Component Focus: Pages 3-7
LUXEON V2 CSP LED from Lumileds produces very bright 760lm output at 2A drive current

Design Note: Pages 8-9
ON Semiconductor on robot design and TE Connectivity on very high-speed communications

Application Spotlight: Pages 12-16
Infineon’s XMC4700 MCUs: high-speed Arm® Cortex®-M4 core and real-time Ethernet capability

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Microsemi: advanced capabilities for implementing automatic speech recognition in smart speakers

Analog Corner: Pages 22-23
Featuring selected products for analog applications

Application Spotlight on:
Industrial Automation
New interface technology for true wireless earbuds

aims has introduced POW.COM, an innovative interface technology which enables power transfer and communication between a true wireless earbud and a charging cradle over a two-wire connection. A true wireless earbud previously required as many as six pins, compromising the mechanical design of a product which must be small enough to fit comfortably in the user’s ear. The POW.COM interface is implemented with the AS3442D header for the earbud, and the AS3447 client IC in each earbud.

Medical-grade wall-mount power adaptors comply with strict efficiency standards

MEAN WELL has released three 65W medical-grade wall-mount power adaptors: the GEM600 series which features an interchangeable AC plug for Europe, the US, UK and Australia; the GEM60E with a fixed plug for Europe; and the GSM60U with a fixed plug for the US. The GEM600 and GEM60E/U series adaptors may be plugged directly into 880-264V AC outlets, without pairing with an external AC cable. For medical safety applications they offer 2 x Means Of Patient Protection (MOPP). They also comply with the US Level VI and European EUP efficiency regulations.

Trust anchor solution provides secure connections to Google Cloud IoT Core

NXP Semiconductors has announced a solution for secure, scalable connections of devices using its AT17C to the Google IoT Cloud service. The solution based on the AT17C provides OEMs with a “Plug & Trust” experience for authenticating devices to Google Cloud IoT Core.

NXP’s AT17C is a trust anchor ready-to-use solution designed for integration into next-generation IoT devices, such as edge nodes and gateways. When embedded into devices, the chip signs a secure token and is validated by Google IoT Core to enable seamless peer-to-peer cloud connections.

New communications, control and sensor components point to an exciting future for industrial system design

One of the key ingredients of Industry 4.0 systems is communication between devices. Previous issues of FTM have covered the topics of wireless communication and security and encryption. Much of the technology shown previously is useful in industrial networks, but it is fair to say that the communications requirements of industrial equipment are somewhat specialized.

Today there are a number of ways of connecting sensors and actuators to a gateway, remote I/O module or I/O section of a PLC Level 1. The trend points towards IO-Link being used to replace traditional 4-20mA interfaces. In the middle layer, network protocols such as Profinet, Modbus, DeviceNet and CAN are being used to connect the device-level interfaces above to switches, gateways, PLC Level 2 and human-machine interface devices. On top of this is the control network, industrial Ethernet systems provide for real-time communications requirements – protocols such as DeviceNet, PROFINET, EtherCAT and Powerlink to link the middle layer to servers, routers, switches, or PCs.

Here we see a strong trend to connect these Operational Technology (OT) industrial networks with enterprise IT networks. This is driving consolidation in the form of Time-Sensitive Networking (TSN), which is specified by the IEEE 802.1 standard. TSN offers added determinism, shorter worst case delays, improved network robustness and better scalability.

The integration of industrial Ethernet call capabilities for the use of robust Ethernet switches. The WAGO series of multi-port switches featured on p16 is an ideal choice for industrial communications designs.

CSP LED sets new standard for flux and efficacy

It sets a new standard for flux and efficacy in the domain of CSP LED category, enabling luminaire manufacturers to create more efficient luminaire designs with a high lighting output. The LUXEON V2’s 2mm2 die provides design flexibility and supports high flux density. The 4,000K V2 die is capable of producing a typical light output of 315mW at an efficiency of 150lm/W when driven at 700mA, a figure we believe is not a “hot test” conditions at a junction temperature of 85°C. Output rises to 760lm when the LUXEON V2 is driven at 2A.

The LUXEON V2 offers a compact directional light source which maximises usable light: 99% of the light output is forward facing. The source luminance distribution is designed to match that of the LUXEON TX to enable drop-in replacement of the earlier device, and accelerates time-to-market with brighter, more efficient designs. The LUXEON V2 is supplied in a 3035 ceramic package with a three-strap footprint for ease of integration in board layouts.

Integrated light guides improve optical control to give more comfortable viewing of LED lighting

They are offered with a variety of CCT and CRI options. They also enable LED selection by parameters such as flux or forward voltage using the Oben Intelligent Assembly pick-and-place system for board-to-board consistency.

The Circuit of the LUXEON V2

• 2.4A maximum drive current
• CCT ranges: 2,700K, 3,000K, 4,000K, 5,000K, 5,700K, 6500K
• High color consistency over beam angle
• 2.36V forward voltage
• Low thermal resistance

APPLICATIONS
• Architectural lighting
• High and low bay lighting
• Stadium lighting
• Street and area lighting

FEATURES
• 3535 ceramic package
• Dimming electronics
• Integrated drivers
• Wired and wireless connectivity
• Advanced lighting controls

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**VISHAY**

Vishay’s SiR626DP is a fourth-generation TrenchFET® 60V N-channel MOSFET which enables power-system designers to improve the efficiency of DC-DC converters across the load profile.

The MOSFET combines low on-resistance with low output charge of just 68nC at a drain-source voltage of 50V and a gate-source voltage of 5V. Ideal for designs with a high-power output, the SiR626DP also features an optimized interconnection design which reduces package resistance by 66%. Total on-resistance is 40% lower than that of the previous generation of 60V MOSFETs from Vishay. This helps to minimize conduction loss and reduce operating temperature. As a result, DC-DC converter designs can increase both their power density and output current per device. The SiR626DP is supplied in a 6.2mm x 5.2mm SO-8 package.

**HIROSE**

Hirose has introduced a miniature board-to-board connector which features a rugged design and supports high data-transmission speeds of more than 10Gbits/s. This combination makes the new ER8 series ideal for use in industrial applications such as servomotors, servo-amps, AC drives and electric measuring instruments.

The ER8 is a licensed second source for the Samtec Edge Rate® series of connectors. With a pitch of only 0.8mm, the ER8 series’ contacts are optimized for signal integrity, ensuring reliable high-speed performance. The ER8 connectors offer a wide self-alignment range and a lower mating force than competing micro-pitch connectors while maintaining higher extraction forces. In addition, the ER8 series connectors have an increased contact wipe and insertion depth, making them ideal for industrial applications that require a high number of mating cycles and good resistance to shock and vibration. The ER8 series is available in parallel (mezzanine) and right-angle versions. The vertical connectors are offered with pin counts ranging from ten to 120 positions, while the right-angle model is offered with a 120-position version. Featuring vertical stacking heights from 7mm to 12mm, the ER8 meets the size requirements of the latest generation of industrial equipment.

**SUSUMU**

Susumu’s new URG series of thin-film chip resistors offers an improvement in reliability as well as in the linearity of its Temperature Coefficient of Resistance (TCR) compared to the high standard set by the existing RG series.

The URG series offers better absolute tolerance of resistance, at ±0.01%, than any other thin-film chip resistor on the market. It also offers the lowest TCR of ±0.02%/°C.

Susumu’s new URG series is compatible with IEEE 802.3ap specification for 10Gbits/s data rate, 100V AC voltage rating, 0.5A current rating, and 1206 EIA standard package sizes: 0603, 0805. It offers all the advantages of the thin-film type of resistor, such as low noise of -25dB to -35dB, and support for high frequencies up to 1GHz. In addition, the linearity of the URG series’ TCR makes it easy to develop an appropriate compensation algorithm.

For applications that require extreme precision and reliability, Susumu now offers a wide choice of resistor families, providing in addition to the URG series:

- The RG-PV series offering tolerance of ±0.02% and TCR of ±5ppm/°C
- The RG-LL series with tolerance of ±0.05% and TCR of ±5ppm/°C

Susumu’s URG series offers lower cost than the RG and RR series and high reliability of resistance over temperature range.
Triad’s 50/60Hz World Series Transformers

With more than 70 years of transformer design and manufacturing experience, Triad now offers over 500 different power transformers that are available off-the-shelf from the industry’s leading distributor network. In today’s shrinking world and global market, it is essential to design products that can be delivered worldwide. For this reason, Triad has designed one of the industry’s most complete offerings of international power transformers.

Triad’s World Series Transformers range in power from 1.1VA to 10kVA. Most have configurable 120/240V primaries with output voltages that range from 5.0 to 240V AC. They are UL recognised and TÜV tested to IEC global safety standards. They can be customised to your requirements and are backed by our world-class service.

**-C2 PC Mount Split Pack Class 2/3**

With dual primaries, -C2 Split Pack Transformers are the only device of their type with TÜV approval and are UL 5085-1 and 3 recognised. They utilize a Class F 155°C insulation system and can be used in myriad applications requiring inherently/non-inherently limited transformers.

**VPP PC Mount Transformers**

Triad’s VPP PC Mount World Series™ Transformers are an advanced line of more than 40 quality transformers. They are perfect for board-level applications requiring the added safety and security of insulating shrouds over the windings. They are also UL 5085-1 and 2/3 recognized.

** FEATURES **
- Split bobbin design
- No electrostatic shielding required
- Use in series, parallel or separate circuits
- High isolation between secondaries

** SPECIFICATIONS **
- Frequency: 50/60Hz
- Electrical rating: 1.1 to 36VA
- Nominal secondary voltage: 5 to 56V
- HIPOT dielectric: 4200V AC

** APPLICATIONS **
- Commercial and food and beverage equipment
- Motor speed controls
- Industrial controls
- Timers

** VPL Chassis Mount Transformer **

Triad’s VPL Series is similar to the VPP Series, but with chassis mounting and leads. The VPL sets the industry standard with European-style split bobbins. These leaded devices meet all international safety agency standards.

** FEATURES **
- Low inter-winding capacitance requires no electrostatic shielding
- 5500V isolation between primary and secondary
- Compact footprint

** SPECIFICATIONS **
- Frequency: 50/60Hz
- Electrical rating: 5 to 56VA
- Secondary voltage range between 5 to 36V

** APPLICATIONS **
- Battery charging
- Spa controls
- Soft drink machines
- Security access and control

** VPM Medical Toroidal Mount **

Triad’s VPM Series transformers offer output power up to 10kVA and are UL recognized and CE certified for medical applications. They feature toroidal construction with dual secondaries, allowing for both series or parallel connections. Faraday and flux band shield maintains low leakage current and low stray fields, respectively.

** FEATURES **
- Dual secondary windings for series or parallel connections
- Low leakage current and low stray fields
- Low temperature rise: 25°C to 55°C

** SPECIFICATIONS **
- Frequency: 50/60Hz
- Electrical rating: 25 to 10,000VA
- Insulation Class F: 155°C

** APPLICATIONS **
- Hospital equipment
- Biomedical equipment
- Test equipment
- Audio equipment

** VPT Toroidal Mount **

Triad’s VPT Series features a compact toroidal design, which is cost effective and efficient with higher power density and reduced magnetic fields. They are approved to UL 5085-1 and 2, CE IEC 61558-1, and CE IEC 61558-2-6 with Class B insulation for use up to 130°C.

** FEATURES **
- Isolated dual primary and secondary coils
- Class B (130°C) rated insulation
- High efficiency

** SPECIFICATIONS **
- Frequency: 50/60Hz
- Electrical rating: 25 to 2500VA
- Secondary voltage range between 5 to 230V

** APPLICATIONS **
- Oil/gas equipment
- Conveyor ovens
- Heat exchangers
- Music equipment

** VPS Chassis Mount Quick Connect **

Triad’s VPS Chassis Mount Transformers are chassis-mount devices requiring higher power up to 175kVA. They meet major U.S. and global standards (CSA, IEC and UL). They are among the industry’s most versatile transformers.

** FEATURES **
- Dual bobbin design with insulating shroud
- Meets global safety standards
- Quick disconnect connection

** SPECIFICATIONS **
- Frequency: 50/60Hz
- Electrical rating: 25 to 175VA
- Secondary voltage range between 5 to 230V

** APPLICATIONS **
- Oil/gas equipment
- Conveyor ovens
- Heat exchangers
- Music equipment

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Autonomous robots: solutions for motor control, image sensing and wireless communication

ON SEMICONDUCTOR

Efficient motor control for autonomous driving robots

ON Semiconductor offers a comprehensive range of power management, connectivity and sensor products which match the needs of advanced robot systems. In industry, robots are used to achieve higher productivity, lower cost and greater safety in the performance of repetitive tasks. As manufacturing becomes more integrated, robots will play an increasing role in a variety of assembly tasks, offering greater functionality, flexibility, range of motion, speed and precision.

The successful development of the next generation of autonomous industrial robots calls for new component technology in the fields of motor control, image sensing and short-range wireless communication. This Design Note introduces developments from ON Semiconductor which designers of autonomous robot systems can apply in new projects, as shown in Figure 1.

ON Semiconductor’s Intelligent Power Modules (IPMs) for motor control contain all the components needed for a BLDC drive stage integrated in a single package: this includes the six MOSFETs or IGBTs as well as the driver IC with integrated logic, control, detection and protection circuits. Because they are highly integrated, IPMs reduce system size and are easy to implement in motor-drive systems, helping to cut development time. They also benefit from thermally enhanced packaging, which helps to improve system reliability.

Control and safety components

One of the primary objectives for designers of autonomous industrial robots is to enable more accurate motion while accelerating production workflows and keeping the factory safe for human operators. To support these requirements, ON Semiconductor offers a market-leading portfolio of CMOS image sensors which are notable for their very high resolution and integrated features.

Although the architecture of a CMOS image sensor requires that each row of pixels is digitized individually, some devices can produce a global shutter read-out: the MT9V34A and AR0144 from ON Semiconductor both offer this feature. A global shutter eliminates the unwanted motion artifacts produced by image sensors that have a rolling shutter, and supports 3D stereo synchronization for depth mapping.

Bluetooth wireless communication for low power consumption

ON Semiconductor’s RSL10 is a multi-protocol radio System on Chip (SoC) which brings ultra-low-power Bluetooth® Low Energy radio technology to autonomous robot designs. Offering the industry’s lowest power consumption, the RSL10 provides advanced wireless features while optimizing system size and extending battery run-times. The highly integrated radio SoC features a dual-core architecture and a 2.4-GHz transceiver, providing the flexibility to support both Low Energy and proprietary or custom 2.4 GHz radio protocols.

ON Semiconductor’s MOSFETs for Battery Management and Protection

The NTMFSxxxx family of MOSFETs from ON Semiconductor feature the industry’s lowest on-resistance and have soft body-diode characteristics which enable increased application efficiency and reduced switching noise in motor drives and battery management systems. Current-sensor amplifiers, such as the NCS2x0 family, are used to monitor current in the inverter in order to provide important safety and diagnostic information to the motor-control system, and to perform overcurrent protection and support accurate power delivery.

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IoT Sensor Nodes in Smart Factories

As factories and manufacturing plants are getting “smarter” to meet the needs of relentless cost-optimization, faster time-to-market expectations, and open-source protocols – it has become increasingly important for companies globally to evolve their infrastructures to make use of real-time sensor data within their very own factory floors. Industrial developers can achieve this new requirement by incorporating connected, small form-factor IoT Sensor Nodes across a factory floor and on manufacturing equipment. These sensor nodes allow for important data such as machine temperature, gas leaks, process cycles, and more to be collected at local points in what will become “a Smart” Factory and then distributed to a central beacon so that a controller can make more informed decisions in running factory operations, emergency technical support, and more.

Cypress’ fully certified Bluetooth Module solutions and ultra-reliable Serial F-RAM Nonvolatile Memory products together are well-positioned to tackle a lot of the design challenges industrial engineers face with these IoT Sensor Nodes. Cypress’ easy-to-use PSoC 4 MCU-based BLE only modules provide the ability to create custom AFKs and programmable digital interfaces for interfacing with all different types of sensors. Cypress’ Dual Mode (BR/EDR/BLE) modules support advanced capabilities such as Bluetooth Mesh to enable these next-generation, large-scale M:M sensor networks. Both categories of modules support long-range capabilities up to 400m (line-of-sight) to ensure stable connections and avoid multi-path fading that is a result of busy factory environments. In addition, Cypress’ Serial F-RAM Nonvolatile Memories bring great value to Factory IoT Sensor Nodes as they provide infinite endurance and industrial-robustness. F-RAM Memories also have low-power consumption to extend the battery life of these energy-constrained devices. In fact, F-RAM consumes 200x less energy than serial EEPROM and 3,000x less energy than NOR Flash.

Programmable Logic Controllers (PLCs) – Powering Industrial Processes

Programmable Logic Controllers (PLCs) are essential to the success of current industrial factory systems as well as future ones. They are optimized and purpose-built to provide the necessary control logic to manufacturing operations, factory robots, and other important processes where there is zero room for error. They are also very diverse devices, with larger “brick-like” nugget form factors with a small number of inputs/outputs, to smaller, modular devices that can be networked and have thousands of inputs/outputs.

Cypress’ family of PSoC 4 Microcontrollers are uniquely qualified to bring value as a processor in a PLC design. The programmable analog and digital blocks of the PSoC 4200 and 4400 family provide flexibility and ease of use to interface with the various inputs/outputs that PLCs must interact with to properly provide logic control. The integration of the PSoC 4 architecture also can reduce PCB footprint and BOM cost of diverse PLC designs. As PLCs are so essential to control of industrial processes, Cypress’ F-RAM memories are the ideal choice for nonvolatile data logging as they ensure instant data capture – thus zero data is at risk in the event of a power outage. F-RAM’s infinite endurance in terms of read/write also is well-suited to withstand the large number of cycles that come with high-performance industrial processes.

At the heart of the next industrial revolution is the need for high-performance, energy efficient, and extremely reliable microcontrollers (MCUs), connectivity, and memory solutions. With a broad portfolio of products available today, and more coming in the future, Cypress’ solutions are architected and designed to meet these requirements. This article explores industrial applications and Cypress’ positioning in each – as well as next-generation technology Cypress is providing to solve the problems engineers will be facing in the industrial systems of tomorrow.
144MHz MCUs provide high-speed communications interfaces and advanced DSP-capabilities

Infineon

Infineon's XMC4700 family of microcontrollers based on the Arm® Cortex®-M4 processor core features high-performance digital-signal processing and floating-point unit capabilities. The XMC4700 MCUs also offer a wide selection of high-speed communication interfaces suitable for the complex, networked environment in which today's industrial equipment operates.

The core in the XMC4700 runs at a fast 144MHz, giving designers the freedom to run complex software applications in real time, as well as to handle data transfers at high speed. In addition to an Ethernet media access controller and USB interface, the XMC4700 devices feature six CAN nodes, providing robust multi-channel communication even in noisy industrial environments. The XMC4700 parts are particularly well suited to use in motor control, Electric Vehicle (EV) charging and power-supply applications.

Motor control

For toys and power tools, pumps and industrial automation systems, Infineon's XMC™-microcontrollers enable designers to create the most innovative, efficient, reliable and energy-friendly motor-control and drive systems. An XMC4700 MCU is an ideal controller for various types of motors, such as permanent magnet synchronous motors, brushless DC motors, AC induction motors, servomotors and brushed DC motors.

EV charging

Off-board charging, when users charge plug-in hybrids and pure EVs in their garage or an open parking lot, demands an MCU which can switch at high frequency to stay efficient and cost competitive. The XMC4700 portfolio is a great fit for the application as it integrates all the features needed for off-board charging, including:

• Platform concept to allow extensive customization
• Performance, efficiency and cost competitiveness
• Accurate analog and mixed-signal peripherals
• Fast timers and PWM peripherals

Switch-mode power supplies

Power-supply designs are subject to ever-increasing requirements. Some are fueled by customer demands; others by industry guidelines or regulations affecting power density, communication, modularity or efficiency. Semiconductor technology advances have enabled MCU manufacturers to develop a new class of products optimized for digital power-conversion applications, providing the right mix of features at the right price point. The XMC4700 devices are particularly well suited to new digital power designs because of their digital-signal-processing and floating-point unit capabilities, advanced timers and high-speed processor cores.

Waterproof speakers with compact frame sizes feature IP67 rating

CUI INC

CUI’s Audio Group has announced the addition of several waterproof micro-speaker models which have an Ingress Protection (IP) rating of IP67.

APPLICATION SPOTLIGHT

The new parts in the CMS product family are housed in compact, low-profile packages measuring as little as 15mm x 11mm. These waterproof speakers are ideal for portable and handheld electronic devices exposed to the moisture and contaminants found in industrial and outdoor applications.

These rectangular frame models can produce a maximum sound-pressure level ranging from 90dB to 92dB at a distance of 0.1m from the speaker. All the new CMS parts offer spring-contact, solder-pad, or wire-lead mounting styles. They are made with neodymium magnets and mylar cones for increased durability.

Compact IR LED generates uniform, parallel light output for high-precision applications

TT ELECTRONICS

TT Electronics has introduced a compact, infrared LED emitter which has the industry’s largest spot diameter of 7mm for reliable optical sensing and light detection in position encoders.

Offering up to 10mW total radiant power at the maximum current of 120mA, and a narrow 2.25° angle of half intensity, the GP2070L/C10 coupled optical flux vary efficiently on to the receiving photo sensor to ensure clearly detectable on/off transitions. Its integrated collimating lens creates a tight beam profile for use with accuracy-dependent devices such as radial or linear encoders for absolute or incremental measurement.

The surface-mount LED with integral moulded lens comes mounted on a 9.9mm x 9.9mm PCB substrate. The compact footprint and height of 6.3mm allow use in space-constrained designs. The GaAlAs LED emits wavelengths in the 840-870nm near-infrared range for good beam profile for use with accuracy-dependent devices such as radial or linear encoders for absolute or incremental measurement. The GaAlAs LED emits wavelengths in the 840-870nm near-infrared range for good

APPLICATIONS

• Handheld devices subject to moisture and contaminants

FEATURES

• 0.7W nominal input rating
• Resonance frequency range: 550 to 800Hz
• Impedance ratings: 6Ω or 8Ω

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APPLICATIONS

• Industrial automation
• Motor control
• USB, SD/MMC
• 10/100Mbits/s Ethernet with IEEE1588 time stamping
• 2,048kbytes

FEATURES

• Quad SPI, SCI/UART, FC, PS and LIN interfaces
• Two PWM timers
• Four delta-sigma demodulators
• External memory interface
• Safety package supporting 8L-2/3
• Operating temperature range: -40°C to 125°C

Various device options are available, including:

• USB, SD/MMC, 10/100Mbits/s Ethernet with IEEE1588 time stamping
• 2,048kbytes

To buy products or download data go to: www.FutureElectronics.com/FTM

Indiein's XMC4700 Relax Kit

The XMC4700 Relax Kit is the ideal tool for evaluating the XMC4700 portfolio. The kit is built around the XMC4700-E196K2048AA MCU. Features include:

• Power-on boot
• USB device/sleep-current protection
• Two user buttons
• Eight user LEDs
• Arduino-compatible 3.3V pin-out
• Real-time clock crystal
• Four delta-sigma demodulators
• External memory interface
• Safety package supporting 8L-2/3
• Operating temperature range: -40°C to 125°C

The kit is designed to be easily re-programmed, giving developers an easy way to test new digital power designs because of their digital-signal-processing and floating-point unit capabilities.
Industry’s first true fault-protection solution for high-speed USB ports

The MAX22505 protection device from Maxim Integrated combines USB fault protection against the high voltages found in industrial systems at high data-transfer rates of up to 480Mbits/s, while providing the flexibility to support either host or device applications including USB On-The-Go (OTG).

The introduction of the MAX22505 is a response to a trend in industrial system design to reduce footprint and increase productivity and throughput, while maintaining robust performance and high uptime. This has led designers to adopt USB in preference to the older RS-232 communications protocol for automation equipment, enabling system designs to benefit from the smaller size of the USB connector as well as the USB protocol’s high data-transfer rates. USB ports in industrial equipment require protection from over-voltage and ground differences between devices. It reduces solution size by more than half compared to competing solutions, and ensures robust communication in harsh environments cost-effectively, in a simple design.


Panasonic offers a line of industrial SD cards and eMMC devices, providing robust storage solutions which can handle heavy usage in many types of applications.

PANASONIC

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Robust SD cards and eMMC devices provide ongoing operating lifetimes in industrial equipment

MAXIM INTEGRATED

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Panasonic offers a line of industrial SD cards and eMMC devices, providing robust storage solutions which can handle heavy usage in many types of applications.

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Robust SD cards and eMMC devices provide ongoing operating lifetimes in industrial equipment

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Robust SD cards and eMMC devices provide ongoing operating lifetimes in industrial equipment
Industrial Ethernet switches support PoE and 24 V DC power rails

WAGO supplies a range of industrial Ethernet switches which offer the flexibility to transfer data at rates up to 1 Gbit/s while supporting Power over Ethernet (PoE) operation on multiple ports simultaneously.

The 852-1411 Industrial ECO Switch is a five-port Gigabit Ethernet switch. Four of the ports support PoE+ at 30 W. These four PoE+ ports can be used simultaneously to provide a power supply. The integrated voltage transformer enables operation on the 24 V DC power rail common in the control cabinet. This reduces the size of the wiring operation, and eliminates the need for a separate power supply for the PoE circuit.

Like the 852-1411, the 852-1417 Industrial Ethernet Switch features five Gigabit Ethernet ports, with four supporting PoE+ at 30 W. These four PoE+ ports can be integrated into larger installations through the use of its SFP slots.

WAGO also supplies the configurable 852-1505 Industrial Ethernet Switch, which features eight 10/100/1000 BASE-T Ethernet ports. All support PoE+ at 30 W, and all can be operated simultaneously.

Industry’s smallest, cheapest Stacklights include acoustic output options

MALLORY SONALERT

While industrial and medical equipment designers have taken advantage of advanced electronic technologies to decrease the size of their products, Stacklights have failed to shrink at the same rate in recent years.

Now, however, Mallory has introduced a series of 30 mm ultra-compact Stacklights which are less than half the size of competing products, at a lower cost. They are available with up to three state-of-the-art LED stocks in red, yellow and green; some are also available with sound.

Designers can choose Stacklights with either a direct-mount package or with a 4 inch extension pole for better visibility. The Stacklights with sound can produce seven different sound types, including a chime tone which is suitable for an office or laboratory environment. Benefitting from advanced design and acoustic techniques, Mallory’s Stacklights with sound are identical in size to the Stacklights without sound, so there is no size penalty for adding an indication sound.

The Mallory Stacklights are small and light enough to be mounted directly on top of a control box, which is a unique feature. They are also ideal for smaller equipment such as 3D printers and measurement equipment.

Qualified Bluetooth Mesh: making lighting controls future-proof

By Patrick Durand
Worldwide Technical Director, Future Lighting Solutions

The infrastructure in buildings is usually designed to last for decades. This is no different for lighting equipment. When a building owner or manager decides to invest in a lighting-control system, they need to have confidence that their decision is going to be the right one not just for the next one or two years, but for the next decade or more. But today the rate at which new technologies are being introduced causes obsolescence to be eliminated. The idea sounds simple, but how can it be implemented?

Future-proof lighting controls: the basics

A basic installation is comprised of a switch, a sensor/controller and nothing more. There should be no gateway, neither for commissioning nor for controlling. The system does however need to provide the option to add a gateway. But in this case, the gateway is just a protocol translator. It is not like a Zigbee® gateway in a large installation, in which the gateway manages the network. In this system, the failure of the main gateway potentially breaks the entire system.

Future-proof wireless technologies

The topology of a wireless system is the key element of a future-proof lighting control installation. If it supports point-to-point and point-to-multipoint topologies, the switch or sensor communicates directly to the controller, which is the wireless device that provides the control signal to the LED driver. The future-proof lighting control gateway, by contrast, is simply a bridge between a wireless protocol and a building management system such as BACnet or KNX, or a cloud-based system. In future it could even bridge to a technology that is yet to be invented.

A simple wireless protocol translator gateway gives the user the choice of what to do and when. It, during the initial installation of a lighting control system, the building manager is not ready for any complexity and just wants the switch and the controller, the wireless technology just needs to support these requirements, as shown in Figure 1.

But, if two years later the building is upgraded and a BACnet building-automation system is installed, the lighting controls can easily be integrated with it, whether the system is supplied by Schneider, Siemens, Johnson Control, Honeywell or any other manufacturer. There will be no need to change any part of the initial installation of wireless luminaries and switches; all that is required is the addition of a small number of protocol translator gateways to translate and forward data from the wireless protocol to the BACnet protocol.

Then, if five years later the building manager realises that he/she can no longer achieve his/her objectives with BACnet and wants to migrate to a cloud-based system, he/she can simply change the small number of BACnet gateways to cloud-based gateways. This is a future-proof solution.

Andrea Frieden
Product Manager, Future Lighting Solutions

Continued over...
EnOcean and Bluetooth wireless are the main technologies that support this type of topology, as shown in Figure 2.

A new Qualified Bluetooth Mesh standard was also released in July 2017. This provides for a mesh of nodes which can forward data to other nodes between the wireless switch/sensor and the wireless controller. Although the accurate term for the Bluetooth Mesh topology is many-to-many, one can still think of Bluetooth Mesh as supporting the point-to-point topology with the added benefit of being able to extend the range and reliability of the wireless network via meshing.

While the choice between EnOcean and Bluetooth Mesh is a question of personal preference, both systems have advantages and drawbacks. EnOcean is already installed in over 400,000 buildings. It is a mature protocol, widely adopted in HVAC and in lighting control. Another advantage of EnOcean is that it operates in the sub-GHz frequency range, so its wireless signals can travel through walls far better than the Bluetooth 2.4-GHz signals, and there is no risk of interference with any of the 2.4-GHz signals from other devices.

On the other hand, the benefit of Bluetooth Over EnOcean is that it is supported by every mobile device, so that they can directly communicate with the Bluetooth Mesh controller. This greatly simplifies the commissioning process. The other major benefit of Bluetooth technology is that it supports over-the-air updates, giving it a future-proofing advantage over EnOcean. Finally, there is the cost advantage of Bluetooth Mesh, since there are multiple Bluetooth radio and module vendors while there is only one single formal vendor of the EnOcean radio modules.

Cost is the biggest barrier to the mainstream adoption of wireless lighting-control solutions. However, the lighting industry, being a cost-effective industry that is focused on cost-effective lighting solutions, has a cost-effective attitude of ‘The first duck out of the pond gets shot’, to ‘The early bird gets the worm’.

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Automatic speech recognition in smart devices: the audio processing challenges

This article is a primer on speech recognition in smart devices. It will describe the various technologies which make this remarkable tool work seamlessly in consumers’ everyday lives.

Speech recognition technology is becoming integrated into various applications and end products. Research into the use of voice search suggests that half of all searches will be performed by voice by 2020 (source: ComScore). Voice is fast, and since it does not require typing it is easier to do on a smartphone.

Another product type in which Automatic Speech Recognition (ASR) is gaining popularity is the smart speaker. The Google Home* and Amazon’s Echo and Dot smart speakers are penetrating homes faster than most imagined they would, as shown in Figure 1. Apple also plays in this market with its HomePod™ speaker.

A smart speaker has a unique set of operational conditions and challenges. First, the smart speaker is always listening: it waits for a wake-up signal or trigger word before it opens a channel to the cloud, as shown in Figure 2.

Automatic gain control: the user might sometimes be located in front of the speakers, and this may result in the appropriate gain control applied to the microphone array.

DSP or general-purpose MCU?

ASR Assist technologies, then, enable a smart speaker to perform speech recognition at a distance in noisy real-world environments. The hardware technology underlying ASR Assist is digital signal processing, which has traditionally been implemented in specialized microprocessors that have a dedicated architecture. While it is possible to process signals digitally in a general-purpose MCU which executes digital-signal processing algorithms, it is more efficient and cost-effective to do this using ASR Assist technologies. For ASR applications, specialized audio DSP products provide the best environment in which to implement ASR Assist functions. A leading example of such a device is the ZL38063 from Microsemi, a Microchip company. The ZL38063 is part of Microsemi’sterrific family of audio processors. It improves ASR performance at extended distances while providing barge-in capability, and is optimized for detecting voice commands. The Microsemi AcuEdge™ technology in the ZL38063 is designed for use in televisions, set-top boxes and smart speakers, but also works well in other connected-home applications. The device is capable of both voice control and two-way full-duplex audio with voice enhancements such as acoustic echo cancellation and noise reduction to improve both the intelligibility and subjective quality of voice in harsh acoustic environments.

A different hardware platform which can implement advanced voice-recognition technologies is the Digital Signal Controller (DSC). This offers a number of advantages to OEMs’ system designers. It can reduce the software development costs of a combination of a microcontroller and DSP with a single DSC. It can also provide a reduction in system-level complexity by removing the need for shared memory, MCU and DSP communication, cross-chip processor bus architectures and custom glue logic between an MCU and DSP. A DSC also offers the advantage of reducing software development costs, as the entire project can be developed with a single compiler, debugger and integrated development environment. This type of technology may also be written in a high-level programming language such as C or C++, rather than the handcrafted assembler often used for a proprietary DSP. Product in the DSC331F/DSC family from Microchip enables barge-in capability and is optimized for detecting voice commands. As fans.

Applications beyond the smart speaker

The discussion in this article has centered on the smart speaker. Moving beyond smartphones and smart devices, developers should consider what their devices can do when they interact with their machines using speech. Advances in speech recognition have enabled the use of voice commands in modern HMIs. The technology is now ready for mass adoption. It is the most natural HMI for many products and systems. Developers and product managers need to think how they can use the technology to increase demand for their next product design.

Distance is not the only challenge for the smart speaker: interference from other audible noise sources can make it difficult for a smart speaker to detect the user’s voice and to recognize words.

The key to the solution of the problem of recognizing speech at a distance is to deploy an array of ASR Assist technologies, as shown in Figure 3.

Audio beamforming: it is not unusual to find multiple sources of noise, speech and sounds in a room. Technology for locating the sources, thereby separating the particular sound of interest, is called beamforming, which minimizes the amplitude of undesired signals and noise.

To perform beamforming effectively, an array of microphones implements spatial filtering. These microphones pick up propagating waves to create spatial samples. Spatial filtering requires information on the microphones’ characteristics and the configuration of the microphone array. Barge-in: while a smart speaker may be deployed at full time or weather, users will also frequently ask to play music. Barge-in allows trigger words to be detected during music playback.

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Fig. 1: The Google Home, Amazon Echo and other smart speakers

Fig. 2: The command architecture for the Amazon Alexa voice service. (Image credit: developer.amazon.com)

Fig. 3: ASR Assist technologies. (Image credit: Microsemi)

Fig. 4: Simplified block diagram of the ZL38063 audio processor. (Image credit: Microsemi)

Fig. 5: Simplified block diagram of the ZL38063 audio processor. (Image credit: Microsemi)

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Fig. 48: Simplified block diagram of the ZL38063 audio processor. (Image credit: Microsemi)

Fig. 49: Simplified block diagram of the ZL38063 audio processor. (Image credit: Microsemi)
**100V three-phase BLDC motor pre-drivers**

The MP6357/89 is a gate driver family designed for three-phase, brushless DC motor driver applications. It is capable of driving three half-bridges consisting of six N-channel power MOSFETs up to 100V. This driver family uses a bootstrap capacitor to generate a supply voltage for the high-side MOSFET driver. An internal charge pump maintains the high-side gate driver. If the output is held high for an extended period of time, full protection includes programmable Over-Current Protection (OCP), adjustable dead-time control, Under-Voltage Lockout (UVLO), and thermal shutdown.

- Supports 100V operation
- Internal LDO supplies external NPN for high-current drive requirements
- Low-power sleep mode for battery-powered applications
- Adjustable dead-time control to prevent shoot-through
- Fault indication output
- 120V VS Nat maximum voltage
- Integrated current sense amplifier
- Programmable Over-Current Protection (OCP) of external MOSFETs
- Thermal shutdown and Under Voltage Lockout (UVLO) protection
- TSSOP-28 and QFN-28 packages

**±40V high-speed USB port protector**

The MAX22505 is designed to protect a USB port on commercial and industrial equipment against damage due to faulty or incorrectly wired power supplies. The USB port is protected against connection to typical 24V DC or 24V AC Meters with a maximum data line protection of ±40.7V and power/ground line protection up to ±50V. VS USB, ground and connector shield connections can be configured for any level of ESD, burst, and surge protection by choosing external components. USB data D+ and D- are protected by external diode clamps to VUSB and GND, allowing for the lowest possible insertion loss while providing high ESD and Burst protection.

- Integrated ±50V DC protection for VUSB/GND
- Integrated ±40.7V DC protection for D+/D-
- High (48MHz), full (12MHz), and low (1.5MHz) speeds
- 4Ω VBUS and GND, allowing for the lowest possible insertion loss while providing high ESD and Burst protection
- Thermal shutdown and Under Voltage Lockout (UVLO) protection
- 24-pin, 4mm x 4mm TQFN package

**65V synchronous PWM buck regulators**

The FAN650xx is a wide V IN highly efficient synchronous buck regulator family with integrated high side and low side power MOSFETs. The devices incorporate a fixed frequency voltage mode PWM controller supporting a wide input range from 4.5V to 65V. The family includes three parts, FAN650048/5A/B, and can handle continuous currents up to 6A, 8A, and 10A respectively. This single-phase buck regulator family offers complete protection features including over-current protection, thermal shutdown, undervoltage lockout, over-voltage protection, under-voltage protection and short-circuit protection.

- 100mV/0.5% full scale range for current-sense voltage
- External sense resistor sets full scale current range
- 1% power measurement accuracy over a wide dynamic range
- 48-bit power accumulator register
- Sampling rates of 16, 64, 256, and 1024 samples per second
- Selectable bidirectional measurement capability
- 0 to 32V input common mode voltage
- On-chip accumulation of 28 bit power results for energy
- UCR and WCLSP packages

**12-bit programmable position sensor for contactless potentiometer applications**

The AS5200L is an easy to program stacked dual-die magnetic rotary position sensor with a high-resolution 12-bit ISC FC or PWM output. This closed-loop system measures the absolute angle of a diametric magnetized on-axis magnet. The AS5200L is designed for contactless potentiometer applications and its robust design eliminates the influence of any homogeneous external stray magnetic fields. The industry-standard PC interface supports simple user programming of non-volatile parameters without requiring a dedicated programmer.

- Contactless angle measurement
- 0 to 350 degrees measurement range
- Automatic entry into low-power mode
- AEC-Q100 automotive qualified
- Digital output over ISC or PWM-encoded output
- Automatic magnet detection
- MLI-15 (9mm x 5mm) package with floating waffles
- ±40 to 125°C temperature range

**Multi-channel DC power/energy monitor with accumulator**

The PAC1902/33 is a dual/three-channel power monitor and energy meter platform that reports on bus voltage and sense voltage 16 bits of resolution. Power is reported as a simultaneous product of two 16-bit independent bus and sense voltages. All registers are accessible through FC/SMBUS including an 8-byte average for reading stability.

- 100mV full scale range for current-sense voltage
- External sense resistor sets full scale current range
- 1% power measurement accuracy over a wide dynamic range
- 48-bit power accumulator register
- Sampling rates of 16, 64, 256, and 1024 samples per second
- Selectable bidirectional measurement capability
- 0 to 32V input common mode voltage
- On-chip accumulation of 28 bit power results for energy
- UCR and WCLSP packages

**Low-power 3D Hall sensor with i²C interface and wake-up function**

The TLE4903D offers accurate three-dimensional sensing with extremely low power consumption. Within its 6-pin package the sensor provides direct measurement of the x-, y-, and z-components of a magnetic field. The sensor provides a standard two-wire digital IC communication interface, which enables a bidirectional communication between the sensor and the microcontroller. 3D magnetic sensors are ideal for control elements, judders and e-meters (anti-tampering), and the TLE4903D is also suited for low-power 3D magnetic automotive applications such as indicators and gear shifters.

- ±100mT 3D magnetic flux density range
- X-Y angular measurement mode
- ±40°C temperature range
- ±5V reference voltage
- 0.67% accuracy
- Dual LDOs for single-supply operation and low power loss
- Adjustable soft start and pre-boost start-up
- True linear function with adjustable input voltage "Under-Voltage Lockout" (UVLO)
- 10kHz to 1MHz switching frequency
- External compensation for wide operation range
- 6 x 6 mm PQFN 35 package

**Miniature digital infrared thermometer IC**

The MLX90622 is a miniature SMD thermometer IC for accurate non-contact temperature measurement, especially in thermally dynamic environments and when available space is limited. The device is factory calibrated with calibration constants stored in the EEPROM memory. The ambient and object temperature can be calculated based on these calibration constants and the measurement data. The MLX90622 is factory calibrated for an accuracy range of ±2°C to ±5°C from 20°C to 85°C, and from 20°C to 20°C for the object temperature range. The measured value is the average temperature of all objects in the Field Of View of the sensor.

- 50°C Field of View
- 0.05°C measurement resolution
- 3.2V supply voltage
- ±5°C supply current and 2.5µA sleep current
- Integrated post-calibration option
- External ambient and object temperature calculation
- ±3°C compatible digital interface
- Software definable I2C address
- 0.5s default refresh rate, configurable between 16ms and 2s
- 3 x 3 x 1 mm QFN package

**TVOC and indoor air quality sensor platform**

The ZMC04410 gas sensor module is designed for detecting Total Volatile Organic Compounds (TVOC) and monitoring Indoor Air Quality (IAQ). It is a 12-pin LGA assembly (3.0 x 3.0 x 0.7 mm) that consists of a gas sensor element and MCU signal-conditioning IC. The modules sense element consists of heater element on a Si-based MEMS structure and a metal oxide (MOx) chemiresistor. The signal conditioner controls the sensor temperature and measures the MOX conductivity, which is a function of the gas concentration.

- Measurement of TVOC concentrations and I2C
- Multipurpose input channel for heater, resistance, and temperature measurements
- Up to 40kHz FC interface
- 16-bit adjustable ADC resolution
- Module algorithm estimates Carbon Dioxide level (CO2)
- Internal auto-compensated temperature sensor; not stress sensitive
- Configurable alarm/Interrupt output
- Multi-channel analog input for measurement
- Siloxane resistant

**Integrated device technology**

The MAX22505 is designed to protect a USB port on commercial and industrial equipment against damage due to faulty or incorrectly wired power supplies. The USB port is protected against connection to typical 24V DC or 24V AC Meters with a maximum data line protection of ±40.7V and power/ground line protection up to ±50V. VS USB, ground and connector shield connections can be configured for any level of ESD, burst, and surge protection by choosing external components. USB data D+ and D- are protected by external diode clamps to VUSB and GND, allowing for the lowest possible insertion loss while providing high ESD and Burst protection.

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- Thermal shutdown and Under Voltage Lockout (UVLO) protection
- 24-pin, 4mm x 4mm TQFN package
Single supply logic gates with voltage translation

Our 74AUP1Txx logic family provides solutions that integrate voltage level translation with a Boolean function. 74AUP1Txx types are single 2.3 V to 3.6 V supply general-purpose voltage translating devices. Our 74AUP1Txx family is currently composed of ten logic functions including buffers, inverters and gates (AND, OR, NAND, NOR, EXCLUSIVE-OR, EXCLUSIVE-NOR).

Our 74AUP1Txx family achieves single-supply translation through the use of low-threshold and over-voltage protected inputs. The output level is always referenced to $V_{cc}$, which can range from 2.3 V to 3.6 V. For $V_{in} = 2.5$ V, input logic signals for 1.8 V is valid. For $V_{cc} = 3.3$ V, input logic signals for 1.8 V and above are valid. This wide $V_{in}$ range allows the interconnection between most logic level signals. 4 mA output drive provides a balance between drive current and reductions in line reflections, overshoot and undershoot.

Key Features
- 2.3 V to 3.6 V supply voltage range
- Up and down translation possible
- $I_{on}$ circuitry for partial power-down operation
- Schmitt-trigger inputs
- Overvoltage tolerant inputs
- Up to 50 MHz operation at 3.3 V
- Low static power use

Applications
- Portable devices
- Industrial controllers
- Servers, PC & Notebooks
- Automotive

Benefits
- Partial power down mode support
- Integration of logic function with translation saves device count and PCB space
- Footprint-compatible with existing non-translation devices
- Available in smallest package for use without step-down mask (X2SONS)

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