

FUTURE



FUTURE TECHNOLOGY MAGAZINE

ISSUE 1810

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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

Technical View: Pages 17-21

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

Analog Corner: Pages 22-23

Featuring selected products for analog applications

AMERICAS EDITION

Application Spotlight on:

Industrial Automation

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New interface technology for true wireless earbuds

ams 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 AS3442 host IC in the cradle, and the AS3447 client IC in each earbud.

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

MEAN WELL has released three 60W medical-grade wall-mount power adapters: the GEM60I series which features an interchangeable AC plug for Europe, the US, UK and Australia; the GSM60E with a fixed plug for Europe; and the GSM60U with a fixed plug for the US.

The GEM60I and GSM60E/U series adapters may be plugged directly into 80V-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 ErP 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 A71CH to the Google IoT Cloud service. The solution based on the A71CH provides OEMs with a 'Plug & Trust' experience for authenticating devices to Google Cloud IoT Core.

NXP's A71CH is a trust anchor, ready-to-use security 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.

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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 Profibus, 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 in 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) 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 capability calls 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.

Add power supply, sensor, actuator and control elements to the communication function and you have the main ingredients for a robot. More and more development of industrial robots is taking place: any FTM reader involved in robot design will benefit from a study of the ON Semiconductor Design Note on autonomous robots on pages 8-9.

Motor systems are another important element of much industrial equipment. Infineon's XMC4700 series of microcontrollers are intended for use in this and in other industrial applications, since they include the digital-signal processing and floating-point unit capabilities that motor-control systems require, as featured on page 12.

For technical support in using these or any other components featured in FTM1810, please get in touch with your nearest, or call 1.800.FUTURE.1 for help.



Martin Schiel
EMEA Vertical Segment Manager, Industrial Automation
Future Electronics EMEA



CSP LED sets new standard for flux and efficacy

LUMILEDS

The LUXEON V2 from Lumileds is a new Chip-Scale Package (CSP) high-power domed LED optimized for directional applications.



Lumileds' LUXEON V2: High optical efficiency

It sets a new standard for flux and efficacy in the domed CSP LED category, enabling luminaire manufacturers to create more efficient luminaire designs with a high light output.

The LUXEON V2's 2mm² die provides design flexibility and supports high flux density. The 4,000K CCT version is capable of producing a typical light output of 315lm at an efficacy of 159lm/W when driven at 700mA, a figure which is obtained in realistic '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 maximizes 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 accelerate time-to-market with brighter, more efficient designs.

The LUXEON V2 is supplied in a 3535 ceramic package with a three-stripe footprint for ease of integration in board layouts.



APPLICATIONS

- Architectural lighting
- High and low bay lighting
- Stadium lighting
- Street and area lighting

FEATURES

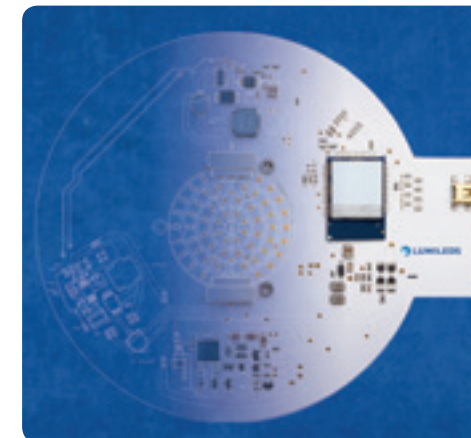
- 2.4A maximum drive current
- CCT range: 2,700K, 3,000K, 4,000K, 5,000K, 5,700K, 6,500K
- High color consistency over beam angle
- 2.83V forward voltage
- Low thermal resistance

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

LUMILEDS

Lumileds supplies a line of Integrated Light Guides under its Matrix Platform Advanced Technologies offering, which provides optimized design and production solutions to enable luminaire manufacturers to get to market more quickly with high-performance products.



Lumileds: Multiple light distribution options

The Integrated Light Guides are thin plates which soften high-flux LED light, enabling unprecedented light control in a compact form factor. Implementations in outdoor fixtures have produced a light output of 20,000lm at an efficacy of 120lm/W, exceeding Design Lights Consortium (DLC) Premium requirements.

The Integrated Light Guide plates provide the flexibility of design that lighting producers need to address indoor or outdoor applications. Options range from Types 3, 4 and 5 light distributions for street lights, to a batwing distribution for parking garages, to a Lambertian or asymmetrical light distribution for indoor lighting fixtures.

Use of the Matrix Platform Integrated Light Guides enables luminaire manufacturers to achieve uniform, glare-free light distribution.

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 Oberon Intelligent Assembly pick-and-place system for board-to-board consistency.



APPLICATIONS

- Indoor lighting
- Outdoor lighting

FEATURES

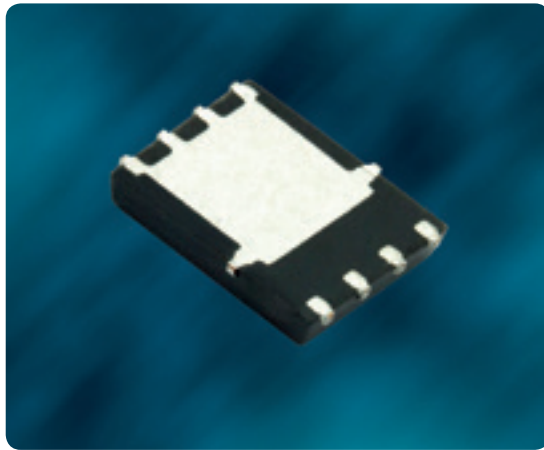
- Integrated drivers
- Dimming electronics
- Wired and wireless connectivity
- Advanced lighting controls

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60V MOSFET combines low on-resistance and low output charge for efficient power conversion

VISHAY

Vishey'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.



SiR626DP: Low package resistance

The MOSFET combines low on-resistance with low output charge of just 68nC at a drain-source voltage of 30V and a gate-source voltage of 0V.

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.



APPLICATIONS

- Synchronous rectification
- 24V power systems
- Motor drives
- DC-DC converters
- Solar micro-inverters
- Power tools

FEATURES

- 100A maximum drain current
- 104W maximum power dissipation
- 2V minimum threshold voltage
- Operating-temperature range: -55°C to 150°C

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Micro-pitch board-to-board connector supports high data-transfer rates in industrial equipment

HIROSE

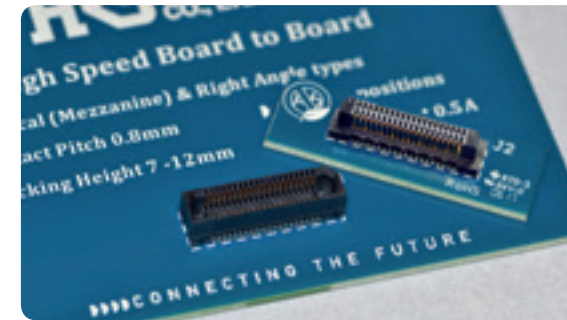
Hirose has introduced a miniature board-to-board connector which features a rugged design and supports high data-transmission speeds of more than 10Gbits/s. This combination makes the new ER8 series ideal for use in industrial applications such as servomotors, servo-amps, AC drives and electric measuring 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 pin count. Featuring vertical stacking heights from 7mm to 12mm, the ER8 meets the size requirements of the latest generation of industrial equipment.



Hirose ER8 connector: Resistant to shock and vibration



APPLICATIONS

- Industrial equipment
- Broadcast equipment
- Medical devices
- Multi-function printers
- Point-of-sale equipment
- Vehicle navigation systems

FEATURES

- Excellent insertion-loss-to-crosstalk ratio
- Far-end crosstalk performance complies with IEEE 802.3ap specification for 10Gbits/s data rate
- 100V AC voltage rating
- 0.5A current rating

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Edge Rate is a trademark of Samtec, Inc.



New Products Launch 6-10W DC-DC Converter in Chassis and DIN-Rail Mounting

- Ultra-wide 4:1 Input Voltage Range
- High Efficiency up to 86%
- I/O Isolation 3000VDC
- Operating Ambient Temp. Range -40°C to +87°C
- Designed for Rugged Industry Applications.



<p>General Industrial Power Solutions</p> <p>1-60W DC-DC Converter</p> <p>2-60W AC-DC Power Supply</p>	<p>Ultra-high Isolation Power Solutions</p> <p>1-60W DC-DC Converter</p>	<p>Railway Certified Power Solutions</p> <p>3-75W DC-DC Converter</p>	<p>Medical Safety Power Solutions</p> <p>1-20W DC-DC Converter</p> <p>24-60W AC-DC Power Supply</p>
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Thin-film precision resistor series sets new standard for reliability

SUSUMU

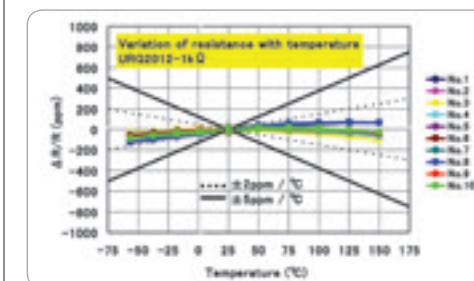
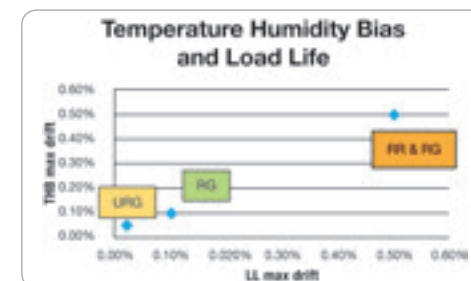
Susumu's new URG series of thin-film chip resistors offers an improvement in reliability as well as in the linearity of its Temperature Coefficient of Resistance (TCR) compared to the high standard set by the existing RG series.

The URG series offers better absolute tolerance of resistance, at $\pm 0.01\%$, than any other thin-film chip resistor on the market. It also offers the lowest TCR of $\pm 2\text{ppm}/^\circ\text{C}$.

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 $\pm 0.02\%$ and TCR of $\pm 5\text{ppm}/^\circ\text{C}$
- The RG-LL series with tolerance of $\pm 0.01\%$ and TCR of $\pm 2\text{ppm}/^\circ\text{C}$



Susumu's URG resistors offer lower drift than the RG and RR series (left) and high stability of resistance over temperature (right)



APPLICATIONS

- Precision industrial instruments
- Test and measurement instruments
- Automotive electronics
- Laboratory-grade scales

FEATURES

- $\pm 0.02\%$ maximum drift for load life (2,000 hours at 70°C)
- $\pm 0.05\%$ humidity bias drift
- $\pm 0.02\%$ temperature cycle drift
- $\pm 0.02\%$ high-temperature exposure drift
- Stable when exposed to atmospheric sulfur
- EIA standard package sizes: 0603, 0805 and 1206

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Triad's 50/60Hz World Series Transformers

TRIAD
MAGNETICS

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 recognized. They utilize a Class F 155°C insulation system and can be used in myriad applications requiring inherently/non-inherently limited transformers.



FEATURES

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

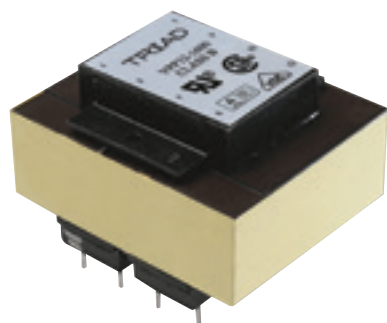
SPECIFICATIONS

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

APPLICATIONS

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

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

- Dual bobbin construction
- Insulating shroud meets UL V0 flammability specs
- No electrostatic shielding needed

SPECIFICATIONS

- Frequency: 50/60Hz
- Electrical rating: 2.5 to 56VA
- Secondary voltage range between 5 to 36V

APPLICATIONS

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

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
- 3500V isolation between primary and secondary
- Compact footprint

SPECIFICATIONS

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

APPLICATIONS

- Building and plant equipment
- Lighting
- Temperature controls
- Material handling

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
- Primary: 100, 120, 220 or 240V AC
- 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

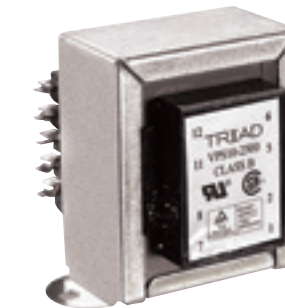
SPECIFICATIONS

- Frequency: 50/60Hz
- Electrical rating: 25 to 2500VA
- Secondary voltage from 6 to 230V

APPLICATIONS

- Sound reproduction
- Power system equipment
- Production equipment

VPS Chassis Mount Quick Connect



Triad's VPS Chassis Mount Transformers are chassis-mount devices requiring higher power up to 175VA. 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

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.

Efficient motor control for autonomous driving robots

ON Semiconductor offers a wide range of trench MOSFETs: when used in the inverter power stage of a motor, these MOSFETs can help the system designer to implement an efficient motor-control system, as shown in Figure 2. To prolong the lifetime of a motor, it is important to control the operating temperature carefully. An increase of 10°C in operating temperature can reduce the lifetime of a motor by half. To extend this lifetime, designers can use ON Semiconductor's PowerTrench® MOSFETs: this line of devices, which includes the FDMS861xx family, helps to reduce EMI and voltage spikes and to increase power output, while maintaining good heat dissipation.

The three-phase inverter in a Brushless DC (BLDC) motor can benefit from the use of MOSFETs which produce very low conduction losses. The NTMFS5xxxxx 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-sense amplifiers, such as the NCS2xx 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 over-current protection and support accurate power delivery.

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 a 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 designs, 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.

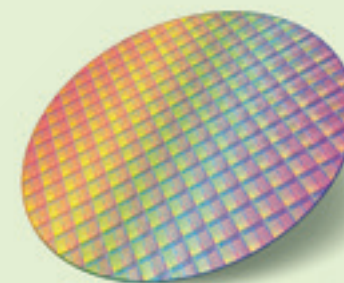
Although the architecture of a CMOS image sensor requires that each row of pixels is digitized individually, some devices can produce a global shutter read-out: the MT9V034 and AR0144 from ON Semiconductor both offer this feature. A global shutter eliminates the unwanted motion artifacts produced by 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 2.4GHz transceiver, providing the flexibility to support Bluetooth Low Energy and proprietary or custom 2.4GHz radio protocols.

Silicon Technology

- Lower $R_{DS(ON)}$
T6, T8, PTNG
- Reduce Q_{RR}/T_{RR}
T8, PTNG
- Lower C_{ISS}
T8, PTNG
- Improved Q_{GD}/Q_{GS}
T8, PTNG
- Lower R_G
T6, T8, PTNG



Packaging Technology

- Improve die to package ratio
PQFN: 8x8, 5x6, 3x3
- Reduce parasitic inductance
Power clips: 8x8, 5x6, 3x3
- Improve thermal performance
Dual cool packaging
- Increase current capability
8x8, D²Pak7L, TOLL



Application Benefits

- Lower conduction loss
- Lower switching loss
- Simpler gate drive
- Reduced EMI
- Reduced voltage spike
- No gate bounce
- Higher power density
- Reduced system cost

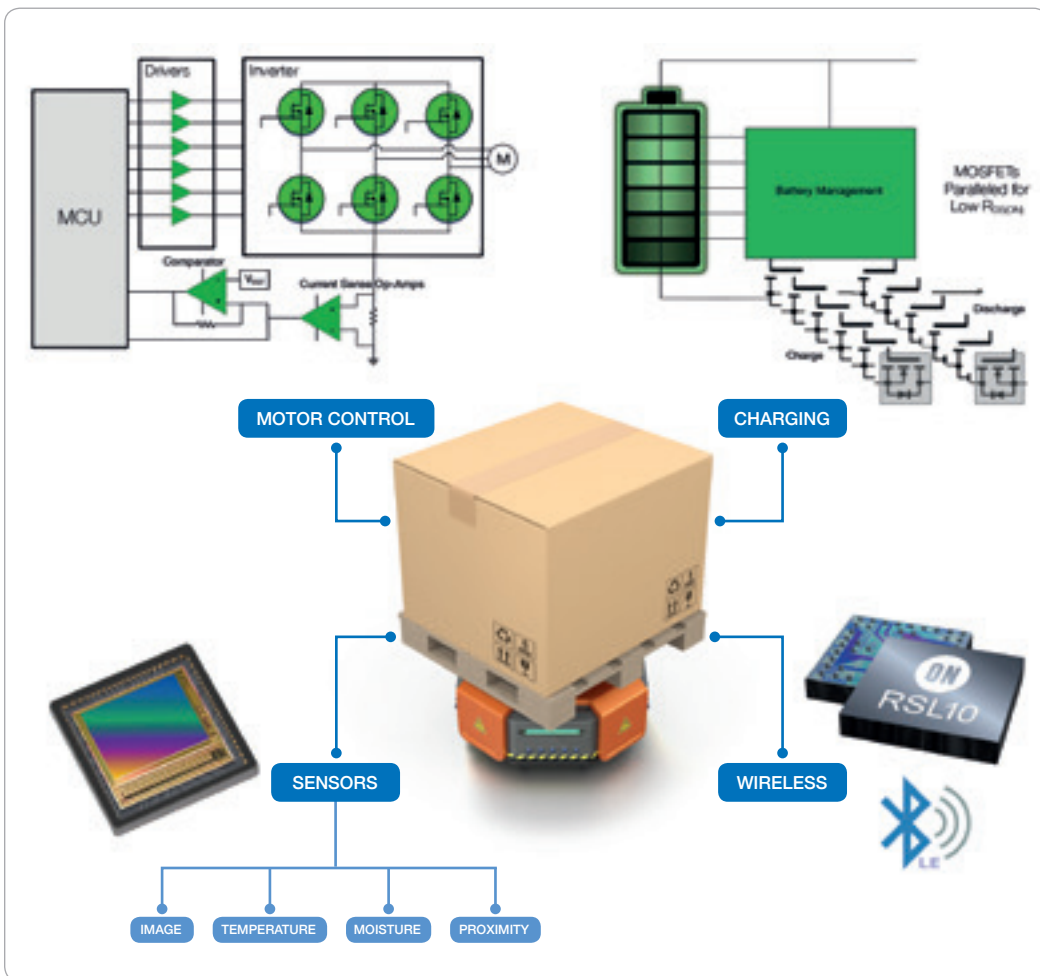


Fig. 1: New autonomous robot designs can benefit from an array of ON Semiconductor component technologies

Proximity Sensors				
Part Number	Output Current (µA)	Output Interface	Minimum Input Voltage	Maximum Input Voltage (V)
NOA1212	64	Analog	2	5.5
NOA1213	64	Analog	2	5.5
NOA1305	120	I²C	2.4	3.6
NOA2301CUTAG	75	I²C	2.3	3.6
NOA2301W	75	I²C	2.3	3.6
NOA3315CUTAG	75	I²C	2.3	3.6
NOA3315W	75	I²C	2.3	3.6

MOSFETs for Battery Management and Protection				
Part Number	Breakdown Voltage (V)	On-resistance at 10V (mΩ)	Package	Technology
NTMFS5C404N	40	0.7	SO8FL	T6
NTMFS5C410N	40	0.92	SO8FL	T6
NTMFS5C604N	60	1.2	SO8FL	T6
NTMFS5C612N	60	1.6	SO8FL	T6
NTMFS5D4N04C	60	0.4	Punched 8x8	T6
NTMFS5D7N06C	60	0.75	Punched 8x8	T6
NTMFS6H800N	80	2.1	SO8FL	T8
NTMFS6H801N	80	2.8	SO8FL	T8
NTMFS1D2N08H	80	1.2	Punched 8x8	T8
NTMFS1D1N08H	80	1.1	TOLL	T8
NTMFS10N3D2C	100	3.2	PQFN5x6	PTNG
FDBL0200N100	100	2	TOLL	PTNG
FDB1D7N10CL7	100	1.75	D²Pak7L	PTNG
NTMFS1D6N10MC	100	1.6	Punched 8x8	PTNG
FDMT800120DC	120	4.2	Sawn 8x8DC	MV5
FDMS8D8N15MC	150	8.8	PQFN5x6	PTNG

Current-sense Amplifiers for High- or Low-side Sensing		
Product	NCS199A1R/A2R/A3R	NCS210R/1R/3R/4R
Common-mode input	-0.3V to 26V	-0.3V to 26V
Supply-voltage range	2.2V to 26V 30V absolute maximum	2.2V to 26V 30V absolute maximum
Maximum output signal at 25°C	±150µV	±35µV
Output-voltage temperature drift	0.5µV/°C	0.5µV/°C
Gain options	50V/100V/200V/V	50V/100V/200V/500V/V
Maximum gain error	±1.5%	±1%
Gain-bandwidth product	40-90kHz	25-90kHz
Minimum common-mode rejection ratio	100dB	105dB

FTM Boards
 Orderable Part Number: RSL10-002GEVB
 To buy development boards go to:
www.FutureElectronics.com/FTM
 To buy products or download data go to:
www.FutureElectronics.com/FTM

Fig. 2: ON Semiconductor MOSFET technology is ideally suited to motor-control applications

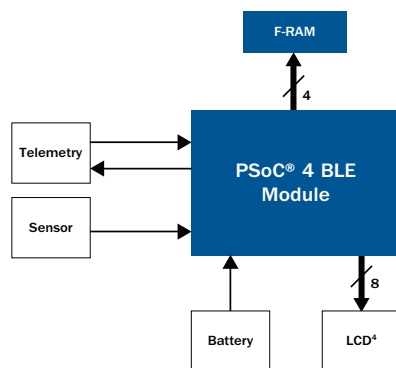


CYPRESS MICROCONTROLLERS, CONNECTIVITY, AND MEMORY: Designing for Industrial Applications and Industry 4.0 Systems

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 three 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.

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 AFEs 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 instant non-volatility. 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.

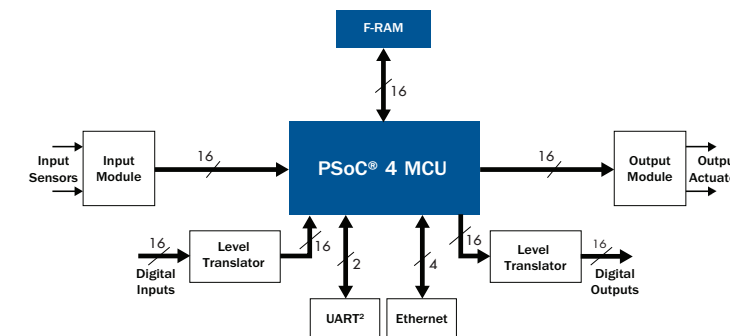
Development Kits To Get Started	Bluetooth Modules	Serial F-RAM
CYBT-343026-EVAL CY8CKIT-042-BLE-A CY8CKIT-145-40XX CY8CKIT-149 CY8CKIT-046 CYBLE Module Eval Boards CY15FRAMKIT-001	CYBT-343026-01 CYBLE-202007-01 CYBLE-212006-01 CYBLE-202013-11	16 - 256 Kb Serial F-RAM

Programmable Logic Controllers (PLCs) – Powering Industrial Processes

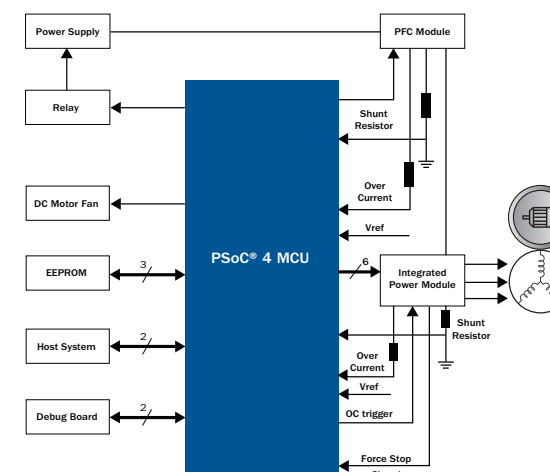
Programmable Logic Controllers (PLCs) are essential to the success of current industrial factory systems as well as future ones. They are optimized and purpose-built to provide the necessary control logic to manufacturing operations, factory robots, and other important processes where there is zero room for error. They are also very diverse devices, with larger "brick-like" rugged 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 4100 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/writes also is well-suited to withstand the large number of cycles that come with high-performance industrial processes.



Development Kits To Get Started	PSoc 4 MCUs	Serial F-RAM
CY8CKIT-042 CY8CKIT-046 CY8CKIT-049-42XX CY8CKIT-146 CY15FRAMKIT-001	PSoc 4200 MCU Family PSoc 4100 MCU Family	4 Mb Serial F-RAM



Easily Design High-Performance Motor Control Applications

The industrial market of today has adopted a wide variety of motor control methods, with some of the most prominent being FOC (Field Oriented Control), BLDC control, and Stepper Motor Control. These techniques have numerous advantages to suit different applications, including: better speed vs. torque characteristics and high dynamic response (BLDC), increased efficiency of electric motors and smoother operation (FOC), as well as being easy to use and cost-effective (Stepper).

Cypress provides PSoc MCU and F-RAM products that are specifically positioned for the different motor control techniques that are discussed above. Cypress provides a full Motor Control Reference Design platform for developing motor control applications based on the PSoc 4200 MCU family – with an Eval Kit and ready-made example projects for: Single-shunt and Sensor-less FOC (Field Oriented Control), Sensor-ed BLDC control, Sensor-less BLDC control and Stepper Motor Control. Ensuring data is not lost is critical for both safety and cost of these high-performance motor control applications – and Cypress' F-RAM memories can ensure peace-of-mind with instant non-volatility as well as infinite endurance.

Development Kits To Get Started	PSoc 4 MCUs	Serial F-RAM
CY8CKIT-037 CY8CKIT-042 CY8CKIT-046 CY15FRAMKIT-001	PSoc 4200 MCU Family	1 Mb Serial F-RAM

Orderable Part Numbers: CY8CKIT-042-BLE-A
CYBLE-222005-EVAL and CY15FRAMKIT-001

To buy development boards go to:
www.FutureElectronics.com/FTM

Next-Generation Cypress Technology for the Industrial Systems of Tomorrow

Cypress has multiple next-generation MCU, Connectivity, and Memory technologies that will enable designers to solve future Industrial IoT and Industry 4.0 challenges and problems

PSoc 6 MCUs

The PSoc 6 MCU is Cypress' ultra-low-power microcontroller built on a dual-core architecture integrating an Arm® Cortex®-M4 and Cortex-M0+ onto a single chip

Semper™ NOR Flash Family

Cypress' next-generation Flash Memory product that provides a fail-safe storage solution for industrial applications

Excelon™ F-RAM Nonvolatile Memory

The industry's highest-performance mission-critical nonvolatile memory for Industrial IoT applications

WICED® 802.11ac CYW54907 SoC

Provides industry-leading Wi-Fi connectivity for industrial IoT applications that need higher bandwidth and increased range

PSoc 4700 MCUs

PSoc 4700S Sense Anything MCUs extend the PSoc 4 family with the new inductive sensing technology, MagSense™, and industry-leading capacitive-sensing, CapSense®

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



Learn more at: www.cypress.com

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

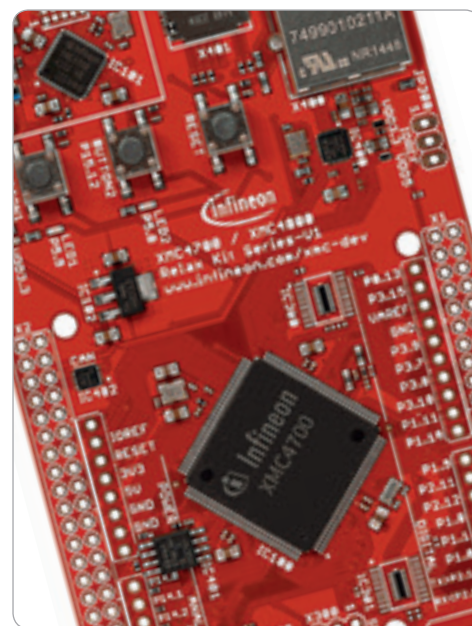
Off-board charging, when users charge plug-in hybrids and pure EVs in their garage or an open parking lot, demands an MCU which can switch at high frequency to stay efficient and cost competitive. The XMC4700 portfolio is a great fit for the application as it integrates all the features needed for off-board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



Infineon's XMC4700 Relax Kit

Product	Orderable Part Number	Package	Flash Program Memory	Digital I/O Pins	Additional Interfaces
XMC4700-E196K2048 AA	XMC4700E196K2048AAAXQMA1	PG-LFBGA-196	2,048kbytes	155	USB, SD/MMC, 10/100Mbps/s Ethernet with IEEE1588 time stamping
XMC4700-F100K2048 AA	XMC4700F100K2048AAAXQMA1	PG-LQFP-100	2,048kbytes	75	USB, SD/MMC, 10/100Mbps/s Ethernet with IEEE1588 time stamping
XMC4700-F144K2048 AA	XMC4700F144K2048AAAXQMA1	PG-LQFP-144	2,048kbytes	119	USB, SD/MMC, 10/100Mbps/s Ethernet with IEEE1588 time stamping



APPLICATIONS

- Automation systems
- Commercial, construction and agricultural vehicles
- Industrial equipment
- Motor controls and drives
- Power supplies
- Solar energy systems

FEATURES

- Quad SPI, SCI/UART, I²C, I²S and LIN interfaces
- Two PWM timers
- Four delta-sigma demodulators
- External memory interface
- Safety package supporting SIL-2/3
- Operating-temperature range: -40°C to 125°C



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

FTM Boards

The XMC4700 Relax Kit is the ideal tool for evaluating the XMC4700 developing early prototype designs. The kit is built around the XMC4700-F144 MCU. Features include:

- On-board debugger
- Power over USB
- ESD and reverse-current protection
- Two user buttons
- Two user LEDs
- Arduino-compatible 3.3V pin-out
- Real-time clock crystal
- Quad SPI Flash
- microSD card slot
- Ethernet PHY and RJ45 jack
- CAN node

Orderable Part Number: KIT_XMC47_RELAX_V1

To buy development boards go to: www.FutureElectronics.com/FTM

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.



CMS micro-speakers: Durable magnet and cone components

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 93dB 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.



APPLICATIONS

- Handheld devices subject to moisture and contaminants

FEATURES

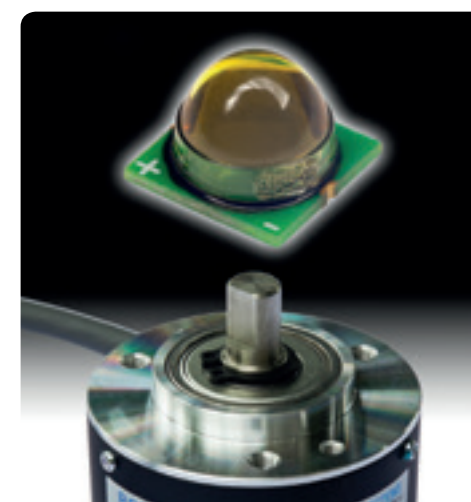
- 0.7W nominal input rating
- Resonance frequency range: 550 to 800Hz
- Impedance ratings: 6Ω or 8Ω

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

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.



OP207CL: Maximum 10mW radiated power

Offering up to 10mW total radiated power at the maximum drive current of 100mA, and a narrow 2.25° angle of half intensity, the OP207CL couples optical flux very 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 spectral matching with silicon photo-sensors, and the typical rise/fall time of 22ns ensures a fast response to On/Off signals.



APPLICATIONS

- Safety light curtains
- Edge detectors
- Incremental linear and rotary encoders
- Scanners
- Optical switches
- Industrial automation
- Robotics
- Security detectors

FEATURES

- Parallel beam uniformity
- Homogeneous light
- 190mW power dissipation
- 1.5V forward voltage
- 10µA maximum reverse leakage current
- Operating-temperature range: -40°C to 105°C

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

Industry's first true fault-protection solution for high-speed USB ports

MAXIM INTEGRATED

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 480Mbps/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 while maintaining communications performance at high data rates. Damage to both the host and device side can occur in these systems, requiring a solution that achieves high levels of fault protection. Existing USB fault-protection solutions on the market today compromise either USB operating speed or the voltage- or current-limit protection on a device's data and power lines.

By contrast, the MAX22505 supports high-speed operation while protecting equipment from over-voltage or negative voltage on power and data lines, as well as ground-potential



MAX22505: Protects against voltages up to 50V on USB power lines

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.

Learn more about connecting smart sensors in factory automation applications with Maxim's Solutions Guide 6454, the IO-Link Handbook, available from the Maxim website.

www.maximintegrated.com/en/app-notes/index.mvp/id/6454

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- Building automation
- Industrial PCs
- Programmable logic controllers
- Machine vision systems
- Diagnostic USB ports

FEATURES

- ±50V DC protection for power lines
- ±40.7V DC protection for D+/D- data lines
- 24-pin 4mm x 4mm TQFN package
- Operating-temperature range: -40°C to 105°C

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

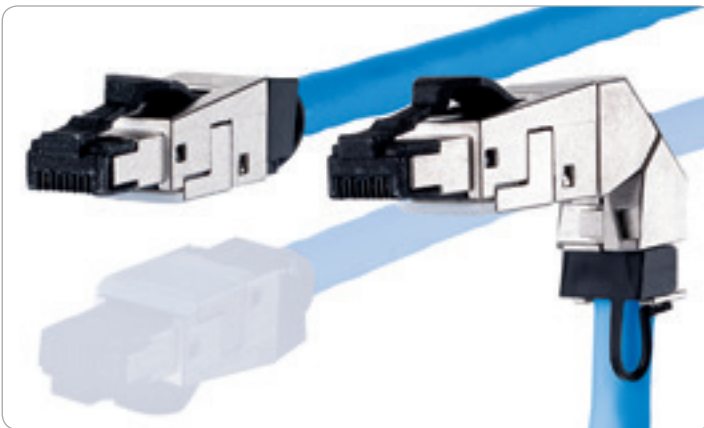
RJ45 plug provides reliable connections in industrial equipment

METZ CONNECT

The C6A RJ45 Field Plug Pro from Metz Connect provides reliable connections and is very simple to install on-site without requiring special tools.

Metz Connect offers the C6A RJ45 Field Plug Pro in a straight 180° version which has the part number 130E405032-E, and in a variable 360° version which has the part number 130E405042-E. Both types have a compact form factor which is suitable for multi-port applications and can be used in confined spaces.

To provide a reliable flow of data, both versions of the C6A RJ45 Field Plug Pro are shielded against external sources of EMI by a die-cast zinc housing. The C6A RJ45 Field Plug Pro offers the transmission technology features of Cat 6A in accordance with the ISO/IEC 11801 Ed.2.2:2011-06 standard Class EA, and is therefore suited for data transmission at rates up to 10Gbits/s.



C6A RJ45 Field Plug Pro: Die-cast zinc housing shields plug from EMI

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- Industrial controls
- Industrial communications systems
- Structured cabling
- Audio-visual equipment
- Security systems
- Industrial Ethernet terminations

FEATURES

- Supports Power-over-Ethernet
- Crimp-less field termination
- Rugged and snagless locking clasp
- Color-coded wire diagram for error-free connection
- Supports re-termination of wires of same size or larger

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

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



- Panasonic RP-SEMC08
- Panasonic RP-SEMC16
- Panasonic RP-SEMC32

PANASONIC

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.

These storage devices are suitable for use as on-board memory for factory automation equipment that runs firmware or a data logging function. For instance, in programmable logic controllers SD cards are used for the transfer and storage of program files, quality-control data and production information. An SD card provides a convenient and removable form of storage which enables the machine operator to back-up the data to a PC for later use, or to load new programs for the controller to run.

The industrial SD cards are comprised of Panasonic's proprietary controller and firmware, alongside high-reliability 2D Single-Level Cell (SLC) and Multi-Level Cell (MLC) NAND Flash memory provided by third-party NAND Flash suppliers. The cards feature efficient wear-leveling algorithms, and robust error-correction and power-fail protection functions.

The FX series of standard-size SD cards is rated for 60,000 program/erase cycles, and is available in either speed Class 6 or Class 10, as well as UHS-I speed grades in certain capacities.

This series is available in a wide range of capacities from 512Mbytes up to 16Gbytes.

The SC series of microSD cards is also rated for 60,000 program/erase cycles, providing the same reliability as the FX series but in a smaller package. The SC series cards are available in 2Gbyte, 4Gbyte and 8Gbyte capacities in speed Class 6, Class 10, and UHS-I grades.

At the other end of the storage spectrum, Panasonic also offers industrial- and automotive-grade eMMC storage products. These embedded cards are more secure than a removable medium such as an SD card, and are more resistant to vibration. They include a 153-ball BGA package with a 0.5mm pitch and program/erase cycle capability of 2,000 cycles.

The Panasonic eMMC devices are suited to the storage of program code and infrequently logged data; they are not recommended for high-frequency Writes of small data files. Panasonic's eMMC products are AEC-Q100 qualified, providing quality and reliability assurance for use in automotive applications.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- Programmable logic controllers
- Factory automation equipment
- Industrial systems
- Automotive

FEATURES

- Static wear leveling for long operating life
- Compatible with all file systems including FAT, exFAT and EXT
- Wide range of capacities, from 512MB to 32GB
- Power-fail protection
- Operating-temperature range: -40°C to 85°C

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

Industrial Ethernet switches support PoE and 24V DC power rails

WAGO

WAGO supplies a range of industrial Ethernet switches which offer the flexibility to transfer data at rates up to 1Gbit/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 30W. These four PoE+ ports can be used simultaneously to provide a power supply. The integrated voltage transformer enables operation on the 24V DC power rail common in the control cabinet. This reduces the scale 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 30W.

The 852-1417 also offers two SFP-1000BASE-SX/LX ports; SFP modules are available as an option. This means that, while the switch is ideal for small and medium-sized networks, it can also 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/Gigabit Ethernet ports. All support PoE+ at 30W, and all can be operated simultaneously.



WAGO switches feature rugged housing and redundant power supply

Four SFP-1000BASE-SX/LX ports are available. The switch has a rugged housing, redundant power supply and function monitoring with a relay. It features web-based/SNMP management, and DIP switches to set alarm functions. All three switches operate over an extended temperature range of -40°C to 70°C.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- Industrial Ethernet equipment

FEATURES

- Front-panel diagnostic LEDs
- Supports Auto-MDI/MDI-X functions
- Full-/half-duplex transfer modes for each port
- Store-and-forward switching method
- Integrated address look-up table supports up to 8,000 MAC addresses
- Over-voltage protection
- IEEE 802.3x flow control in full-duplex mode
- For DIN-35 rail mounting

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

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 many building managers to say, 'It is best to wait until the technology landscape matures and a single technology wins.'

In fact, there is no need to delay investments in lighting controls. With a future-proof lighting control system, the building manager's concern about obsolescence is eliminated. The idea sounds simple, but how can it be implemented?

Future-proofing 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.

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, optional protocol translator gateway gives the user the choice of what to do and when. If, 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 luminaires 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 realizes 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.

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-multi-point topologies, the switch or sensor communicates directly to the controller, which is the wireless device that provides the control signal to the LED driver.

Continued over...

Industry's smallest, cheapest Stacklights include acoustic output options

MALLORY SONALERT

While industrial and medical equipment designers have taken advantage of advanced electronics 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 30mm 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 stacks 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. Benefiting 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.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- Label printers
- Scientific and laboratory equipment
- 3D printers
- Measurement equipment

FEATURES

- Opaque white lens
- 3.9kHz sound frequency
- IP52 rating
- NEMA 12 rating
- cUL approval

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

Stacklight, Light Only			
Part Number	Nominal Voltage	Stack Colours	Mount Type
JR16-R-D	12V DC	R	Direct
JR16-R-4	12V DC	R	4" Pipe
JR16-RYG-D	12V DC	RYG	Direct
JR16-RYG-4	12V DC	RYG	4" Pipe
JR28-R-D	24V AC/DC	R	Direct
JR28-R-4	24V AC/DC	R	4" Pipe
JR28-RYG-D	24V AC/DC	RYG	Direct
JR28-RYG-4	24V AC/DC	RYG	4" Pipe

Stacklight with Sound (Continuous Tone Option)			
Part Number	Nominal Voltage	Stack Colours	Mount Type
JR16-R-DLCT1	12V DC	R	Direct
JR16-R-4LCT1	12V DC	R	4" Pipe
JR16-RYG-DLCT1	12V DC	RYG	Direct
JR16-RYG-4LCT1	12V DC	RYG	4" Pipe
JR28-R-DLCT1	24V AC/DC	R	Direct
JR28-R-4LCT1	24V AC/DC	R	4" Pipe
JR28-RYG-DLCT1	24V AC/DC	RYG	Direct
JR28-RYG-4LCT1	24V AC/DC	RYG	4" Pipe

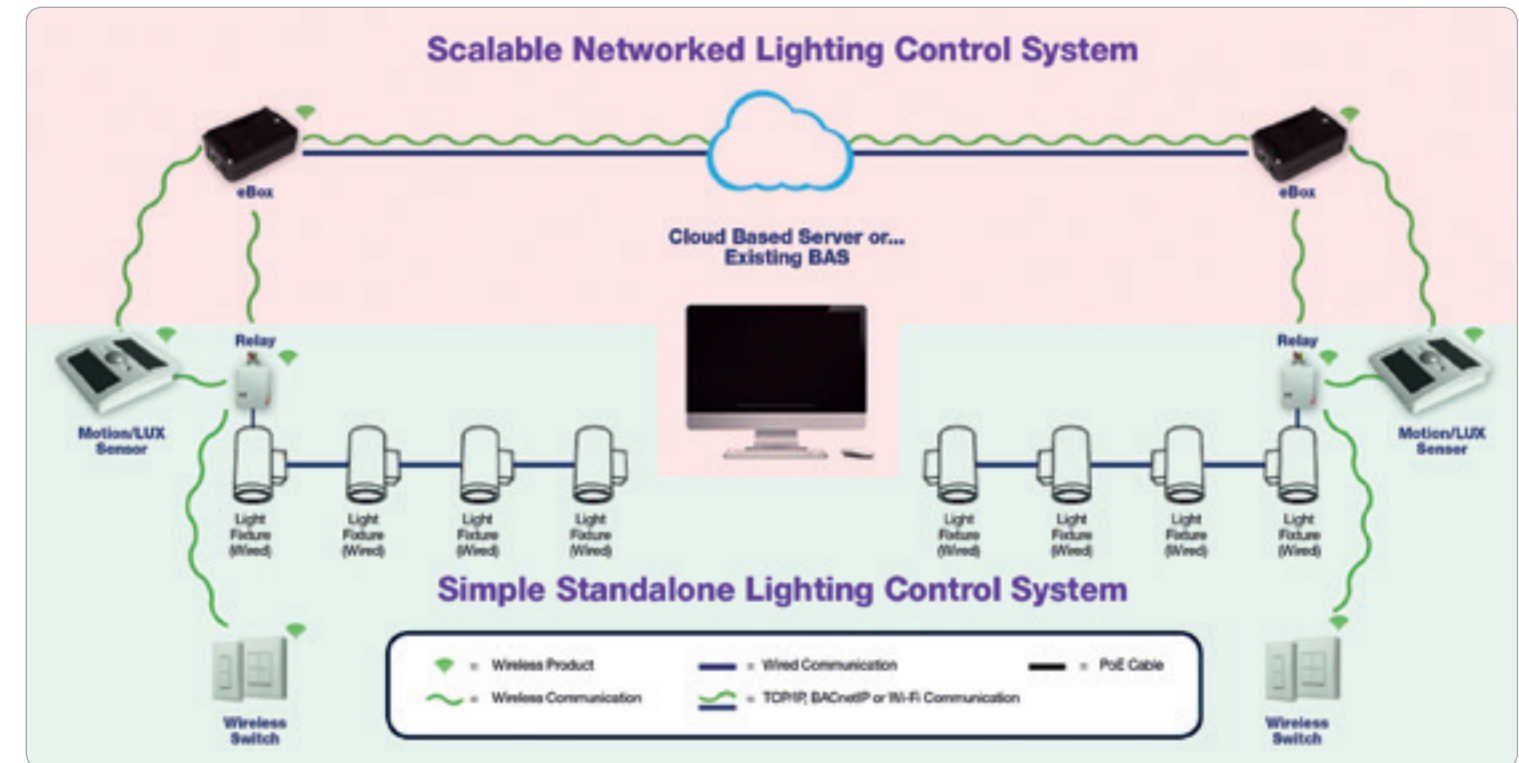


Fig. 1: A future-proof lighting control architecture

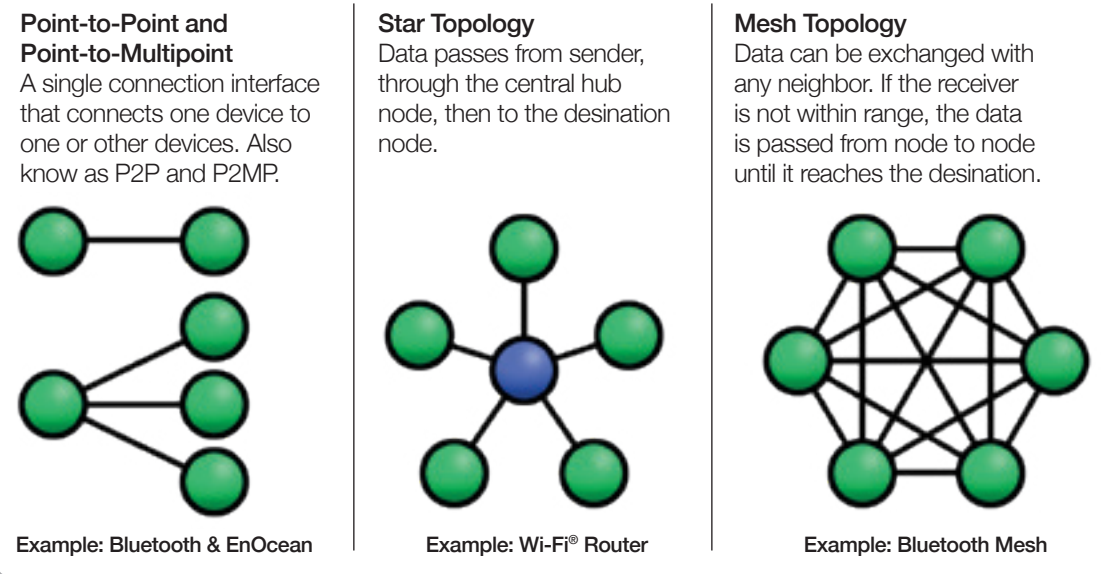


Fig. 2: Network topologies for lighting control

EnOcean and Bluetooth wireless are the main standard 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.

Technically, there are significant differences between the Bluetooth Low Energy (BLE) and Bluetooth Mesh standards, they both use the same radio chip or radio module. The ability of Qualified Bluetooth Mesh to relay data sets the two standards apart. Furthermore, for BLE, security is optional whereas for Bluetooth Mesh, security is mandatory. The Bluetooth Mesh standard actually incorporates the entire BLE functionality, which allows existing mobile devices with BLE to directly connect to and control a Bluetooth Mesh network. And since gateways are optional devices in a Bluetooth Mesh network, and can act as a protocol translator between Bluetooth Mesh and a building automation system or a cloud service, Bluetooth Mesh can enable future-proof lighting-control systems.

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: its wireless signals can travel through walls further than the Bluetooth 2.4GHz signals, and there's no risk of interference with any of the 2.4GHz wireless systems in noisy urban environments.

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 a single formal vendor of the EnOcean radio and modules.

Cost is the biggest barrier to the mainstream adoption of wireless lighting-control solutions. What the lighting industry needs are control solutions that are so cost-effective that lighting OEMs integrate a wireless controller in the luminaire regardless of whether the end user will immediately use its capabilities. The scale and presence of Bluetooth means that its mesh derivative is the only technology with a realistic chance

of meeting both the cost and future-proofing requirements of mainstream lighting-control solutions.

Security of Bluetooth Mesh solutions

Security is a mandatory part of the Bluetooth Mesh standard: all mesh messages are encrypted and authenticated. There are three types of security keys in Qualified Bluetooth Mesh. The first is the network key, which is required for a lighting node to join and send a message that will propagate through the mesh network. Furthermore, it is possible to create sub-networks or zones, each with its own network key: this enables the operator to limit the authority of a user to control lights only in his/her office but not for other offices in the building.

The second type of key is an application key, so that a user who only has the right to control lights cannot also control the HVAC or other building systems.

The third is the device key, which enables the removal of a node from the network, while the network and application keys are retained. This eliminates the risk that a discarded node could be used by a hacker to attack the building network.

Even with security, there are ways for lighting-control vendors to go beyond the standard to differentiate themselves. For example, in an installation of luminaires from multiple luminaire vendors that are all based on Qualified Bluetooth Mesh, it is possible to automatically check in the background whether the node's firmware contains any vulnerabilities or malware before it is allowed to join the network. No extra hardware devices would be required, as the installer would use the same internet-connected mobile device for this enhanced commissioning process.

Is the multi-protocol approach valid?

Besides Bluetooth, Wi-Fi is also used in all mobile devices. And since Wi-Fi routers are found almost everywhere, it might seem sensible to use this infrastructure. The question is: should this be an alternative strategy? Or should we potentially consider a multi-protocol node to hedge our bets?

From a technical standpoint, it's possible to have a wireless node that can support multiple protocols: several radio chips support both Bluetooth and Wi-Fi, and other chips support both Bluetooth and 802.15.4 (ZigBee). The difficult part of implementing a lighting-control system, however, is not the hardware but the firmware and software. Support of multiple protocols adds complexity and may render the node incompatible with nodes from other vendors.

It is also important to understand the differences between Bluetooth, Wi-Fi and ZigBee, and not to attempt to employ a riskier multi-protocol node strategy at the luminaire level. Wi-Fi power consumption is higher than that of BLE or Bluetooth Mesh, and requires a router and Wi-Fi routers are prone to failure. For large ZigBee installations, gateways are required, adding complexity and single points of failure, since the gateways have the task of managing the ZigBee network, as shown in Figure 3.

The winning technology will be the one which has an advantage in cost, simplicity, reliability, scalability and security: Bluetooth Mesh is clearly superior in these respects. One year on from its introduction, the Bluetooth Mesh standard has already been implemented in 65 interoperable products from various vendors; that number is expected to grow exponentially over the next few years. The key now is to build an ecosystem of Bluetooth Mesh solutions as quickly as possible.

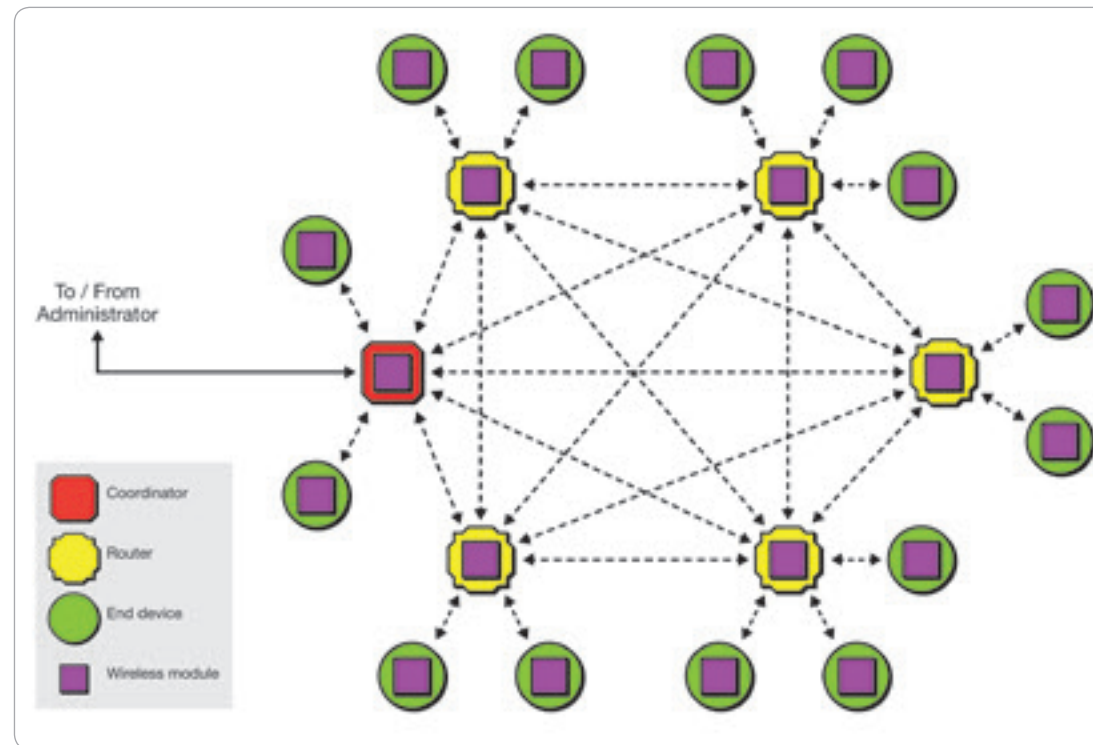


Fig. 3: Architecture of a ZigBee network (Source: Synapse Wireless)

An ecosystem of Bluetooth Mesh solutions

A large ecosystem of solutions based on an open interoperable standard such as Qualified Bluetooth Mesh can provide the functions and capabilities required to support any conceivable project specification. The solutions can cover parameters such as:

- Control signals to the LED driver, such as DALI, 0-10V, PWM
- A choice of form factors for integration into the luminaire
- Various types of sensors, such as sensors for occupancy, daylight harvesting, carbon dioxide, pollutant gases, noise, temperature or humidity
- Applications such as people counting, asset tracking, beaconing and power metering

The benefit of the future-proofing characteristics of Qualified Bluetooth Mesh is that if the end customer is not ready to use the data on the cloud that a system can generate, they do not need to include gateways at the time of installation. If a decision is made at a later date to use the power of the cloud, the option to do so is available by adding low-cost Qualified Bluetooth Mesh gateways.

Wired technologies: an option for a future-proof installation

Some installation proposals deliberately avoid the use of radio frequencies: bus systems operate via a controlling cable, power-line carriers or Power-over-Ethernet (PoE). Marketing promotion of these technologies has suggested that they are more reliable than wireless systems. But are they competitive?

More attention in recent years has been given to PoE than any other wired communication technology for building infrastructure. For a disruptive technology to be successful, it must also embrace or bridge from an existing one. In the case of lighting controls, the most difficult element to change in the short term is the LED driver. Lighting OEMs must have flexibility in their choice of LED driver options: choice over output power, output current, output voltage and form factor.

With PoE, however, traditional LED drivers cannot be used, because there is today a very limited choice of PoE-compatible LED drivers. Furthermore, the PoE switches which power the PoE LED drivers are expensive, and their power output is low, limiting their ability to supply multiple luminaires.

Finally, the operator's IT department will need to be involved in and supportive of a PoE system, which adds complexity. Since Bluetooth was initially developed to be a reliable cable-replacement technology, for PoE to carve a niche in the lighting control arena, it needs to provide some additional value that draws on its strengths, such as a high data rate. With PoE, luminaires can also process and send audio and video data from and to microphones and speakers and IP cameras, enabling the integration of lighting and security, or enhancing the functionality of a video conference room.

The other wired protocol that is evolving with the needs of the market is DALI, and in particular DALI 2.0. For example, the DALI 2.0 standard has improved the interoperability of the protocol, helping to reduce problems in installation. The upgrade also incorporates the use of occupancy sensing and daylight harvesting. Advanced functionality such as

tunable white lighting control from a single DALI address is now also supported by the standard.

But the greatest impact on the lighting OEM and lighting-control markets is the forthcoming release of the DALI driver diagnostic standard which will also include power metering. This will enable all LED driver manufacturers to use a common interface and protocol when developing the next generation of LED drivers.

Conclusion

More and more companies are starting the process of adopting Qualified Bluetooth Mesh. The advantages the protocol will bring to the lighting industry and building automation as a whole are clear. It is an interoperable, low-cost, simple, reliable, scalable and secure standard which has the potential to bring unity and clarity to lighting OEMs, specifiers and building managers.

Qualified Bluetooth Mesh addresses the drawbacks of existing protocols, which had previously induced several new lighting-control equipment vendors to create their own proprietary solutions. This, however, had caused confusion in the lighting industry, leading many lighting OEMs to wait for the dust to settle before investing in the implementation of wireless lighting-control technology.

It will still take a couple of years before the Qualified Bluetooth Mesh ecosystem reaches critical mass. The opportunity cost for lighting OEMs of continuing to wait might be too high, however: competitors might already be investing, and could gain an early-mover advantage.

Now is the time for lighting OEMs to change their mindset, from an 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

By Microsemi

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.



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

To a consumer, speaking to a smartphone is no different from speaking to a smart speaker. In fact, consumers expect the same level of word-recognition capability that they have come to expect from their smartphone, even though the implementation of a smart speaker is more difficult from an acoustic standpoint.

Operation of a smart 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, where audio processing will take place. For Amazon, a single word, 'Alexa', triggers the speaker to wake up. The Google Home command 'OK Google', or Apple's 'Hey Siri' do not seem so natural. They lead to the awkward construction of simple commands, such as, 'OK Google, turn on the lights', or 'OK Google, turn up the volume'.

In the case of the Amazon Echo, the detection of the wake-up word is carried out locally. This is crucial: if this is not executed entirely within the smart speaker, it will need to continuously send voice packets to the cloud for processing.

Once a wake-up word is detected, the user issues a command, such as 'Turn on the kitchen light'. The connected device sends the verbal command to the Amazon Web Services (AWS) cloud computing service. After deciphering the command, it will then instruct the kitchen light to turn on.

This architecture works because developers have built the skills for using the Amazon Alexa cloud-based voice service into devices running on AWS, as shown in Figure 2.

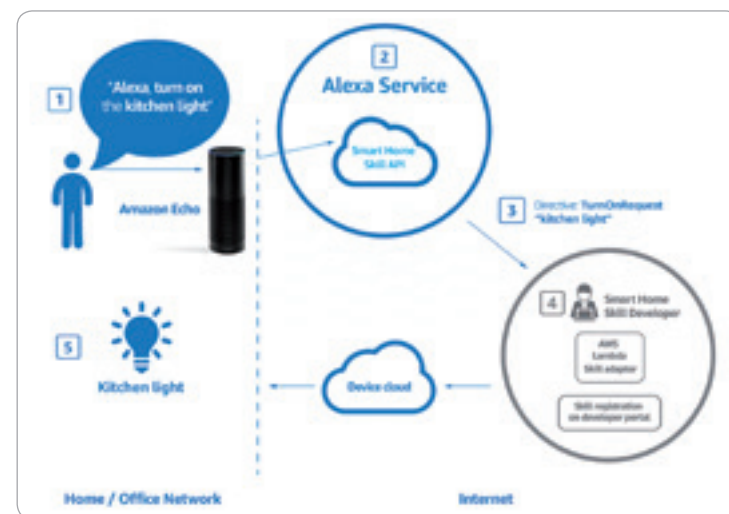


Fig. 2: The command architecture for the Amazon Alexa voice service. (Image credit: developer.amazon.com)

There are particular challenges involved in implementing speech recognition in a device which may be as far as 10m away from the user. Distance is not the only challenge for the smart speaker: interference from echoes bouncing off the walls in the room, from music playing from an audio speaker, or from other audible noise sources can make it difficult for a smart speaker to distinguish 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 source, 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 about the microphones' characteristics and the configuration of the microphone array.

Barge-in: while a smart speaker may be deployed to tell the time or weather, users will also frequently ask it to play music. Barge-in allows trigger words to be detected during music playback.

De-verberation: this feature removes the echo in the room to improve voice clarity.

Automatic gain control: the user might sometimes be located in front of the speakers, at other times 5m away. Automatic gain control applies the appropriate gain to the signal for the distance over which the voice carries.

Noise reduction: this feature mitigates the effect of ambient noise such as fans.

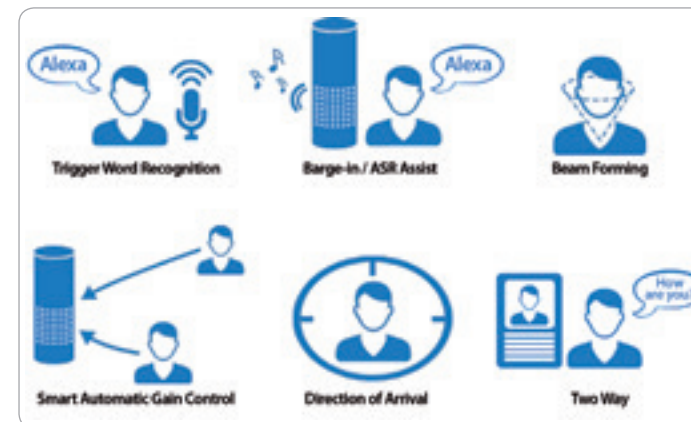


Fig. 3: ASR Assist technologies. (Image credit: Microsemi)

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 underpinning 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 to use a Digital Signal Processor (DSP) chip.

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's Timberwolf 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.

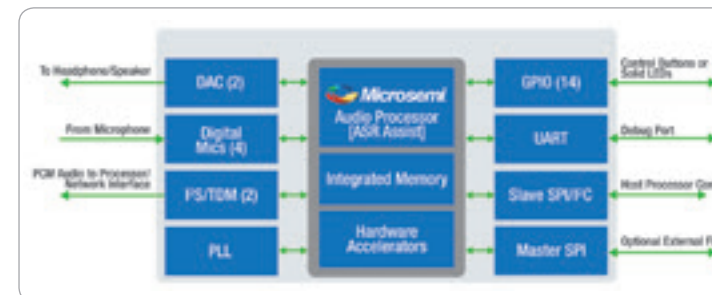


Fig. 4: Simplified block diagram of the ZL38063 audio processor. (Image credit: Microsemi)

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 bill-of-materials costs, by replacing a design based on a combination of a microcontroller and a 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, complex multi-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.

The project's software 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 dsPIC33E/F DSC family from Microchip may be used in ASR applications, since they offer features such as speech encoding and decoding, noise suppression, acoustic/line echo cancellation, equalizer and automatic gain control.

Amazon's approach to implementing ASR capability in the Echo smart speaker has been to integrate an audio DSP into the device. The audio DSP performs most of the operations required for the ASR Assist functions. A clean signal is then sent to an applications processor via an I2C or serial peripheral interface for routing to the cloud computing service.

Local ASR: when there is no access to the cloud

Thus far, the discussion has been around speech recognition in the cloud. But what if the user wishes to control lights or the temperature of the hot tub when she or he has no access to the Alexa cloud-based voice service? There will be use cases in which an internet connection is not available: this means that speech recognition must be performed locally.

Without access to the cloud, there is no access to the vast Artificial Intelligence (AI) capability which underpins the operation of speech recognition. When performing speech recognition locally, a smart speaker is limited to a vocabulary of at most 20 short phrases. However, this is perfectly acceptable for convenience applications at home, for which users can remember only a limited number of command phrases.

Various companies specialize in such technology: they will work with OEMs to develop custom command phrases which may be loaded in the audio DSP or host MCU.

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 whether speech will be the Human-Machine Interface (HMI) of the future for a much broader range of end products. Users had buttons and switches for centuries: in just the past decade, Apple's iPad® and iPhone® mobile digital devices have introduced a completely new way of interfacing with electronics products. Now customers expect a device's HMI to include a smooth touchscreen experience.

The same phenomenon is happening with voice: smart speakers are proliferating at an unprecedented rate, and eventually customers will come to expect to 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 help increase demand for their next product design.

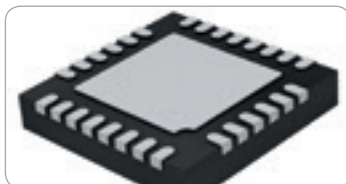
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100V three-phase BLDC motor pre-drivers

MONOLITHIC POWER SYSTEMS

The MP6537/8/9 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 features include programmable Over-Current Protection (OCP), adjustable dead-time control, Under Voltage Lockout (UVLO), and thermal shutdown.

- Supports 100V operation
- Internal LDO supports 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 VBST 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



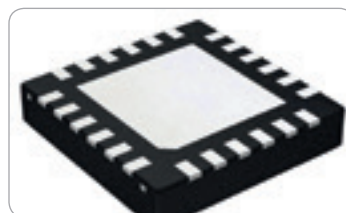
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±40V high-speed USB port protector

MAXIM INTEGRATED

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 systems with a maximum data line protection of ±40.7V and power/ground line protection up to ±50V. V_{BUS}, 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 V_{BUS} and GND, allowing for the lowest possible insertion loss while providing high ESD and Burst protection.

- Integrated ±50V DC protection for V_{BUS}/GND
- Integrated ±40.7V DC protection for D+/D-
- High (480Mb), full (12Mb), and low (1.5Mb) speed capable
- 4Ω V_{BUS}/D+/D- channel resistance
- Supports USB OTG
- Thermal shutdown protected
- -40°C to 105°C operating temperature
- Supply voltage: 3.0V to 5.5V
- 24-pin, 4mm x 4mm TQFN package



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12-bit programmable position sensor for contactless potentiometer applications

AMS

The AS5200L is an easy to program stacked dual-die magnetic rotary position sensor with a high-resolution 12-bit I²C or PWM output. This contactless system measures the absolute angle of a diametric magnetized on-axis magnet. This AS5200L is designed for contactless potentiometer applications and its robust design eliminates the influence of any homogenous external stray magnetic fields. The industry-standard I²C interface supports simple user programming of non-volatile parameters without requiring a dedicated programmer.

- Contactless angle measurement
- 0 to 360 degrees measurement range
- Automatic entry into low-power mode
- AEC-Q100 automotive qualified
- Digital output over I²C or PWM-encoded output
- Automatic magnet detection
- MLF-16 (5mm x 5mm) package with wettable flanks
- -40 to 125°C temperature range



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Miniature digital infrared thermometer IC

MELEXIS

The MLX90632 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 MLX90632 is factory calibrated in the ambient temperature range from -20 to 85°C and from -20 to 200°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° Field of View
- 0.02°C measurement resolution
- 3.3V supply voltage
- 1mA supply current and 2.5μA sleep current
- Integrated post-calibration option
- External ambient and object temperature calculation
- I²C compatible digital interface
- Software definable I²C address
- 0.5s default refresh rate, configurable between 16ms and 2s
- 3 x 3 x 1mm QFN package



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Multi-channel DC power/energy monitor with accumulator

MICROCHIP

The PAC1932/33 is a dual-/three-channel power monitor and energy monitor 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 I²C/SMBus including an 8-sample 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 8, 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 measurement
- UQFN and WLCSP packages



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65V synchronous PWM buck regulators

ON SEMICONDUCTOR

FAN6500xx 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 voltage range from 4.5V to 65V. The family includes three parts, FAN65004B/5A/8B, 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, under-voltage lockout, over-voltage protection, under-voltage protection and short-circuit protection.

- 4.5V to 65V input voltage range
- 0.6V reference voltage with 0.67% accuracy
- Dual LDOs for single-supply operation and to reduce power loss
- Adjustable soft start and pre-bias startup
- Enable function with adjustable input voltage Under-Voltage Lockout (UVLO)
- 100kHz to 1MHz switching frequency
- Selectable CCM PWM mode or PFM mode for light loads
- External compensation for wide operation range
- 6 x 6 mm PQFN 35 package



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Low-power 3D Hall sensor with I²C interface and wake-up function

INFINEON

The TLE493D offers accurate three-dimensional sensing with extremely low power consumption. Within its small 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 I²C communication interface, which enables a bidirectional communication between the sensor and the microcontroller. 3D magnetic sensors are ideal for control elements, joysticks and e-meters (anti tampering), and the TLE493D is also suited for low-power 3D magnetic automotive applications such as indicators and gear shifters.

- ±160mT 3D magnetic flux density range
- X-Y angular measurement mode
- Power-down mode with 7nA typical power consumption
- Variable update frequencies and power modes (configurable during operation)
- Supply voltage range: 2.8V to 3.5V
- Down to 65μT programmable flux resolution
- Diagnostic functions
- 12-bit data resolution for each measurement direction plus 10-bit temperature sensor
- Temperature range: -40°C to 125°C
- Interrupt signal to indicate a valid measurement to the MCU



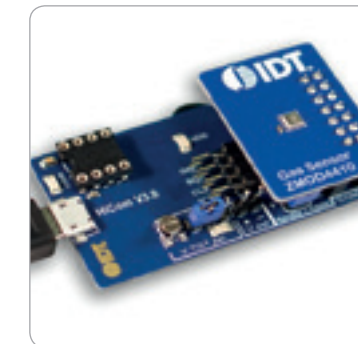
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TVOC and indoor air quality sensor platform

INTEGRATED DEVICE TECHNOLOGY

The ZMOD4410 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 sense element and a CMOS 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 IAQ
- Multiplexed input channel for heater, resistance, and temperature measurements
- Up to 400kHz I²C interface
- 16-bit adjustable ADC resolution
- Module algorithm estimates Carbon Dioxide level (eCO₂)
- Internal auto-compensated temperature sensor; not stress sensitive
- Configurable alarm/interrupt output with static and adaptive levels
- Siloxane resistant



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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 $V_{cc} = 2.5$ 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_{cc} 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_{off} 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-translating devices
- › Available in smallest package for use without step-down mask (X2SON5)

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EFFICIENCY WINS.