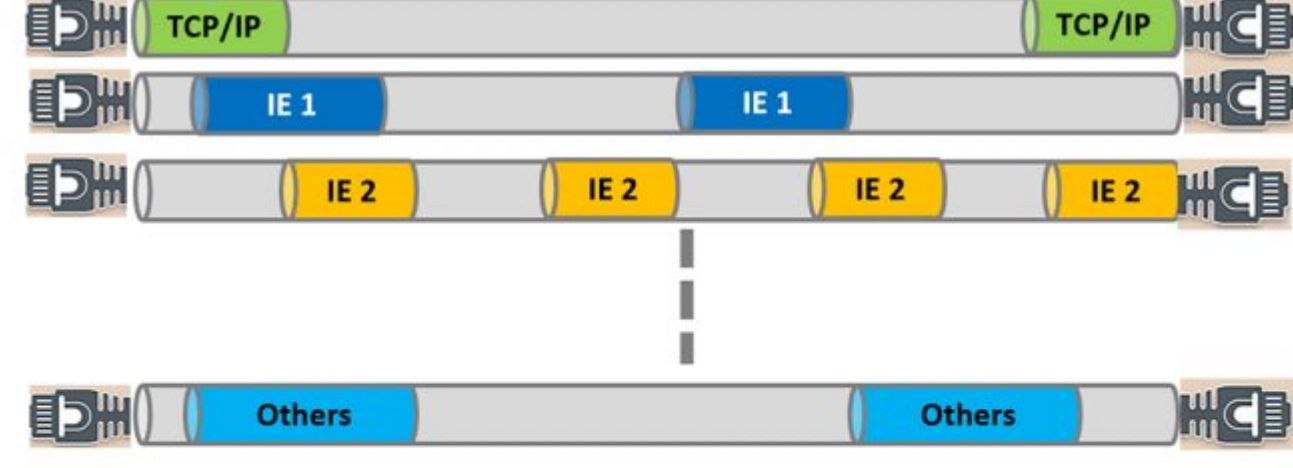
The multitude of networking standards inside the factory also isolates different sets of equipment into networked silos: equipment in one silo is hidden from equipment in another silo. This hinders the integration of equipment across a factory automation system. There is a similar lack of transparency between OT and IT systems.

The sheer complexity of the network architecture also makes maintenance and repair operations more difficult, time-consuming and expensive.

TSN provides a way to eliminate all of these problems. In a factory system, it can operate as the carrier for traffic generated by fieldbus and industrial Ethernet protocols. In terms of the Open Systems Interconnection (OSI) model, TSN is a Layer 2 networking technology.

Ethernet products supporting TSN also offer higher data-transfer rates of 100 Mbits/s or higher, while most of today's industrial Ethernet networks and other connected services in the factory operate at data rates of 100 Mbits/s or less. This means that the implementation of TSN technology allows the operator to integrate multiple services on a single Ethernet medium, shown in Figure 2.

Conventional factory automation network



The same services integrated into a TSN network

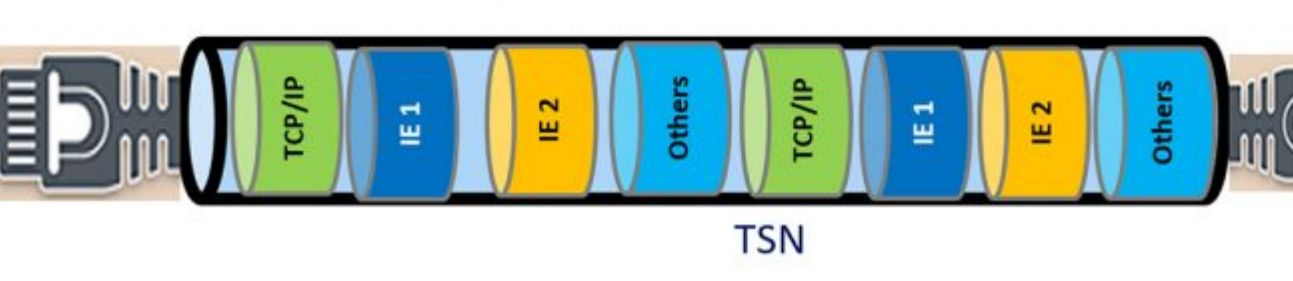


Fig. 2: TSN can act as the carrier for multiple fieldbus and industrial Ethernet networks. (Image credit: Future Electronics)

So TSN can address the problems arising from the proliferation of industrial networking technologies:

- A single network cable results in reduction in materials usage, simpler installation, and reduced capital expenditure.
- Greater transparency between devices supplied by different vendors gives simpler interoperability testing, and easier integration of equipment into a TSN-based infrastructure.
- Simpler integration of OT and IT systems and services. This supports the adoption of the Industry 4.0 approach, in which devices in the field are connected to the internet.
- Simpler and cheaper operational procedures. When the network system is integrated into a TSN-based infrastructure, there are fewer network devices to monitor and maintain, making it easier to track the point of failure and to repair faults.

The simplification of the network also contributes to the provision of security, an indispensable condition for the adoption of Industry 4.0 technology. Before TSN, the OT system might consist of multiple network segments, the security of each of which has to be managed discretely. This puts an increased burden on the IT department, and increases the risk of security vulnerability.

With TSN, VLAN technology enables the operator to run multiple different network services virtually within a single, integrated Ethernet topology. This means that security procedures only need to be applied to TSN nodes instead of to heterogeneous network nodes: this simplifies security management on the IT side and thus reduces the risk of leaving the network vulnerable.

The key features of the TSN protocol

The work started by the AVNU Alliance in 2011 has ended with a robust protocol codified in various IEEE standards. These standards cover the following main operating features of the network:

- Time synchronization
- Latency
- Resource management
- Reliability

The standards sit on top of the basic IEEE 802.3 Ethernet standard, ensuring that the service levels of the various network protocols are maintained after their integration into TSN, shown in Figure 3.

Category	Standards	Functions	Objectives
Time synchronization	IEEE 802.1AS, IEEE 1588	Timing and synchronization	Enables some devices in the network to act simultaneously
Latency	IEEE 802.1Qbu, 802.3br	Frame pre-emption and interspersing express traffic	Enables high-priority frames (express traffic) to be handled immediately; recovery of pre-empted frames
	IEEE 802.1Qbv	Scheduled traffic, time-aware traffic shaping	Differentiation of high- and low-priority frames with control of time windows
Resource management	IEEE 802.1Qcc	Stream reservation (SRP)	Registration/deregistration of nodes in the network and handshaking of routing paths and traffic control
	IEEE 802.1Qca	Path control and reservation	Advanced SRP for more efficient path routing with centralized network monitoring
Reliability	IEEE 802.1Qci	Time-based ingress policing	Monitoring of traffic to eliminate abnormal behavior and protect nodes from attack
	IEEE 802.1CB	Frame replication and elimination	Enhancing frame transmission reliability with a back-up mechanism with copied frames

Fig. 3: The additional standards on top of the legacy Ethernet standard which form the TSN protocol

A fully-formed ecosystem of TSN components and modules

Equipment designers who implement TSN in industrial equipment have a choice of discrete versions of the key components of TSN network equipment, the transceiver and the switch, and of system-on-chip (SoC) versions.

The discrete versions are dedicated to either transceiver or switching functions, and operate alongside a separate host CPU. The use of a discrete transceiver or switch gives the designer the freedom to maintain a legacy microprocessor architecture, and to re-use application software developed for this architecture.

Typical examples of discrete TSN transceivers are the Microchip LAN9668, a TSN switch. It may be combined with the LAN8814, a Layer 1 (physical layer) product launched in January 2022 which provides up to eight Ethernet ports in a single device.

Renesas also supplies the RZ/N2L family of three-port TSN switches. NXP's SJA110x family provides another TSN switch option.

The SoC versions include an on-chip processor to run the TSN protocol and perform network control functions, as well as to support the application. Examples of TSN transceiver SoCs include:

- NXP Semiconductors i.MX8M Plus, i.MX 8DualLite, and i.MX RT1176
- Renesas RZ/G2, RZ/V2M and RZ/T2, which also support other industrial Ethernet protocols to be integrated into TSN, such as Profinet CC-D, known as Profinet-over-TSN

While the above examples are transceiver SoCs supporting TSN, there are also TSN switch SoCs:

- NXP LS1018 and LS1028
- Microchip Sparx-5i

SoC versions offer the advantage of a simpler hardware layout with a reduced component count, and thus less development time and potentially a lower bill-of-materials cost.

These TSN products, both the discrete and SoC versions, are backed by comprehensive software and tools offerings to support the development of a complete TSN application.

While the SoC versions provide for a simpler hardware layout than the discrete equivalents, they still present the designer with integration challenges, including the provision of DRAM memory and a power management system. To ease implementation and reduce time-to-market, a system-on-module (SOM) which carries a SoC version of the TSN components is a viable option. The SOM option would also be helpful for manufacturers which have limited hardware development resources and time. SOM products from Karo Electronics and iWave are available from Future Electronics, and they support transceiver SoCs such as the i.MX 8MPlus.

The ecosystem of TSN components is also supported by widely available portfolios of the passive and connector products required to implement a TSN or Ethernet design, all available from Future Electronics:

- Connectors from manufacturers such as TE Connectivity, Amphenol Communications Solutions, Hirose, Harting, WAGO, METZ CONNECT
 - RJ45 jacks and receptacles
 - ix Industrial connectors
 - Clamp-terminated terminal blocks for Ethernet wiring
 - Single-pair Ethernet connectors, which offer a cost-reduction opportunity in industrial Ethernet and TSN designs
- Magnetics for Ethernet terminals, available from manufacturers such as Eaton and Pulse Electronics
- Power-over-Ethernet (PoE) and associated power components, from manufacturers such as YAGEO and Eaton

Supportive development environment

The wide choice of products described above shows that implementation of TSN in factory automation equipment is supported by a mature component ecosystem. In addition, many designers of networked industrial equipment who are familiar with the legacy fieldbus and industrial Ethernet protocols can carry over many of their development assets to TSN.

Nevertheless, it is still fair to say that the migration to a TSN-based network architecture requires the designer to learn and adapt to the new technology. This includes the need to configure features of TSN to support an entire network. Future Electronics is ready to support design engineers in the transition, providing guidance on network implementation and component selection through local and regional specialists in networking and embedded computing.

Future Electronics thanks Kenji Iijima, Martin Schiel, Joshua Schlotman, and Björn Thiem for their help in the preparation of this article.

New RISC-V-based MPU provides fast interfaces for high-performance gateway applications

Renesas has introduced a microprocessor option for developers who want to base new designs on the RISC-V instruction set architecture.

The Renesas RZ/Five has a 1 GHz RISC-V core and a generous set of communications interfaces and security capabilities.



RENESAS

FEATURES

- Memory error detection and correction
- Two-channel SD memory card host interface
- Two-channel ADC

APPLICATIONS

- Industrial gateways
- IoT edge equipment
- Home gateways
- Solar inverters

The Renesas RZ/Five Group of MPUs provides a RISC-V implementation backed by a rich set of memory and communications interfaces. The RZ/Five RISC-V CPU core is an AX45MP Single running at a clock frequency of up to 1 GHz. The MPU also provides a 16 bit interface to high-speed DDR3L or DDR4-1600 DRAM.

For high-speed data transfers, the RZ/Five MPU features a one- or two-channel Gigabit Ethernet interface. It also provides two-channel CAN-FD and USB 2.0 interfaces. Renesas supports comprehensive security protection for connected devices based on the RZ/Five. These include secure boot capability, a cryptography engine, true random number generator, and a 1 kbit one-time programmable memory for key storage.

The RZ/Five is supplied in two versions:

- 361-pin BGA package measuring 13 mm x 13 mm with the part number R9A07G043F01GBG#BC0
- 266-pin BGA package measuring 11 mm x 11 mm with the part number R9A07G043F00GBG#BC0

Designers using the RZ/Five can reduce system cost by implementing designs on a four-layer PCB. The 13 mm x 13 mm version is pin-compatible with the RZ/G2UL Arm® Cortex®-A55-based MPU, part number R9A07G043U11GBG#BC0.

FREE DEV BOARD

The RZ/Five evaluation kit consists of a SMARC v2.1 system-on-module (SOM) board and a carrier board. The carrier board can be used with the RZ/G2L, RZ/G2LC, RZ/G2UL and RZ/V2L SOMs which are compatible with the SMARC v2.1 standard, as well as with the RZ/Five SOM. This means that it provides a flexible platform for evaluating the entire RZ family of devices.

Orderable Part Number
RTK9743F01S01000BE

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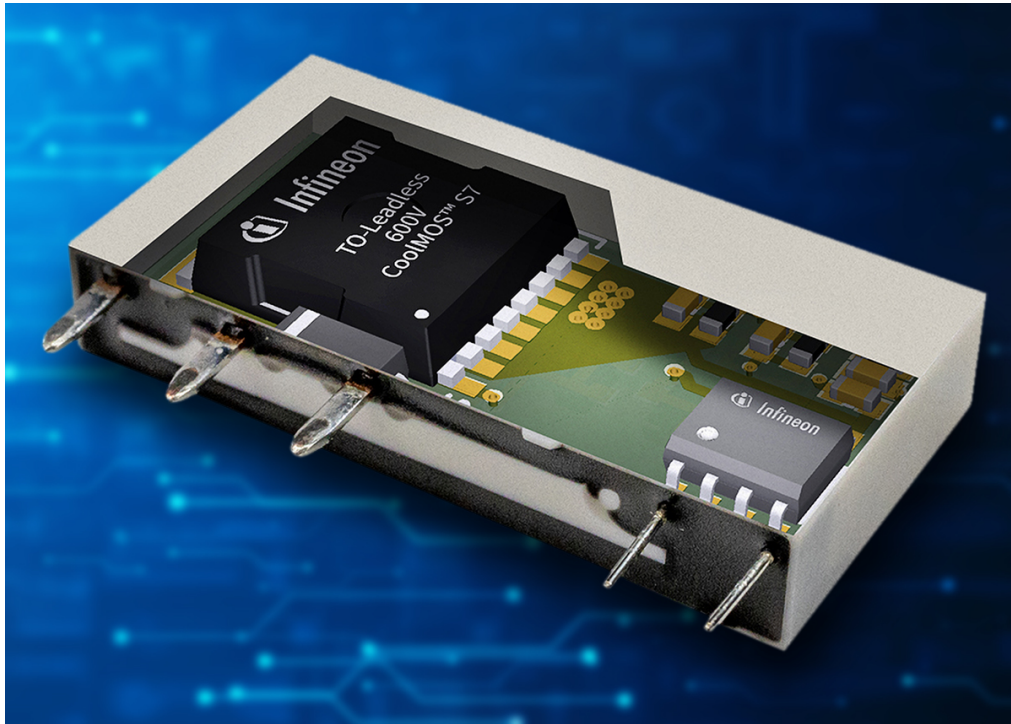


TELECOMS

Superjunction MOSFETs support design of more reliable and efficient relays and fuses

Infiniteon provides S7 and S7A MOSFET families to replace electromechanical relays and fuses with superior solid-state technology.

Infiniteon is releasing a set of design guides and MOSFET products to help OEMs to replace conventional electromechanical switching devices such as relays, circuit breakers and melting fuses with new solid-state solutions.



FEATURES

CoolMOS S7

- Best-in-class on-resistance in surface-mount packages
- Best on-resistance for a superjunction MOSFET
- Optimized for conduction performance
- Low thermal resistance
- High pulse-current capability
- Robust body diode at AC line commutation

APPLICATIONS

- Solid-state relays
- Solid-state circuit breakers
- Electronic fuses

With the Super Solid-State Solutions (S4) range, Infineon enables manufacturers of switching devices not only to extend the lifetime of products, but to realize efficiency gains, performance improvement, and higher reliability.

In electromechanical devices that have switching functionality, such as relays, circuit breakers, and fuses, the switching element between a set of contacts is prone to wear, failure or overheating. This mechanical moving part can be replaced with Infineon MOSFET-based technology to create a superior solid-state alternative.

In a relay, the transition to an Infineon S4 product gives various benefits:

- No mechanical contact or moving parts
- Longer electrical and mechanical life expectancy and higher reliability
- Higher shock and vibration resistance
- No bounce or electrical arcing
- Typically far lower power consumption

The S4 range from Infineon uses 600 V CoolMOS™ S7 superjunction MOSFETs for industrial applications, and 600 V CoolMOS S7A MOSFETs for automotive applications. The S7 MOSFETs are supplied in a novel, efficient QDPAK package that has top-side cooling, making it ideal for low-frequency switching applications and solid-state solutions.

The 600 V CoolMOS S7 and S7A MOSFET families offer the best performance for low-frequency switching applications at the best price. A highlight of the S7 family is the IPDQ60R010S7, which offers on-resistance as low as 10 mΩ, and is housed in the top-side-cooled surface-mount package.

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TELECOMS

New MOSFET technology gives improved power density and efficiency

MDmesh M9 MOSFETs from STMicroelectronics are suitable for both hard-switching and resonant topologies.

STMicroelectronics has introduced MDmesh M9 superjunction power MOSFETs, offering the industry's best figure-of-merit for on-resistance x gate charge in its class. Use of the MDmesh M9 devices enables designers to substantially reduce power losses in power systems in communications equipment, microinverters and resonant dc-dc converters.



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FEATURES

STP65N045M9

- 55 A maximum continuous drain current at a case temperature of 25°C
- Handles dV/dt up to 120 V/ns and dI/dt up to 900 A/ μ s
- Easy to drive
- 100% avalanche tested
- Operating-temperature range: -55°C to 150°C

APPLICATIONS

- Servers
- Telecoms equipment
- 5G wireless infrastructure
- Microinverters
- Fast chargers

The MDmesh M9 series sets a new benchmark for 650 V and 600 V superjunction MOSFETs, offering a reduction of around 30% in on-state resistance compared to the previous technology.

This enables developers to increase power density and realize more compact power-system designs based on hard- or soft-switching topologies.

The new product range, which is available in versions for industrial and for automotive applications, also includes 250 V-rated medium voltage MOSFETs.

The first MDmesh M9 device to be launched is the 650 V STP65N045M9, which has maximum on-resistance of 45 m Ω . On-resistance as a function of area is very low, as is gate charge, which is just 80 nC at a 400 V drain voltage.

The MDmesh M9 technology reduces both turn-on and turn-off switching losses compared with the earlier MDmesh M5 technology. The MDmesh M9 MOSFETs also feature very low reverse-recovery charge and reverse-recovery time, helping to improve efficiency and switching performance.

An essential element of the MDmesh M9 technology is an additional platinum diffusion process which produces a fast intrinsic body diode. The peak diode-recovery slope, dV/dt , is also greater than for earlier processes.

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TELECOMS

DDR5 DIMM sockets compatible with the latest high-performance computing architectures

High-quality construction and space-saving design make the sockets ideal for use in data centers.

TE Connectivity (TE) has introduced DDR5 DIMM sockets to support the next generation of memory hardware for high-performance computing and server platforms.



FEATURES

- Data rate up to 6.4 Gbits/s
- 1 A current rating per pin
- 106.8 N maximum insertion force
- Minimum 25 mating cycles
- Withstands high shock and vibration

APPLICATIONS

- Data centers
- Servers
- High-performance computing (HPC) equipment
- Work stations

The TE DDR5 DIMM sockets enable high-speed operation at a rate of up to 6.4 gigatransfers per second.

When partnered with TE processor sockets and PCIe Gen 5 connectors, the new DDR5 DIMM sockets provide a complete high data-rate connector framework for the latest computing architectures.

The TE sockets offer long life and robust operation. Thermal protection minimizes asset downtime and increases system reliability. In addition, the robust construction and design features allow for easy installation and system upgrades.

Narrow latch types and space-saving features provide for good airflow between components. Custom features are selectable by configuring the part number at the time of ordering.

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TELECOMS

Tiny cellular module provides worldwide connectivity for IoT edge devices

New Type 1SE module from Murata includes high-performance ST microcontroller and a hardware security framework.

Murata has introduced a new space-saving cellular networking module for LTE Cat.M1 and NB-IoT connectivity which provides a complete application-ready platform for IoT and smart connected devices.



muRata
INNOVATOR IN ELECTRONICS

FEATURES

- Optimized for Class 3 LTE output power
- Maximum +23 dBm Transmit power
- FCC/IC/RED/TELEC certified
- Supports GPS and Glonass satellite positioning
- UART host interface
- Operating-temperature range: -40°C to 85°C

APPLICATIONS

- Smart metering
- Wearable devices
- Tracking devices
- Machine-to-machine communication
- IoT edge nodes

The LBAD0ZZ1SE is a Type 1SE module which integrates a microcontroller, the STMicroelectronics STM32L462, based on an Arm[®] Cortex[®]-M4 core, with a radio unit which operates in LTE bands and supports both the LTE Cat.M1 and NB-IoT Release 13 cellular communications protocols. The tiny module has a metal case and an LGA footprint for surface-mounting. Its dimensions are 15.4 mm x 18.0 mm x 2.5 mm.

The LBAD0ZZ1SE is supplied with GCF and PTCRB carrier approvals and supports the Truphone eSIM technology to enable worldwide connectivity. A u.FL receptacle provides a connection to an external antenna.

The module's low power consumption gives up to 10 years of battery life. Hibernation current is 3 μ A, and current in eDRX mode is <50 μ A at eight hyperframes.

The LBAD0ZZ1SE provides strong security capabilities to protect it from cyber-attack, including a secure boot architecture and a robust hardware-based security framework. Provision for over-the-air firmware updates ensures that security protection can be continuously maintained. Access to ST's X-CUBE-CELLULAR software helps designers to accelerate system development.

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TELECOMS

Bluetooth Low Energy MCU provides an integrated solution for smart connected devices

RSL15 from onsemi protects connected devices with a comprehensive set of advanced security functions including TrustZone® support and root-of-trust.

The RSL15 from onsemi, a secure low-power wireless microcontroller which implements Bluetooth® Low Energy 5.2 networking, provides a complete set of control and connectivity functions for smart devices in industrial and medical applications.



Based on an Arm® Cortex®-M33 processor core, the RSL15 features built-in power management, a wide supply-voltage range suitable for coin cells, a flexible set of GPIOs, and an extensive set of peripherals. The RSL15 includes 80 kbytes of RAM. Flash memory options are 284 kbytes or 512 kbytes.

The RSL15 is backed by a comprehensive but easy-to-use software development kit (SDK) which provides sample applications to demonstrate the MCU's hardware capabilities. Other features of the SDK include a cybersecurity platform, a low-power Smart Sense mode for acquiring sensor data, and tools for configuring the power management functions and to select Bluetooth Low Energy features.

onsemi has ensured that connected devices based on the RSL15 are safe from cyber-attack. The RSL15 provides a comprehensive mix of security capabilities, including Arm TrustZone technology, which provides trusted execution environments for at-risk peripherals and functions. The RSL15 also features Arm CryptoCell™-312 technology to provide root-of-trust and additional security mechanisms such as:

- True random number generator
- Standard encryption accelerators
- Support for a wide range of encryption algorithms, including:
 - AES 128/192/256
 - SHA
 - Support for public key infrastructure
 - Elliptic curve cryptography
 - Message authentication
- Secure boot embedded in hardware ROM
 - Hardware-based root-of-trust using secrets stored in dedicated hardware
 - Managed life cycle model
- Secure key storage
- Secure debug controlled with certificates

The RSL15 supports capabilities provided by the Bluetooth 5.2 specification, including long range, higher data transmissions, and localization through detection of the angle of arrival and angle of departure of wireless transmissions.

The low power consumption of the RSL15 has been verified by the Embedded Microprocessor Benchmark Consortium. The MCU achieved a score of 60.5 on its ULPMark™-CoreMark benchmark in the performance category, the best in its class. On the ULPMark-CoreProfile benchmark, which calculates the deep-sleep efficiency of MCUs, the RSL15 holds second place, only behind the onsemi RSL10 wireless MCU.

onsemi™

FEATURES

- Bluetooth Low Energy 5.2 certified:
 - Up to 10 simultaneous connections
 - Long range
 - 2 Mbits/s transceiver
 - Extended advertising
 - Backwards compatibility with earlier Bluetooth specifications
- 36 nA sleep mode current
- 2.7 mA peak Receive current at 1 Mbit/s
- 4.3 mA peak Transmit current at 0 dBm output power
- -94 dBm sensitivity at 2 Mbits/s data rate
- Configurable output-power range: -17 dBm to +6 dBm
- Supply-voltage range: 1.2 V to 3.6 V

APPLICATIONS

- Industrial automation and sensing
- Connected medical sensors
- Wearable devices
- Asset tracking
- Electronic tags
- Access control
- Electronic labels
- Data loggers
- Smart appliances
- Energy-harvesting switches

FREE DEV BOARD

The RSL15-EVB evaluation and development board is intended to be used with the onsemi integrated development environment. It enables evaluation of the RSL15, and development of software applications for the device.

Orderable Part Number
RSL15-EVB

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TELECOMS

Six-axis motion sensor features built-in AI processing unit

STMicroelectronics ISM330IS combines an accelerometer and gyroscope in a single small package.

The ISM330IS motion sensor from STMicroelectronics, which combines a three-axis digital accelerometer and a three-axis digital gyroscope, contains a new processing unit to provide real-time sensor data to the host application.



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FEATURES

- Low power consumption in always-on mode
- Low operating current:
 - 0.59 mA in high-performance mode
 - 0.46 mA in low-power mode with ISPU inactive
- 70 $\mu\text{g}/\text{Hz}$ noise in high-performance mode
- SPI/I2C interface
- Operating-temperature range: -40°C to 85°C
- Embedded temperature sensor

APPLICATIONS

- Industrial robots
- Condition-based monitoring
- Asset tracking
- Smart home automation
- Personal health monitoring equipment

The ISM330IS system-in-package's intelligent sensor processing unit (ISPU) is an ultra-low power, high-performance programmable core which can execute signal processing and artificial intelligence (AI) algorithms at the edge. The ISPU supports C programming, and is backed by an ecosystem of libraries and third-party tools and development environments. Its circuitry is optimized for the real-time execution of algorithms, providing a streamlined implementation of AI in wireless sensor nodes.

The ISM330IS has a full-scale acceleration range of $\pm 2\text{ g}/\pm 4\text{ g}/\pm 8\text{ g}/\pm 16\text{ g}$. The angular rate range is between $\pm 125^\circ/\text{s}$ and $\pm 2,000^\circ/\text{s}$.

The sensor provides a programmable interrupt function, and an on-chip sensor hub for the internal accelerometer and gyroscope and up to four external sensors.

The LGA package of the ISM330IS measures 2.5 mm x 3 mm x 0.86 mm.

FREE DEV BOARD

The STEVAL-MKI233KA evaluation kit consists of: STEVAL-MKI233A main sensing board which has an ISM330ISNTR motion sensor STEVAL-MKIGIBV5 adapter board A flat cable The kit is compatible with the STEVAL-MKI109V3.

Orderable Part Number
STEVAL-MKI233KA

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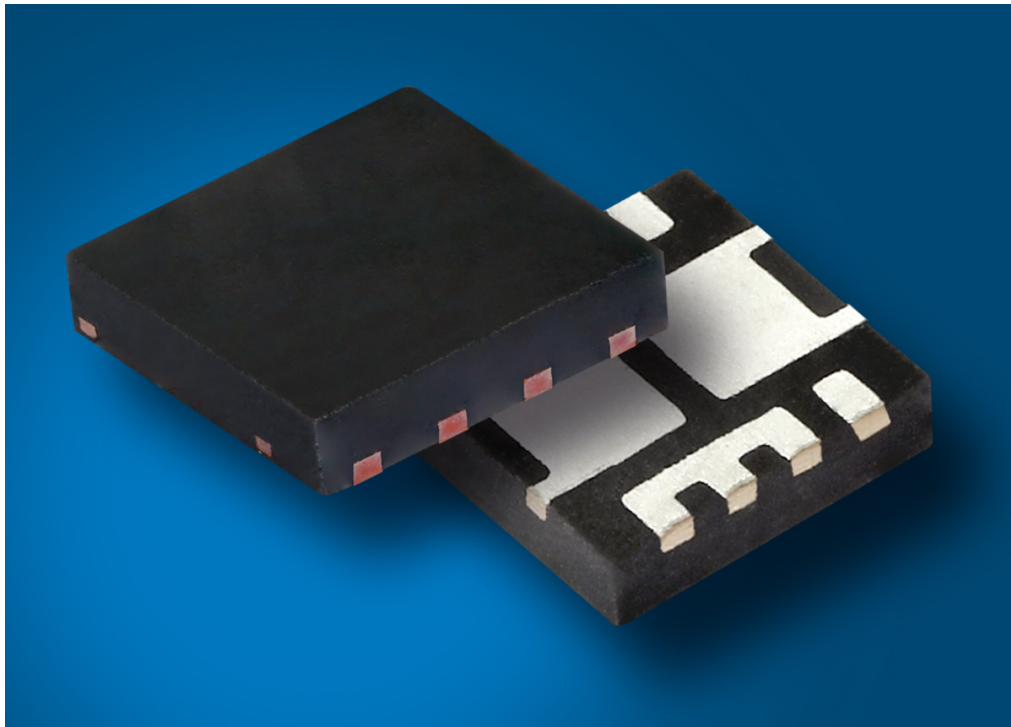


TELECOMS

30 V MOSFETs save space and power in dc-dc converters

Vishay SIZF5302DT and SIZF5300DT benefit from excellent thermal performance of 3 mm x 3 mm PowerPAIR package.

Vishay has introduced a fifth generation of its TrenchFET[®] MOSFET technology which enables power-system designers to build smaller, more efficient dc-dc converters.



FEATURES

- 2 V maximum gate-source threshold voltage
- Maximum junction-to-case thermal resistance:
 - SIZF5302DT – 2.6°C/W
 - SIZF5300DT – 2.2°C/W
- ±100 nA maximum gate-source leakage current
- Operating-temperature range: -55° to 150°C

APPLICATIONS

- Computer and server peripherals
- Point-of-load power supplies
- Telecoms power supplies

The TrenchFET Gen V technology has been implemented in new low-voltage MOSFETs. The SIZF5302DT and SIZF5300DT are 30 V dual N-channel MOSFETs. The devices' combination of high- and low-side MOSFETs are suitable for operation in a 50% duty cycle. Thanks to low on-resistance and low gate charge, the MOSFETs enable designers to achieve high efficiency in high-frequency synchronous buck converters and in half-bridge circuits.

The MOSFETs are housed in a 3 mm x 3 mm PowerPAIR[®] package. Based on flip-chip technology, this package offers excellent thermal performance.

The SIZF5302DT features maximum on-resistance of 3.2 mΩ at 10 V, and gate charge of 6.7 nC. It can handle a maximum drain current of 100 A. The SIZF5300DT's maximum on-resistance is 2.4 mΩ at 10 V, and gate charge is 9.5 nC. Maximum current is 125 A.

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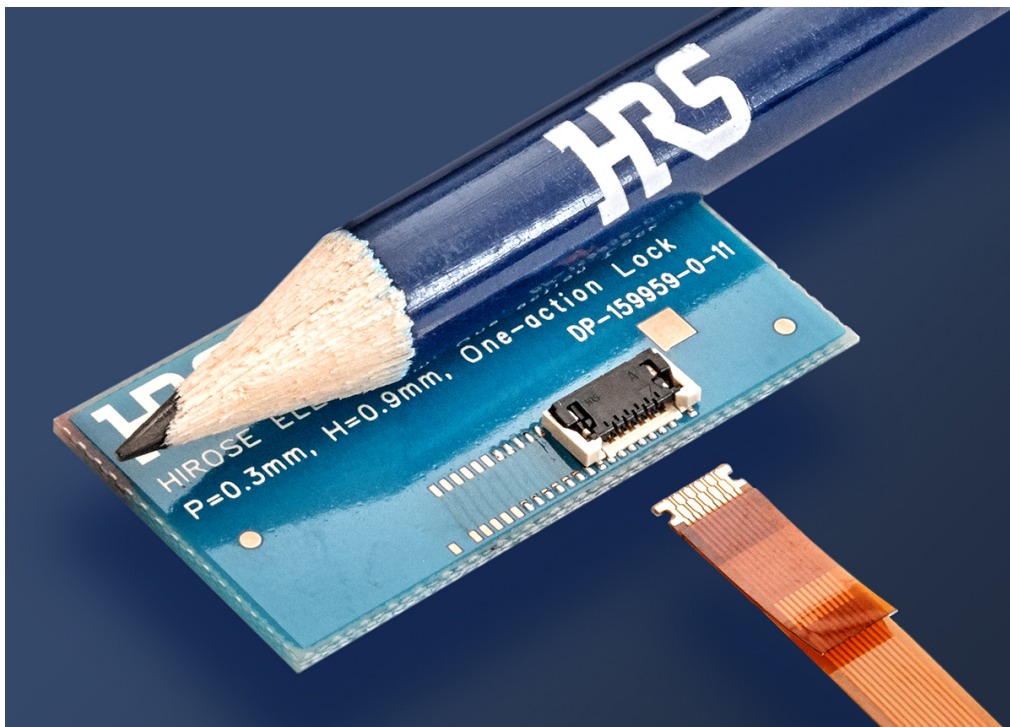
 **SAMPLES**



Space-saving FPC connector features robust single-action lock

Hirose FH72 series connector is just 0.9 mm high and has a contact pitch of 0.3 mm. The new Hirose FH72 series of flexible printed circuit (FPC) connectors is designed for quick, fail-safe installation in space-constrained applications.

With a contact pitch of just 0.3 mm and a height of 0.9 mm, this compact connector is suitable for small applications where space on the board is at a premium.



HRS HIROSE
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FEATURES

- 0.3 A rated current
- 30 V ac/dc voltage rating
- Number of contacts: 11, 15, 21, 31
- Compatible with 0.2 mm thickness FPC
- Rated for 10 mating cycles
- Operating-temperature range: -55°C to 85°C

APPLICATIONS

- Wearable devices
- Smart home applications
- Medical devices

The unique one-action lock on the FH72 series allows an FPC to be locked into place simply by inserting it. This locking mechanism and the connector's wide entry point make it possible for the FPC to be inserted with one hand or by automated machinery. This reduces both assembly time and the chance of mating failure that may be caused by movement involved in a two-step locking process.

Once in place, the high retention force achieved by the lock levers at either end of the connector ensures the tabbed FPC is held securely in the correct position. The correct placement of the FPC can be checked through small openings in the top of the connector.

The integral molding structure of the FH72 series leaves no gaps for solder wicking.

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New automated machine learning software tool for users of STM32 MCUs

NanoEdge AI Studio from STMicroelectronics simplifies and shortens the development of systems for condition-based monitoring and other AI applications.

NanoEdge™ AI Studio is a new machine learning (ML) tool which enables developers to create in a few simple steps an optimal ML library for their STM32 microcontroller-based project, based on a minimal amount of training data. A demonstration version, with the part number STNEAIEVALLIC, is available for three months for free experimentation.



FEATURES

- Designer can optimize for accuracy, confidence, inference time, and memory footprint
- Embedded emulator to test library performance live
- Native support for STM32 development boards with no configuration required
- Easy portability between STM32 MCUs

APPLICATIONS

- Industrial equipment
- Consumer devices

A PC-based push-button development studio, NanoEdge AI Studio can easily be used by developers who have no experience in data science projects. The tool can generate four types of library: anomaly detection, outlier detection, classification, and regression libraries.

An **anomaly detection library** is generated from a minimal amount of data examples showing normal and abnormal behaviors. Once created, the library runs in an STM32 microcontroller to first train and then infer directly on the device. The library learns the equipment's behavior from data acquired locally and adapts to this behavior. Once trained, the inference engine compares data coming from the equipment over time against the locally created models to identify and report anomalies.

Outlier detection can be used to detect any abnormality with the one-class classification method. No example of abnormal behavior is needed. After importing normal signals into the studio, the STM32 MCU will create an optimized outlier detection library.

A **classification library** can be used to classify a collection of data, such as types of equipment defects in a condition-based monitoring ML application. When running on an STM32 MCU, the classifier analyzes live data and indicates the percentage of similarity with its classifier model derived from training data.

A **regression algorithm** can be used to extrapolate data and predict future data patterns. The developer first imports signals and target values into the desktop tool. Then it only requires a few steps to generate a smart library to, for example, improve energy management or forecast the remaining lifetime of an equipment.

These libraries can be combined and chained together. In this chained mode, anomaly or outlier detection could detect a problem on the equipment, classification could identify the source of the problem, and regression could extrapolate information and provide insight into the cause of the problem for the maintenance team.

The input signals can include vibration, pressure, sound, motion, magnetic fields, temperature, time-of-flight and more. Multiple sensors can be combined, either in a single library, or using multiple libraries concurrently.

The libraries generated by NanoEdge AI Studio are small enough to run on STM32 MCUs based on an Arm® Cortex®-M0+ core.

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TELECOMS

Flexible MCU improves touch-sensing performance in HMI applications

New Infineon PSoC 4100S Max supports latest CAPSENSE technology, and provides more memory capacity and I/Os.

Infineon has introduced the PSoC™ 4100S Max family of microcontrollers which support the fifth-generation CAPSENSE™ touch-sensing technology, bringing new capabilities and better performance to human-machine interface (HMI) applications in smart home, industrial and automotive applications.



The Infineon PSoC 4100S Max's new features include dual fifth-generation CAPSENSE blocks, which offer a better signal-to-noise ratio thanks to a new ratiometric analog architecture and advanced hardware filtering. This results in superior liquid tolerance, and robust and reliable touch-sensing performance in harsh environments. The fifth-generation CAPSENSE also gives higher sensitivity to enable the use of smaller sensors, as well as longer proximity detection range. The new CAPSENSE supports a much wider range of overlay thicknesses and materials.

The PSoC 4100S Max, which includes a 48 MHz Arm® Cortex®-M0+ CPU core with a DMA controller, features up to 384 kbytes of Flash memory and up to 84 GPIOs, as well as a CAN-FD controller. An I2S master interface supports fully embedded audio solutions. This latest PSoC device also includes a cryptographic accelerator for fast and efficient cryptographic operations.

The MCU is supplied in various TQFP package sizes: 48-lead 7 mm x 7 mm, 64-lead 10 mm x 10 mm, and 100-lead 14 mm x 14 mm.

The MCU is compatible with the latest ModusToolbox™ 3.0 development platform, which can be downloaded from the Infineon Developer Center. The ModusToolbox software, which provides a collection of development tools, libraries, and embedded runtime assets, offers a flexible and comprehensive development experience.



FEATURES

- Supports mutual and self-capacitance touch sensing
- AEC-Q100 automotive-qualified version available
- Programmable analog blocks:
 - 12-bit, 1 Msample/s SAR ADC
 - Two op amps configurable as programmable gain amplifiers, comparators and more
 - Two low-power comparators
 - Two multi-sense converter blocks for touch sensing
- Programmable digital blocks
 - Eight 16-bit timer/counter/PWM blocks
 - Five serial communication blocks
 - Segment LCD
 - Two I2S master channels

APPLICATIONS

- Industrial control
- Automotive HMI systems
- Home automation
- Large home appliances
- Robots
- Printers
- Smart thermostats
- Air-conditioning units

FREE DEV BOARD

The PSoC 4100S Max Pioneer Kit is a low-cost hardware platform that enables the development and debugging of the PSoC™ 4100S Max device. The kit provides CAPSENSE™ technology with on-board capacitive sensing interfaces including buttons, slider, touchpad, and proximity sensors.

Orderable Part Number
CY8CKIT-041S-MAX

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TELECOMS

Buck converter IC performs direct conversion of 60 V to 3.3 V

BD9V101MUF-LB from ROHM Semiconductor uses innovative technology to maintain stable output with pulse widths as short as 20 ns.

ROHM Semiconductor has developed technology, called Nano Pulse Control™, which enables direct power conversion from 60 V to 3.3 V. The technology provides a way for manufacturers to meet the growing demand for power supplies operating from a 48 V power distribution bus in applications such as mild hybrid electric vehicles, forklift trucks, base station back-up power supplies, and industrial robots.



The Nano Pulse Control technology has been implemented in products including the BD9V101MUF-LB, a current-mode synchronous buck converter. The converter, which operates from a wide input-voltage range of 16 V to 60 V, maintains stable control of the output voltage with very short pulse widths down to a minimum of 20 ns. This enables direct conversion from 60 V to 3.3 V at a switching frequency of 2.1 MHz. This high switching frequency means that the power-system designer can use smaller magnetics and capacitors, reducing the system board footprint. The BD9V101MUF-LB is housed in a package measuring 4 mm x 4 mm.

Reliable operation of the BD9V101MUF-LB in challenging automotive and industrial conditions can be maintained thanks to the provision of comprehensive protection functions. These include:

- Over-current protection
- Input under-voltage lockout
- Input over-voltage lockout
- Thermal shutdown
- Output over-voltage protection
- Short-circuit protection

Nano Pulse Control is one of a set of nano power supply technologies that were developed with the aid of ROHM Semiconductor's advanced analog expertise, which encompasses circuit design, processes, and layout, and that take advantage of the company's vertically integrated production system.

ROHM
SEMICONDUCTOR

FEATURES

- Output-voltage range: 0.8 V to 5.5 V
- 1 A maximum output current
- Long-term product support
- Soft start
- Operating-temperature range: -40°C to 150°C

APPLICATIONS

- Industrial equipment
- Automotive power supplies
- Consumer devices

FREE DEV BOARD

This evaluation board enables the developer to exercise the BD9V101MUF's ability to step an input voltage of 60 V directly to 3.3 V.

Orderable Part Number
BD9V101MUF-EVK-001

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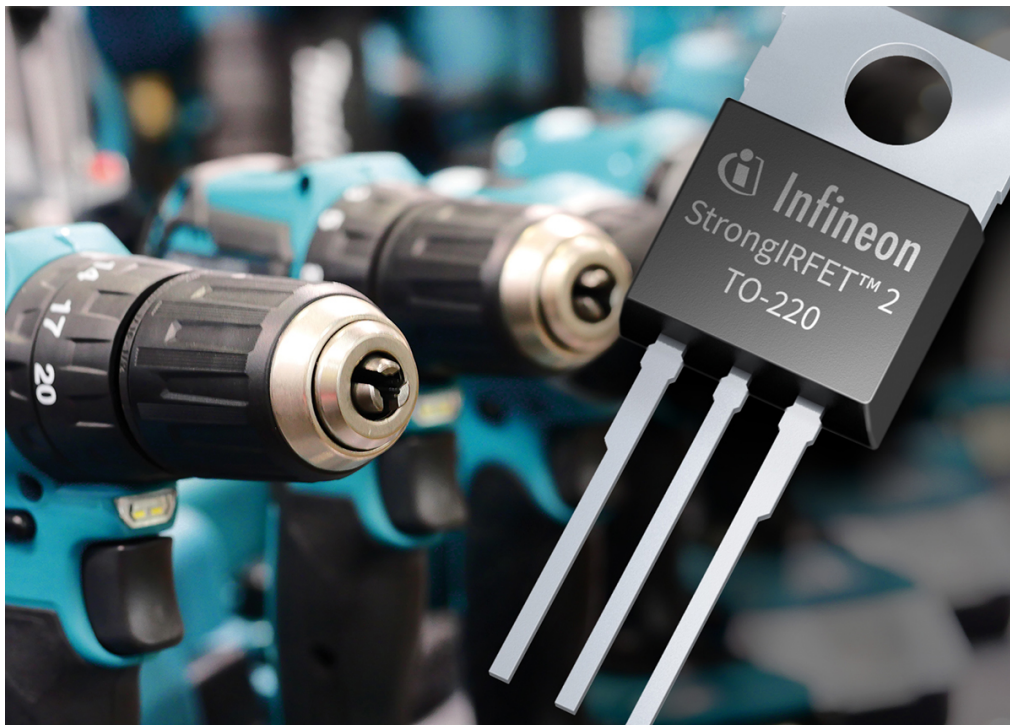


TELECOMS

New power MOSFET family offers higher efficiency in switching converters

Infinion StrongIRFET 2 MOSFETs offer lower on-resistance and gate charge than earlier StrongIRFET products.

The StrongIRFET™ 2 family of N-channel power MOSFETs from Infineon offers higher efficiency in switching power-conversion applications than the first generation of StrongIRFET devices, while matching the attractive price/performance ratio and broad availability.



FEATURES

- Operating-temperature range: -55°C to 175°C
- 100% avalanche tested
- Gate threshold voltage: 2.8 V or 3 V

APPLICATIONS

- Switch-mode power supplies
- Power adapters
- Motor drives
- Battery-powered applications
- Battery management systems
- Uninterruptible power supplies
- Light electric vehicles

The new StrongIRFET 2 technology offers up to 40% lower on-resistance and up to 60% lower gate charge. Increased current ratings allow for higher current-carrying capability, eliminating the need to parallel multiple devices. This results in lower bill-of-materials cost and a smaller board footprint.

The StrongIRFET 2 MOSFETs are suitable for both low and high switching frequencies, and with breakdown-voltage options of 40 V, 60 V, 80 V and 100 V, they fit a broad range of applications.

The new MOSFETs are available now in an industry-standard TO-220 through-hole package. The standard pin-out allows for drop-in replacement of other MOSFETs. Products in the family are also available in TO-220 FullPAK, D2PAK, D2PAK 7-pin, DPAK and TOLL package options.

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TELECOMS

Motion sensor supplies six-axis outputs for Industry 4.0 applications

ISM330DHCX from STMicroelectronics is an accurate, low-power and low-noise MEMS sensor.

The ISM330DHCX from STMicroelectronics is a system-in-package which combines a high-performance 3D digital accelerometer and 3D digital gyroscope to provide a six-axis motion sensor output. It is ideal for use in condition-based monitoring, predictive maintenance and other Industry 4.0 applications.



Part of a broad family of MEMS sensor modules, it takes advantage of ST's robust and mature micromachining processes. In the ISM330DHCX the sensing elements of the accelerometer and gyroscope are implemented on the same silicon die, giving superior stability and robustness.

The ISM330DHCX has a full-scale acceleration range of $\pm 2\text{ g}/\pm 4\text{ g}/\pm 8\text{ g}/\pm 16\text{ g}$ and a wide angular rate range between ± 125 degrees/s and $\pm 4,000$ degrees/s.

Factory-calibrated, the ISM330DHCX achieves a high level of accuracy and stability, and produces very low noise. The output data from the accelerometer and gyroscope are fully synchronized.

The motion sensing capabilities of the ISM330DHCX are supplemented by signal processing functions which help developers to implement designs for smart and complex sensor nodes that provide high performance at very low power. These include a machine learning core, programmable finite state machine, FIFO, sensor hub, event decoding, and interrupts.



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FEATURES

- Built-in temperature compensation
- SPI/I2C serial interface
 - Auxiliary SPI for output of gyroscope and accelerometer
- Interrupt functions:
 - Tilt
 - Free-fall
 - Wake-up
 - 6D/4D orientation
 - Click and double-click
- Pedometer, step detector and step counter
- Operating-temperature range: -40°C to 105°C

APPLICATIONS

- Industrial robots
- Condition-based monitoring
- Asset tracking
- Smart home automation
- Personal health monitoring equipment

FREE DEV BOARD

The STEVAL-MKI210V2K evaluation kit includes the STEVAL-MKI210V2 main board and the STEVAL-MKIGIBV5 adapter board. The main board carries the ISM330DHCX motion sensor, and is connected to the adapter board through a flat cable to render it compatible with the STEVAL-MKI109V3 motherboard.

Orderable Part Number
STEVAL-MKI210V2K

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TELECOMS

New MOSFETs double safe operating area to provide extra headroom for hot-swap and soft-start

Application-specific MOSFETs from Nexperia that feature optimized on-resistance and wide SOA can manage large inrush currents in 12 V power systems.

Nexperia has extended its portfolio of application-specific MOSFETs, or ASFETs for hot-swap and soft-start applications with the introduction of 10 new 25 V and 30 V devices.



nexperia

FEATURES

- Fully characterized at 125°C
- Supported by hot SOA curves
- Low conduction losses
- Less than 1 μ A leakage current at 25°C
- Copper-clip package for low parasitic inductance and resistance

APPLICATIONS

- Servers and computing equipment
- Networking equipment
- eFuses

The new ASFETs combine a wider safe operating area (SOA) with very low on-resistance, making them ideal for use in 12 V hot-swap power systems, such as those found in data center servers and communications equipment.

In hot-swap applications, damage caused by high inrush current can impair the reliability of standard low-voltage MOSFETs. The Nexperia ASFETs for hot-swap and soft-start applications eliminate this problem by providing an enhanced SOA, marking their ability to withstand high current bursts generated when the power supply to the host equipment is momentarily interrupted.

For example, the PSMNR67-30YLE ASFET offers a 2.2x stronger SOA than previous technologies could provide. Strengthening a MOSFET to increase SOA normally entails a trade-off of higher on-resistance, but in the PSMNR67-30YLE maximum on-resistance is as low as 0.7 m Ω .

In addition, the Spirito effect, in which the SOA curve has a steeper downward slope at higher voltages, has been eliminated. The ASFETs' exceptional performance is also maintained across the full voltage and temperature range.

Part Number	Breakdown Voltage	Maximum On-resistance at 10 V	Maximum Drain Current	SOA Current Capability at 12 V for 10 ms
PSMNR56-25YLE	25 V	0.63 m Ω	320 A	40 A
PSMNR68-25YLE	25 V	0.77 m Ω	285 A	30 A
PSMNR89-25YLE	25 V	0.98 m Ω	270 A	27 A
PSMNR98-25YLE	25 V	1.11 m Ω	255 A	23 A
PSMN1R6-25YLE	25 V	1.88 m Ω	185 A	16 A
PSMNR67-30YLE	30 V	0.70 m Ω	365 A	40 A
PSMNR82-30YLE	30 V	0.87 m Ω	330 A	30 A
PSMN1R0-30YLE	30 V	1.11 m Ω	275 A	27 A
PSMN1R1-30YLE	30 V	1.26 m Ω	265 A	23 A
PSMN2R1-30YLE	30 V	2.17 m Ω	160 A	16 A

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TELECOMS

New Arm-based MCUs include Bluetooth Low Energy connectivity

Microchip has introduced its first Arm[®] Cortex[®]-M4F-based PIC microcontroller family to provide built-in Bluetooth[®] Low Energy connectivity. The PIC32CX-BZ2 MCU family offers excellent analog performance and comprehensive design support alongside wireless functionality.



FEATURES

- AEC-Q100 Grade 1-qualified versions available
- Up to +12 dBm output power
- Up to -103 dBm sensitivity
- I2C, SPI, USART and RS-485 interfaces
- 16-channel DMA controller
- Analog comparator
- Real-time counter with clock

APPLICATIONS

- Consumer devices
- Home and building automation
- Lighting controls

The new PIC32CX-BZ2 MCU family is backed by a comprehensive ecosystem for developing both wireless functionality and the host application. The use of a PIC MCU with built-in Bluetooth connectivity both helps OEMs to achieve regulatory certification, and assures them of long-term supply of a critical element of system functionality.

The Microchip PIC32CX-BZ2 family is comprised of both system-on-chip (SoC) devices and complete modules supplied with certificates of compliance with global regulations. The PIC32CX1012BZ25048-I and PIC32CX1012BZ25048-E SoCs are supplied in a 48-lead, 7 mm x 7 mm QFN package. The WBZ451PE-I module includes a PCB antenna, and the WBZ451UE-I module has a u.FL connector for an external antenna.

Alongside the PIC32CX-BZ2 Bluetooth Low Energy functionality, the MCUs also include Zigbee wireless stacks and over-the-air (OTA) update capabilities. Hardware features include an eight-channel, 12-bit analog to digital converter ADC, multiple timers/counters for control channels, an on-board AES encryption engine, and a broad set of interfaces to touch-sensing, CAN, sensor, display and other peripherals.

The 1 Mbyte of Flash memory in the MCU is sufficient to store large application code bases, as well as multi-protocol wireless stacks and OTA updates.

Development on the PIC32CX-BZ2 MCU family is supported by the MPLAB[®] Harmony 32-bit embedded software development framework. MPLAB Code Configurator integration enables developers to quickly begin prototyping with the PIC32CX-BZ2 family using drag-and-drop automatic code generation. Numerous application code examples are hosted on GitHub.

FREE DEV BOARD

The PIC32CX-BZ2 and WBZ451 Curiosity Development Board, based on the WBZ451PE module, is supplied with an out-of-the-box multi-protocol demonstration application, and features a temperature sensor, a current measurement header, an RGB LED, and a MikroElektronika mikroBUSTM socket to attach sensor and add-on boards.

Orderable Part Number
EV96B94A

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TELECOMS

New high-density F-RAM memory offers low-power solution for mission-critical data logging

EXCELON ferroelectric RAM non-volatile memories from Infineon achieve ultra-fast read and write speeds.

Infineon has announced that new 8 Mbit and 16 Mbit EXCELON™ ferroelectric RAM (F-RAM) memories, the industry's highest density serial F-RAMs, are commercially available. The new products extend the memory capacity of the EXCELON range: existing products offer memory densities of 2 Mbits and 4 Mbits.



EXCELON F-RAM non-volatile memory offers the very fast write speed, unlimited read/write cycle endurance, and ultra low-power operation required in data-logging applications. Used in automotive and industrial systems, F-RAM helps to prevent data loss in harsh operating environments, and in the event of power loss.

The new EXCELON F-RAM support data throughput at rates up to 54 Mbytes/s over a low pin-count interface. The read and write performance is equivalent to that of parallel-interface, battery-backed SRAM, achieving access times as fast as 35 ns.



FEATURES

- Rated for 100 trillion read and write cycles
- Operating-voltage range: 1.71 V to 3.6 V
- Maximum operating temperature up to 105°C
- AEC-Q100 Grade 3 qualified automotive versions available

APPLICATIONS

- Automotive systems
- Industrial equipment
- Medical equipment
- Computing equipment
- Networking equipment
- Smart meters
- Multifunction printers

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TELECOMS

Low-power six-axis sensor supports motion detection and gesture recognition

The STMicroelectronics LSM6DSO16IS is a system-in-package which combines a three-axis digital accelerometer and a three-axis digital gyroscope. It also includes an innovative sensor signal processing unit for implementing AI algorithms at the edge.



life.augmented

FEATURES

- Low operating current:
 - 0.59 mA in high-performance mode
 - 0.46 mA in low-power mode with ISPU inactive
- 70 $\mu\text{g}/\sqrt{\text{Hz}}$ noise in high-performance mode
- SPI/I2C serial interface
- Operating-temperature range: -40°C to 85°C
- Temperature sensor

APPLICATIONS

- IoT devices
- Wearable devices
- Smart watches
- Personal health monitoring devices
- Smart pens
- Gaming equipment
- Remote controls

The low-power features of the LSM6DSO16IS mean that in always-on mode it provides optimal results in personal electronics equipment and IoT devices while extending battery run-time. It can be used for complex motion detection and gesture recognition, and for activity recognition and tracking.

The LSM6DSO16IS has a full-scale acceleration range of $\pm 2 \text{ g}/\pm 4 \text{ g}/\pm 8 \text{ g}/\pm 16 \text{ g}$ and an angular rate range of between ± 125 degrees/s and $\pm 2,000$ degrees/s. The module provides a set of programmable interrupt functions. An on-chip sensor hub manages the inputs from up to six sensors: the internal accelerometer and gyroscope, and four external sensors.

The LSM6DSO16IS embeds a new ST signal processing block, the intelligent sensor processing unit (ISPU), to provide real-time sensor data to the host application. The ISPU is an ultra low-power, high-performance programmable core which can execute signal processing and artificial intelligence (AI) algorithms at the edge. The ISPU supports C programming, and is backed by an ecosystem of libraries and third-party tools and development environments. Its circuitry is optimized for the real-time execution of algorithms, providing a streamlined implementation of AI in wireless sensor nodes.



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TELECOMS

PCIe Gen 5 connectors meet demand for high-performance computing

TE Connectivity has launched a new family of card electromechanical (CEM) connectors which are compatible with the new fifth generation of the PCI Express (PCIe) CEM standard and are backwards-compatible with earlier generations of the PCIe standard.



FEATURES

- 85 Ω impedance
- 1.0 mm pitch
- Pin-count options: x16, x8, x4, x1
- 1.1 A minimum current rating per pin

APPLICATIONS

- Servers
- Storage equipment
- Work stations
- Embedded systems
- Industrial computers
- Desktop PCs

Data centers and communications equipment use PCIe Gen 5-compatible processors and servers to reach new levels of performance in cloud computing and other demanding applications. Now the new TE PCIe Gen 5 CEM connectors provide an interconnect solution which meets the application need for high-speed data transfers and high signal integrity, offering data rates up to 32 gigatransfers per second (GT/s) over a differential signal pair.

The new connectors are backwards-compatible with PCIe Gen 4/3/2/1 connectors in both interface and footprint. They are supplied in various vertical surface-mount mechanical configurations.

TE Connectivity and TE connectivity (logo) are trademarks.

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TELECOMS

Using SiC MOSFETs: the when, the where and the how

One of the world's largest suppliers of silicon carbide MOSFETs, onsemi gives advice here about implementing these new devices in power-system designs.



The advantages of the wide bandgap semiconductor material, silicon carbide (SiC), are well known to designers of power systems: higher efficiency, more tolerance of high operating temperatures, and faster switching frequency. But replacing conventional silicon superjunction MOSFETs with SiC MOSFETs is not a trivial task, and so designers need to be sure that the advantages of the SiC material will be realized in the application before making the switch.

This Design Note provides a high-level guide to when a SiC MOSFET is the right choice, and to the latest advances in EliteSiC semiconductor technology from onsemi.

High-level overview of SiC MOSFET applications

Power-system designers are familiar with the applications for which either silicon IGBTs or silicon superjunction MOSFETs are best suited. As for SiC MOSFETs, their advantages are most likely to be realized in an economically viable way in power circuits that switch at high frequencies of 100 kHz or higher, and that operate within a wide range of line and load conditions. SiC MOSFETs work best in high-power applications of up to several kW, and where a reverse power flow is required. Finally, SiC MOSFETs are suitable for applications in which system power is sourced from the grid.

Application or product types to which these conditions typically apply include:

- Power factor correction (PFC) converters handling a load of 3 kW or more
- Embedded PFC and dc-dc converter circuits
- Motor drives with a load of more than 1 kW
- Solar power generation equipment handling more than 5 kW
- Uninterruptible power supplies (UPS) rated for a load of more than 5 kW
- Electric vehicle charging stations and on-board chargers

In these applications, SiC MOSFETs outperform silicon power switches because of their superior physical characteristics. The figures-of-merit of SiC MOSFETs are markedly superior in:

- On-resistance x reverse-recovery charge
- On-resistance x output charge
- On-resistance x output energy

In addition, a SiC MOSFET's on-resistance remains stable between 25°C and 150°C, whereas in superjunction MOSFETs and IGBTs, on-resistance can double towards the high end of the operating-temperature range. This means that, in applications subject to high operating temperatures, the efficiency advantage of SiC MOSFETs will be particularly striking. It is also worth noting the superior avalanche ruggedness of SiC MOSFETs compared to both IGBTs and superjunction MOSFETs.

The case for the defense of silicon power switches rests mainly on the familiarity and low unit prices. In addition, superjunction MOSFETs are particularly easy to drive, and are tolerant of a very wide range of gate-drive voltages. By contrast, SiC MOSFETs require a carefully regulated gate-drive circuit operating either between 0 V and 15 V, or between -5 V and 18 V depending on the part. The higher gate-threshold voltage of a superjunction MOSFET also gives it better noise immunity.

A strong commercial case for adopting SiC MOSFET technology

The case for using SiC MOSFETs is shown in Figure 1. The robust nature of the devices means that they support simpler topologies which use fewer switches. In these topologies, SiC MOSFETs can switch at higher frequencies than superjunction MOSFETs, and at much higher frequencies than IGBTs. This means that a circuit based on SiC MOSFETs uses smaller magnetic and capacitive components.

In addition, as noted above SiC MOSFETs are highly tolerant of high operating temperatures, and on-resistance does not rise dramatically at high temperatures, so they can be paired with a smaller heat-sink and require less cooling material.

1. SiC – Silicon Carbide Drives Increased Power Density

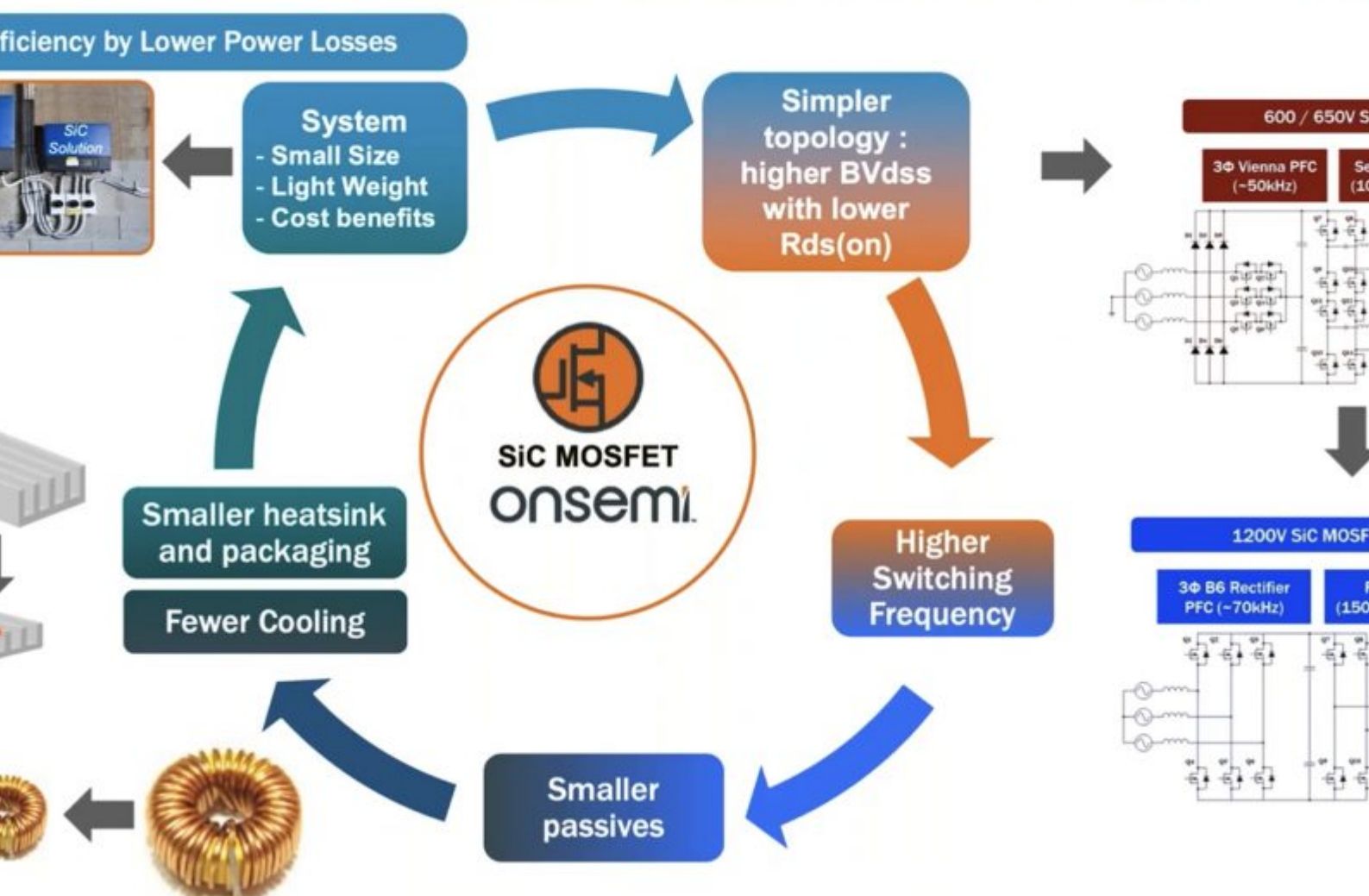


Fig. 1: Use of a SiC MOSFET results in system-wide benefits

The result is that a power circuit based on SiC MOSFETs has the following advantages over the superjunction MOSFET-based alternative:

- Smaller
- Lighter
- Uses less material
- Requires fewer components
- In many cases, lower total cost

Comprehensive testing in application circuits by onsemi demonstrates the superior characteristics of its EliteSiC MOSFETs. The reduction in switching losses is particularly remarkable. In a test circuit which implements a high-voltage totem pole PFC converter, onsemi has demonstrated that turn-on loss in a SiC MOSFET is 133% lower than that of an equivalent superjunction MOSFET. Turn-off loss is 22% lower.

SiC MOSFETs also offer a big advantage in high-voltage LLC converters thanks to their wide dead-time window, which is a feature of the SiC device's lower gate charge and output charge compared to superjunction MOSFETs, and its very low reverse-recovery current.

Tools to support design implementations of the latest SiC technology

onsemi provides unique design technology to support the work of designers implementing SiC MOSFET-based applications. Its SPICE simulator has been completely redesigned to take into account all the physical properties of its EliteSiC MOSFETs. Device-specific models have been developed which give industry-best accuracy when simulating the electro-thermal characteristics of a SiC MOSFET under the designer's choice of operating conditions.

The SPICE tool, detailed documentation and application notes from onsemi help designers to take advantage of the large portfolio of available EliteSiC MOSFETs and diodes. The company has now introduced its third generation of SiC technology in both MOSFETs and diodes, while continuing to supply parts built on the first- and second-generation technology.

The third-generation MOSFETs are divided into two broad families:

- M3S EliteSiC MOSFETs for high-speed applications such as EV chargers, on-board chargers and solar power generation equipment
- M3P/T EliteSiC MOSFETs for applications requiring low on-resistance and a high short-circuit withstand threshold, such as on-board chargers, UPS, energy storage, and high-power industrial equipment

The third-generation D3 EliteSiC diodes are also available, and are optimized for high-frequency applications including PFC power stages and output rectification.

The onsemi portfolio includes both discrete devices in a range of electrically optimized package styles, and integrated power modules.

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SAMPLES

Low-power redriver improves signal integrity of high-speed MIPI data paths

Diodes Incorporated has announced the latest addition to its broad portfolio of ReDrivers™ products with the release of a 1.8 V, 2.5 Gbits/s redriver which has four data lanes. The DIODES™ PI2MEQX2505 redriver is the industry's first to support the MIPI D-PHY 1.2 protocol. The PI2MEQX2505 enables board designers to extend trace lengths without compromising latency or power consumption.



FEATURES

- Supports MIPI DSI bi-directional LP mode
- Programmable output swing and pre-emphasis levels
- Operating-temperature range: -40°C to 85°C

APPLICATIONS

- Mobile devices
- IoT devices
- Laptop computers and PCs
- Tablet computers
- Cameras
- Industrial PCs
- Embedded systems

The PI2MEQX2505 may be used to extend PCB trace lengths in camera systems with a MIPI D-PHY interface while minimizing both latency and power consumption. The redriver consumes 135 mW in active mode, 5 mW in low-power mode, 2 mW in ultra low-power mode, and just 0.2 mW in standby mode. This low power consumption helps to extend the battery life of portable devices that include MIPI cameras, such as laptops and personal computers.

This redriver product has four differential channels providing programmable receiver equalization, output swing, and pre-emphasis functions. Equalization is controlled by either I2C interface or pin-strap control. It optimizes performance over a variety of physical media by reducing inter-symbol interference.

The PI2MEQX2505 is supplied in a 28-lead TQFN package which measures 3.5 mm x 5.5 mm, enabling designers to implement systems with high-density channel routing.

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Dual-port USB Type-C/USB PD power controller accelerates development of power source applications

The FUSB15201 from onsemi is a dual-port USB Type-C[®] and USB Power Delivery (PD) controller for power sources in products such as automotive charging modules, industrial power supplies, USB charging ports, and mains power outlets, and is backed by a full firmware solution and API.



onsemi[™]

FEATURES

- High-voltage protection on CC and D_± pins
- 10-bit ADC for accurate monitoring of bus voltage, external temperature, and voltages
- AEC-Q100 Grade 2 qualified
- I2C interface
- Dual USB BC1.2 provider emulation

APPLICATIONS

- Desktop computers
- Automotive systems
- Industrial equipment
- Consumer devices
- Portable and wireless devices

The FUSB15201 provides a complete, off-the-shelf implementation of USB PD 3.0 and USB Type-C 2.1 power source functionality. The controller includes a low-power Arm[®] Cortex[®]-M0+ processor core with customized peripherals for USB PD 3.0 applications.

A full open-source firmware solution provided by onsemi includes advanced power-sharing algorithms which manage total system power efficiently and effectively. The firmware also provides an applications programming interface (API) for development of a customer-specific device policy manager.

USB Type-C[®] and USB-C[®] are registered trademarks of USB Implementers Forum.



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TELECOMS

Shielded inductors lower costs and save space in high-current converters

The Vishay IHLE-2020CD-51 and IHLE-2020CD-5A inductors feature an integrated E-field shield for the reduction of EMI, enabling power-system designers to lower costs and save board space by eliminating separate board-level Faraday shielding.



FEATURES

- Inductance range at 100 kHz: 0.22 μ H to 15 μ H
- 155°C maximum operating temperature
- High resistance to thermal shock, moisture, and mechanical shock
- Handles high transient-current spikes without saturation

APPLICATIONS

IHLE-2020CD-5A

- Energy storage systems
- Servers and desktop PCs
- Notebook computers
- High-current point-of-load converters
- Power supplies for FPGAs and battery-powered devices

These additions to the IHLE[®] series of low-profile, high-current inductors are housed in a 2020 case with dimensions of 5 mm x 5 mm x 3.4 mm. The case has an integrated tinned copper shield which provides up to -20 dB of electric field reduction at 1 cm above the center of the inductor when the shield is connected to ground. It gives excellent attenuation of EMI noise in high-current filtering applications up to the inductor's self-resonant frequency. The shielded, composite construction of the IHLE-2020CD-51 and IHLE-2020CD-5A also limits buzz noise to very low levels.

The IHLE-2020CD-51 is for commercial applications, and the AEC-Q200-qualified IHLE-2020CD-5A is for automotive applications.

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TELECOMS

Synchronous buck controller ideal for stepping down high-voltage battery supply

The L3751 from STMicroelectronics is a synchronous dc-dc step-down power controller which can support extreme voltage-conversion ratios with good power efficiency. The L3751 operates from a very wide input-voltage range of 6 V to 75 V.



Operating from an input-voltage range of 6 V to 75 V, the L3751 provides an adjustable output of between 0.8 V and 60 V while switching at frequencies ranging from 100 kHz to 1 MHz. The controller is ideal for circuits that convert the output from a high-voltage battery or unregulated 24 V and 48 V bus to an application's 12 V or 5 V power rail.

In diode emulation mode, the L3751 implements a pulse-skipping function which maximizes efficiency at light loads, and limits output-voltage ripple. Forced PWM operation over the entire load range holds the switching frequency constant, and also minimizes output-voltage ripple.

The controller features a Power Good output which validates the regulated output voltage: this is useful for implementing power sequencing during a digital IC power-up phase.

The L3751 includes 7.5 V gate drivers compatible with standard MOSFETs, eliminating the need for external gate drivers in a converter circuit. Embedded protection functions include output over-current, under-voltage lockout, internal voltage monitoring, and thermal shutdown.

Developers can use the ST eDesignSuite software tool to configure the L3751 buck converter for the application. **The tool is available here.**



FEATURES

- 40 ns minimum on-time
- Internal voltage monitoring
- Low drop-out operation during line transients
- Adjustable soft-start or input-voltage tracking
- Operating-temperature range: -40°C to 150°C

APPLICATIONS

- Telecoms and networking equipment
- Fail-safe systems
- Industrial equipment

FREE DEV BOARD

The board provides a regulated 5 V output at a switching frequency of 230 kHz. The output voltage can also be set to 12 V using a jumper connector, or to a different voltage by changing a resistor. The STEVAL-L3751V12 is a 100 W demo board. The default maximum current is set to 15 A. It can be easily selected by changing a resistor.

Orderable Part Number
STEVAL-L3751V12

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TELECOMS

Aluminum polymer capacitors set new benchmark for temperature resistance

The Panasonic SP-Cap portfolio combines improved temperature performance with high capacitance values and ripple current ratings.



Panasonic INDUSTRY

FEATURES

- Capacitance-value range: 220 μ F to 470 μ F
- 6.3 A ripple current rating at 100 kHz
- Operating-temperature range: -55°C to 125°C

APPLICATIONS

- Base stations
- Networking equipment
- Servers
- Accelerators
- Industrial equipment

Panasonic Industry has introduced two series of SP-Cap aluminum polymer capacitors that give designers a new option to extend lifetime in high-temperature operating conditions.

The KX series offers endurance of 5,500 hours at 125°C, promising high reliability in high temperatures. These capacitors also last for a minimum of 1,000 hours at 85°C and 85% relative humidity, making them suitable for operation in demanding outdoor applications. The recently released JX series of SP-Cap capacitors offers similar reliability in demanding temperature and humidity conditions. The JX capacitors are rated for a lifetime of 3,000 hours at 125°C.

As aluminum polymer capacitors, the KX and JX series are typically specified when an application such as noise reduction or voltage smoothing requires low ESR, and the KX series features ESR of 9 m Ω . The SP-Cap capacitors offer an attractive alternative to multilayer ceramic capacitors (MLCCs) and pure tantalum capacitors thanks to the long lifespan and high stability.

The high capacitance also means that designs require fewer parts and a smaller PCB. They produce better performance than other capacitor types, especially in complex, low-profile electronic devices.

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