FTM

FUTURE TECHNOLOGY MAGAZINE

FUTURE ELECTRONICS

ISSUE 1811

EMEA EDITION

Application Spotlight on:

Connectivity

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NXP launches its first MCU to feature Arm TrustZone security technology

The LPC5500 series of microcontrollers from NXP Semiconductors features the recently introduced Arm® Cortex®-M33 core, which supports the renowned TrustZone security technology used widely in Arm A-class processors. TrustZone technology is approved by the banking industry to support secure financial operations.

Other security features in the LPC5500 MCUs include SRAM physically unclonable function-based root of trust and provisioning, and real-time execution from encrypted images in internal Flash memory.

Pre-register at: www.my-boardclub.com

New LoRaWAN expansion software for STM32 MCUs

STMicroelectronics has released a new I-CUBE-LRWAN expansion software package which enables STM32 microcontrollers to support the LoRaWAN™ low-power wide-area networking protocol. The package consists of a set of libraries and application examples for STM32L0, STM32L1 and STM32L4 series MCUs acting as end nodes.

The ST software is compatible with various LoRa® radio expansion boards provided by Semtech.

Bluetooth 5.0-compliant SoC from Microchip enables immersive audio

Microchip has introduced a fully certified System-on-Chip (SoC) which features Sony's LDAC audio codec technology and a Bluetooth® 5 radio, giving OEMs a means to provide high-resolution audio in mass-market Bluetooth wireless products. Microchip supplies the IS2064GM-0L3 SoC in an 8mm x 8mm LGA package. It is available in production volumes.

181101 For samples or pricing e-mail info@my-ftm.com

Different technologies for different requirements: developers enjoy wide range of options in IoT connectivity

The story of the electronics industry's technology battles tends to end with a decisive victory for one side or another. VHS won, and Betamax became extinct. In the mobile phone, Nokia's doomed Symbian was briefly the leading OS in smartphones, until the Android™ operating system became dominant.

It is looking, however, as though the market for IoT connectivity could buck this trend, simultaneously supporting multiple technology options. There is good reason for this: the term 'IoT' applies to an incredibly diverse range of applications, and their connectivity requirements can vary widely. Different technologies can co-exist if they are meeting different needs.

In the field of Low-Power Wide Area Networking (LPWAN), the LoRaWAN™ and Sigfox technologies are growing in popularity. LoRaWAN technology is successfully used to provide campus-wide coverage at sites such as hospitals and colleges, for instance for sensor and control networks that operate at a low data rate. Public Sigfox networks provide broad coverage with very low end-node power consumption at a low operating cost in some countries such as France.

More recently, cellular telephone networks have re-emerged as a viable contender in the LPWAN space because of the introduction of new systems that provide for low power consumption, while offering the same security and privacy protections as the conventional voice network service. The cellular LTE CatM1 technology is particularly attractive to many applications because it operates over existing 2G, 3G and 4G networks – and does not require the build-out of dedicated network infrastructure. This means that worldwide coverage is already almost universal across urban and rural land. Ideal for smart grid, smart city and smart agriculture applications, CatM1 connectivity is provided by modules from Gemalto, a highly respected manufacturer of cellular transceiver modules and terminals featured on pages 16-17.

A choice of competing technologies is also available to designers of applications that use shorter-range, in-building wireless connections. These options include the Wi-Fi® connectivity provided by Panasonic's dual-mode PAN9026 module, as shown on page 18, and the ISM-band networking supported by STMicroelectronics' S2-LP radio, on page 13. Now Bluetooth® wireless networking is emerging as a popular choice in lighting and building automation applications after the introduction of mesh networking capability in the v4.2 and v5.0 versions of the Bluetooth protocol. On page 20, FTM features the new X-CUBE-BLEMESH1 firmware from ST, which provides a ready-made implementation of mesh network control for STM32 microcontrollers. Bluetooth mesh network nodes can use ST's BlueNRG-2 chip featured on page 18, as well as Panasonic's PAN9026.

The field of connectivity for the IoT is dynamic, seeing the frequent introduction of new technologies and capabilities, some of which are featured in this issue of FTM. If you would like advice on choosing the best option for your application, the engineers at Future Electronics are always ready to help. Contact us via your local branch or email info@my-ftm.com.

Amar Abid-Ali
Vertical Segment Director
Future Electronics

FUTURE ELECTRONICS

Latest LDOs offer very low quiescent current

DIODES INCORPORATED

Diodes Incorporated has announced its AP7354 series of Low Drop-Out linear regulators (LDOs), which draw ultra-low quiescent current. They are available in the SOT-23/-25 package style.

AP7354: Convenient SOT-23 and SOT-25 package styles

The AP7354 series is comprised of nine devices which provide fixed output voltages spanning the range from 1.2V to 4.5V, and a maximum output current of 150mA.

Very low quiescent current of less than 0.25µA makes the AP7354 LDOs particularly suited to applications which must comply with tight requirements for stand-by power consumption. They also help designers to implement circuit designs which offer long operating and stand-by run-time in battery-powered devices.

The AP7354 series is an ideal solution when manufacturing constraints preclude the use of chip-scale packages, or when there is sufficient space on the board to accommodate the convenient SOT-23/-25 package.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- IoT sensors
- IoT devices running from battery power or harvested energy
- Remote monitoring devices
- Smoke, gas or CO_2 detectors
- Health and fitness monitors
- Cameras
- Image sensors

FEATURES

- ±1% output-voltage accuracy
- Input-voltage range: 2.0V to 5.5V
- 23dB power-supply rejection ratio
- 200nA stand-by current
- 4kV ESD tolerance on the human body model

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500V cartridge fuses with current ratings up to 63A have industry's smallest footprint

LITTELFUSE

The 606 series high-current fuse from Littelfuse has a compact footprint which allows circuit designers to reduce the amount of board space they reserve for protection components when designing high-wattage equipment.

The 606 is the smallest cartridge fuse available with current ratings from 40A to 63A and an interrupt rating of 2,000A at 500V AC. It is intended for use in power infrastructure for electric vehicles, and in data center and telecoms power supplies.

It may be used to provide over-current protection in power-supply circuits rated for a single-phase output of up to 23kW, and intended for application in extreme temperatures. Use of a 606 fuse also eliminates the need for mounting accessories and/or lead-forming processes.

606 series: 23kW power rating

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APPLICATIONS

- Electric vehicle battery chargers
- Electric vehicle supply equipment
- Electric vehicle off-board charging stations
- Data center and cloud computing infrastructure
- Telecoms uninterruptible power supplies
- Power conversion equipment

FEATURES

- Small package with compact 10mm x 32mm footprint
- End caps with integrated stand-off leads
- Operating-temperature range: -55°C to 125°C

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New aluminium electrolytic capacitors for automotive market offer high ripple current and large capacitance values

PANASONIC

Panasonic Industry Europe has released its new FP series of automotive-qualified aluminium electrolytic capacitors which offer very high ripple current, up to 2.5 times higher than that of existing FC series products. The AEC-Q200 qualified FP capacitors are ideal for use in automotive applications.

The FP series radial lead-type devices are available in large capacitance values up to 60% higher than those of the FC series. The range of capacitance values of the FP devices is from 510µF to 2000µF. Capacitance tolerance is ±20% at 120Hz and 20°C. The FP capacitors are available with a rated voltage of either 25V or 35V DC.

Case Size (diameter x length)	ESR at 20°C (Ω/100kHz)	ESR at -10°C (Ω/100kHz)	Ripple Current at 105°C (mA_{RMS}/100kHz)
10mm x 16mm	0.068	0.136	2,500
10mm x 20mm	0.052	0.104	3,000
12.5mm x 20mm	0.038	0.076	3,250
12.5mm x 25mm	0.030	0.060	4,000

FP series: Capacitance up to 2,000µF

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS
- Automotive systems

FEATURES
- Up to 5,000h endurance at 105°C
- Operating-temperature range: -55°C to 105°C

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Low-profile DC-DC power modules feature standard DOSA footprint

RECOM

RECOM has introduced a new series of DC-DC converter modules which are compatible with a standard Distributed-power Open Standards Alliance (DOSA) footprint, and which operate at very high efficiency of up to 99% to enable operation without a heat-sink.

The four new RPM modules, which are just 3.75mm high, are notable for their high power density, the product of a new controller IC and a novel multi-layer PCB layout.

The modules' surface-mount package is thermally optimized to draw heat away from the board: with no derating, it can supply more than 800W/in³ at a temperature of up to 90°C. The 2A, 3A and 6A RPM modules are rated for operation at full load over a wide temperature range of -40°C to 90°C, and up to 107°C for the 1A modules.

The power modules also help designers to achieve compliance with system EMC regulations, as they feature a ground plane in the PCB and a metal housing which provides six-sided shielding.

The modules include input and output capacitors, and require no additional components.

RECOM's RPM modules: High power density of >800W/in³

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APPLICATIONS
- Industrial equipment
- Network equipment
- Storage devices
- FPGA power supply
- Battery-powered equipment
- Telecoms equipment
- Point-of-load converters

FEATURES
- Adjustable output voltage
- Power sequencing
- Soft-start control
- On-off control
- Power Good signal

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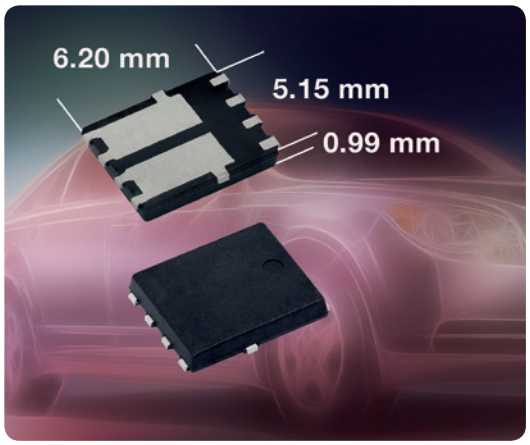
Fast 200V rectifiers increase power density, efficiency and system reliability

VISHAY

Vishay Intertechnology has introduced four new 200V FRED Pt® rectifiers offering very fast reverse recovery in the thermally-efficient FlatPAK™ 5mm x 6mm package with a low profile of <1mm.



FRED Pt rectifiers: FlatPAK package has standard MOSFET footprint

The commercial/industrial-grade VS-6DKH02-M3 and VS-8DKH02-M3 and the automotive-grade VS-6DKH02HM3 and VS-8DKH02HM3 enable developers of automotive or telecoms equipment to realise power-system designs featuring high power density and high efficiency.

Configured as dual-die rectifiers with separate cathode connections, the devices allow designers to simplify PCB layouts by using one package instead of two smaller packages. Vishay's FlatPAK design has a standard 5mm x 6mm QFN package's footprint, which is common in other component types such as MOSFETs, and thus supports the implementation of various circuit topologies.

Part Number	VS-6DKH02-M3	VS-6DKH02HM3	VS-8DKH02-M3	VS-8DKH02HM3
Forward Current	2 x 3A	2 x 3A	2 x 4A	2 x 4A
Forward Voltage	0.71V	0.71V	0.7V	0.7V
AEC-Q101 Qualified	No	Yes	No	Yes

The rectifiers' FRED Pt technology produces a very fast reverse-recovery time of 25ns as well as low reverse-recovery charge and soft recovery characteristics over the junction-temperature range of -55°C to 175°C.

The rectifiers' low forward voltage drop reduces power losses and improves conversion efficiency.

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APPLICATIONS
- Engine control units
- Anti-lock braking systems
- Automotive HID and LED lighting
- Telecoms power supplies

FEATURES
- 200V maximum reverse voltage
- Reverse leakage-current range: 6µA to 7µA
- Junction-capacitance range: 10pF to 14pF
- High-temperature reverse bias tested for 2,000 hours

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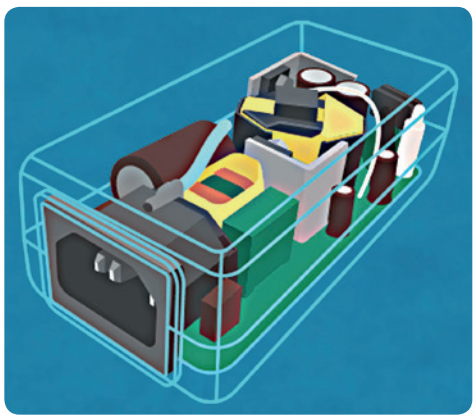
Custom power adapters allow OEMs to specify unique electrical and mechanical parameters

CUI INC



CUI power adapters: Custom design options

Alongside CUI's broad portfolio of off-the-shelf wall plug-in and desktop power adapters, the company also offers numerous modification options, providing users with a custom power adapter precisely specified to meet the requirements of an individual application.

Future Electronics together with CUI priorities being a flexible, collaborative partner which works with the customer from start to finish to create the ideal adapter solution. Potential modifications in a custom power adapter can be made to both the mechanical or the electrical design. CUI can also provide the customer with regulatory assistance to ease the regional or worldwide compliance process.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

COMMON MODIFICATIONS
- Case design and colours
- Labels and branding
- Cord lengths and cables
- Non-standard output voltages
- EMI filtering
- Extended temperature ranges
- Testing and certification management
- Country-specific agency marks

APPLICATIONS
- Consumer
- Mobile devices
- IT and communications equipment
- Audio/visual equipment
- Medical, dental, and home healthcare equipment
- Communication systems
- Measurement equipment

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Compact USB Type-C connector supports 10Gbits/s data-transfer

HIROSE

Hirose has introduced the CX series of surface-mount and through-hole USB Type-C™ connectors which offer a compact footprint to save board space.

CX series receptacle: Symmetrical mating face

The new CX series connector, which conforms to the specifications of the USB 3.1 Gen 2 standard, supports the 10Gbits/s transmission rate, enabling data transfers twice as fast as those of a conventional 5Gbits/s USB 3.0 connector. A high-current variant, the CX90M-16P, operates at the USB 2.0 data rate of 480Mbits/s, and is intended for use in fast battery chargers.

Product	Type	ESR at -10°C (Ω/100kHz)	Ripple Current at 105°C (mA_{RMS}/100kHz)
CX60-24S-UNIT	Plug (Unit)	Surface-mount, double-row	Slim type
CX60-SLDA	Plug (Plug shell)	-	Slim type
CX70M-24P1	Receptacle (Mid-mount)	Hybrid (surface-mount and DIP, 1 row each)	Space saving type, Depth: 8.35mm
CX70M-24P2	Receptacle (Mid-mount)	Hybrid (surface-mount and DIP, 1 row each)	Space saving type, Depth: 7.95mm
CX90B1-24P	Receptacle (Mid-mount)	Surface-mount, double-row	10Gbits/s data transfer, robust structure type
CX90M-16P	Receptacle (Mid-mount)	Surface-mount, double-row	Capable of carrying high current up to 6A for fast charging USB 2.0 data rate of 480Mbits/s
CX90MWD2-24P	Receptacle (Mid-mount)	Surface-mount, double-row	Waterproof (IPx8)

The receptacles feature a hybrid design and use both surface-mount and through-hole soldering to improve mounting accuracy and to minimize the board mounting space needed. The design also facilitates automated optical inspection, and eases reworking of the solder terminal joints with a visible lead design.

The slim plug is reversible, and the user-friendly receptacle features a symmetrical mating face to prevent incorrect insertion.

A tactile click can be felt when mating the connectors to ensure correct engagement and prevent incomplete mating.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- Control systems
- Drones
- Medical devices
- Smart meters
- Point-of-sale equipment
- Imaging equipment
- Small portable devices

FEATURES

- 24 contacts
- Pitch: 0.4mm surface-mount, 0.8mm DIP
- 1.25A maximum current rating
- 20V AC voltage rating
- 10,000 mating cycles

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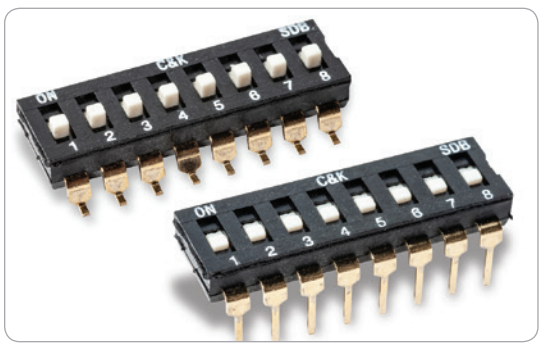
DIP switches in low-profile, space-saving package

C&K SWITCHES

The new SDB series of DIP switches from C&K provides system designers with a cost-effective solution for applications that require a low-profile, space-saving switch. They are ideal for address switching in industrial control equipment, logic switching in computers and peripherals, and for function control in many other applications.



SDB series switches: Flush or extended actuator

The SDB series switches offer a long operating lifetime. They are available in through-hole and surface-mount versions.

The SDB DIP switch series adds to C&K's large family of DIP switches, which includes:

- Surface-mount half-pitch DIP switches
- Low-profile and standard-profile DIP switches
- Rotary and coded DIP switches
- Jumper switches with a variety of extended actuator and flush actuator styles
- Top tape-seal options

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- Industrial automation and control devices
- Servers
- Modems
- Routers
- ATMs
- Point-of-sale terminals

FEATURES

- Number of positions: 1 to 12
- Flush or extended actuator
- Contact ratings: 25mA at 24V DC or 100mA at 50V DC
- 8N maximum operating force
- Electrical life: 1,000 cycles at rated load

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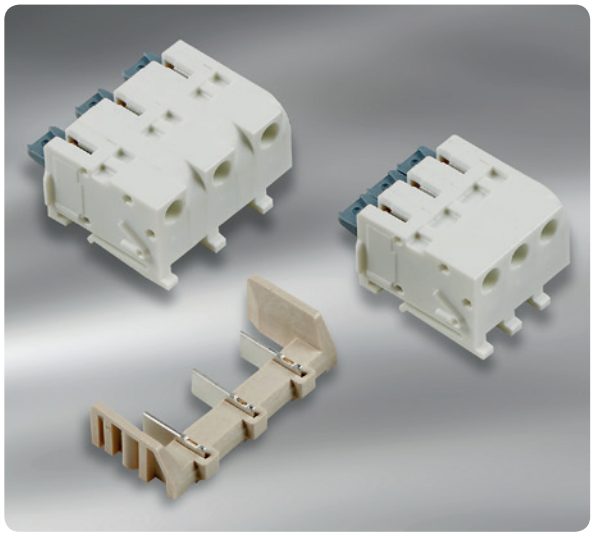
Poke-in wire connectors make wall-mounting easy

TE CONNECTIVITY

TE Connectivity's (TE) BUCHANAN WireMate two-piece poke-in series of connectors provides designers with a three-directional solution for wall-mounting a device. Terminations are easy to make, and present no difficulties even to the novice installer.



TE poke-in connectors: 5mm and 8mm versions available

Wires are routed through an opening in the wall to TE's BUCHANAN WireMate connector mounted on a wall plate. Once stripped of insulation, wires may be easily poked into the terminal block device, providing a reliable termination without the need for tooling. Wire extracting is also easy by means of a simple lever. The system provides a flat connector surface reserved for wire marking. Colour options are available.

The mating header is surface-mounted to the PCB in the device to be mounted on the wall. The two-piece combination allows for wall mounting of a device in three different directions: into the wall, along the wall, or in a twisting or rotating motion.

Separate headers and connectors are available with 2, 3, 4, 5, 6, 7 or 8 positions. The connector/header combinations are supplied in 5mm and 8mm versions.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- Thermostats
- Smoke detectors
- Control panels
- Environmental monitors

FEATURES

- Current ratings: 5A for 18 AWG wire; 3A for 20-24 AWG wire
- 250V AC voltage rating
- 2mm panel thickness
- 10mm height from wall plate to PCB
- UL recognised

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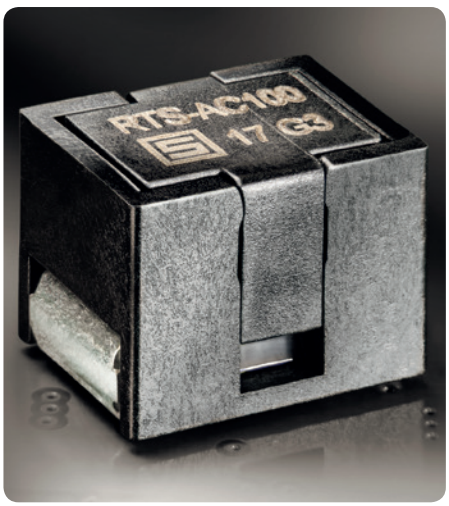
Reflowable safety switch protects power semiconductors from risk of thermal run-away

SCHURTER

Schurter's RTS is a compact thermal switch which protects power semiconductors, safely interrupting the circuit in over-temperature conditions. It gives physical protection against the risk of thermal run-away, guaranteeing the circuit will shut down should software-based safety measures fail.



The RTS switch trips at 210°C

The RTS, or Reflowable Thermal Switch, protects power semiconductors such as MOSFETs, IGBTs, triacs and Silicon-Controlled Rectifiers (SCRs) from overheating. The RTS is a surface-mount device which may be assembled on a PCB using conventional reflow soldering techniques with temperature profiles up to 260°C before it is activated.

After the RTS is soldered to a PCB, mechanical activation arms the RTS for tripping at an over-temperature threshold of 210°C. The advantage of mechanical activation over the electrical activation required by other thermal switches is that the activation status is immediately visible to the installer. In addition, the RTS does not require the third contact required by devices that are activated electrically.

The RTS, which has a footprint of just 6.6mm x 8.8mm, can handle operating currents up to 100A at rated voltages of up to 60V DC.

Variants of the RTS are available with an integrated shunt or an additional over-current fuse. Integrating these functions into the RTS extends the space-saving benefits of the device in high-power circuits.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- Anti-lock braking system
- Automotive fan
- Glow plug
- Fuel heater
- Battery protection
- Motor drives
- Lighting ballasts
- H-bridge circuits

FEATURES

- 95mΩ cold resistance
- AEC-Q200 qualified
- Compatible with MIL-STD specifications
- 50N maximum activation force
- 0.75g weight

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LED in popular 2835 package achieves new high efficacy of >200lm/W

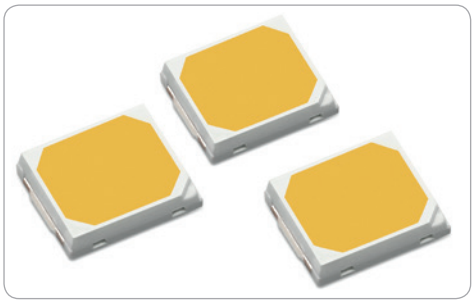
LUMILEDS

Lumileds announces the introduction of the LUXEON 2835 HE, which sets a new standard for efficacy in the mid-power LED market: the 4000K/80CRI variant achieves 202lm/W when producing 36lm at a drive current of 65mA.

The new LED, which extends the successful LUXEON 2835 line, is optimized for high color consistency as well as high efficacy. Color variation at the LED light source is limited to just a two-step MacAdam ellipse over the full operating-temperature range.

Lumileds' high-reliability design also enables the LUXEON 2835 HE to be driven at high currents of up to 480mA, enabling lighting OEMs to produce a high light output from low-profile general lighting fixtures. At 480mA, the 4000K variant produces an output of 220lm.

Lumileds expects the LUXEON 2835 HE to be most popular in applications such as troffers and downlights, in which high efficacy is important and LED count must be minimized.



Lumileds: 220lm output at 480mA drive current

Unlike many 2835 LED packages on the market, the LUXEON 2835 HE is lumen-maintenance tested on the TM-21 basis to 12,000 hours, indicating L70 lumen maintenance of 72,000 hours in the field.

The new 28mm x 35mm LED is available immediately as a drop-in replacement for standard 2835 LED packages. It can also replace 5630 or 3030 mid-power sockets that have similar optical requirements to those of a 2835 LED.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS
- Troffers
- High-bay fixtures
- Low-bay fixtures

FEATURES
- Minimum 80 CRI
- CCT options: 2700K, 3000K, 3500K, 4000K, 5000K, 5700K, 6500K
- 2.71V forward voltage
- 13°C/W junction-to-solder pad thermal resistance

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Power-line filters block noise in LED and fluorescent lighting circuits

TE CONNECTIVITY

The TE Connectivity (TE) Corcom FB series of power line filters now includes new parts, designated FBL, for lighting applications that need standard EMI performance levels.

Corcom FB series: Wire lead terminations at input and output

The filtering integrated in LED drivers and fluorescent ballasts is sometimes insufficient when connected to a load to attenuate conducted emissions. External filters in the FB series from TE may be used to provide greater attenuation of RF noise conducted through the power line. Filters with the new FBL designation offer a standard filtering performance, whereas the FB-designated parts offer high filtering performance.

The 10A and 20A versions of the FBL series are suitable for lighting applications that draw high currents. They are also suitable for use in lighting circuits operating at up to 300V AC.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS
- Fluorescent ballasts
- LED displays
- Office and hospital lighting
- Architectural lighting
- Instrumentation lighting
- Outdoor signage
- UV curing lights

FEATURES
- Wire lead inputs and outputs
- Current ratings: 0.5A, 1A, 2A, 3A, 5A, 10A, 20A
- Maximum leakage current:
  - 0.12mA at 120V AC, 60Hz
  - 0.21mA at 240V AC, 50Hz

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Offline flyback regulator increases efficiency, accuracy and protection in consumer electronic devices' embedded power supplies

By Chris Lee, Senior Product Marketing Manager, Power Integrations

POWER INTEGRATIONS

The InnoSwitch™3-CE family of power regulator ICs enables designers to create highly efficient, compact power supplies for consumer products such as set-top boxes, networking adaptors, wireless speakers and gaming terminals.

The highly integrated InnoSwitch3-CE parts are comprised of a primary-side Quasi-Resonant (QR) flyback controller which operates in continuous and discontinuous conduction modes, and a 650V primary-side power MOSFET. They perform secondary-side regulation without the use of optocouplers, taking advantage instead of a FluxLink™ isolated feedback link which also facilitates precise control of secondary Synchronous Rectification (SR), as shown in Figure 1.

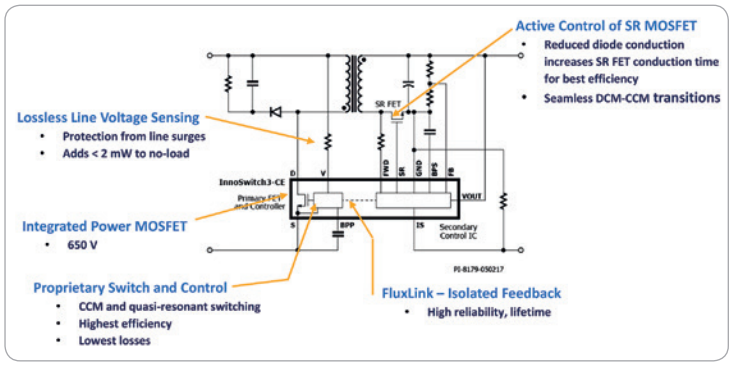

Fig. 1: Key features of the InnoSwitch3-CE

The conversion efficiency of the InnoSwitch3-CE is up to 94%, and is almost flat across the load range. Often eliminating the need for a heat-sink, the InnoSwitch3-CE offers excellent noise immunity and very low output ripple, and this allows small power supplies to be embedded in a wide range of consumer products which previously would have used an external power adapter.

High switching efficiency is complemented by low power consumption in stand-by mode of <15mW with no load enabling OEMs to meet the requirements of both existing and proposed global energy efficiency regulations. A comprehensive array of protection and safety features has also been integrated into the InnoSwitch3-CE family. These include:

- Short-circuit protection
- Line input over-voltage and under-voltage protection
- Open-loop and pin-short protection
- Latching or hysteretic over-temperature protection
- Output over-current and over-voltage protection

InnoSwitch3-CE ICs incorporate Power Integrations' proprietary FluxLink inductive-coupling communications link. Using this technology, they accurately control the operation of the primary-side switch with secondary-side SR to maximize efficiency. Accurate control prevents potentially damaging cross-conduction, or shoot-through, even as load changes force the power supply to repeatedly switch between discontinuous and continuous conduction modes. In addition, FluxLink is a safe barrier-crossing technology which is approved worldwide, providing galvanic isolation between the primary side's high voltage and the low-voltage secondary side. This removes the need for unreliable discrete isolation components such as optocouplers in the feedback circuit.

The primary-side QR flyback controller employs a combination of on-off control, variable-frequency and variable-current control techniques to achieve flat efficiency across the entire load range. This approach allows the InnoSwitch3-CE family to provide almost noiseless power solutions producing an output of up to 65W, well beyond the power capability of traditional on-off control schemes.

The secondary side consists of a controller, a transmitter circuit magnetically coupled to the primary-side receiver via FluxLink, Constant Voltage (CV) and Constant Current (CC) control circuits for output voltage and current regulation and a synchronous rectifier driver. Numerous safety features can be selected to provide either an auto-restart or latching shut-down fault response.

Excellent output-voltage regulation of better than ±3% and output-current regulation of better than ±5% across line and load is achieved by secondary sensing. The secondary-side controller directs the operation of the primary side, initiating a primary-side switching cycle only when it has finished its own switching cycle.

QR or valley switching force the integrated primary-side MOSFET to turn on at the minimum MOSFET drain-source voltage. This significantly reduces switching losses and EMI. Excellent noise immunity enables designs using the InnoSwitch3-CE to achieve Class A performance levels in accordance with the suite of relevant EN 61000-4 standard specifications, making it easy for integrated power-supply designs to comply with EMC regulations.

The InnoSwitch3-CE is available in a compact new InSOP 24D package which offers reinforced isolation up to 4kV and carries UL1577 and TÜV (EN 60950) safety approvals. An online selection tool, Build Your Own InnoSwitch, guides the designer to the InnoSwitch device that best meets the needs of their application. Power Integrations also supplies the comprehensive PI Expert™ design software, and reference designs, including the 36W circuit, featured in Figure 2.

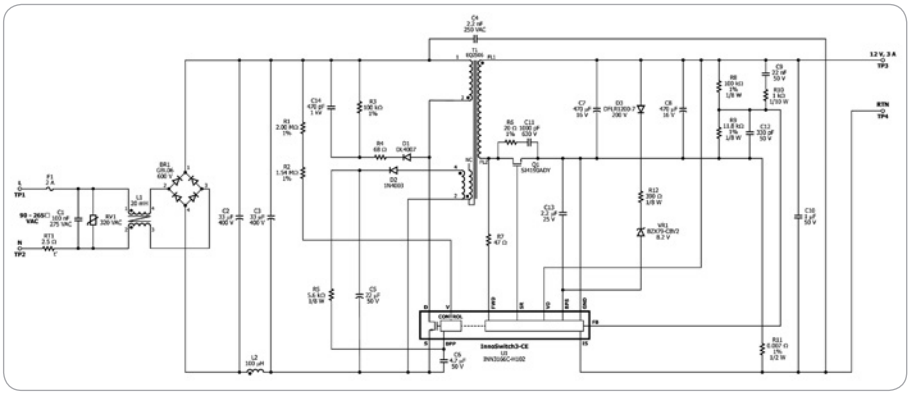

Fig. 2: Typical design for a 36W flyback converter operating from a 90V to 265V AC supply and producing a well-regulated 3A/12V output

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The benefits and uses of the lat package technologies

Christian Backhaus, Application Marketing Manager, Nexperia

NEXPERIA

Electrical circuits in industrial applications often require rectification and unidirectional current flow. Ideally, current should flow without resistance in one forward direction, and reverse current should be completely blocked. In addition, switching between one direction and the other should be extremely fast, and produce low losses.

Schottky diodes and rectifiers provide a good match for these requirements. Very low forward voltage drop is a notable feature of Schottky rectifiers, as is the ability to support high-frequency switching.

Important parameters of Schottky diodes and rectifiers

Schottky rectifiers have a metal-semiconductor junction. The threshold voltage of a Schottky rectifier is much lower than that of the PN type of rectifier, and this means that its forward voltage drop is much lower too: from 400mV to 850mV, compared to a range of 600mV to 1,000mV for PN rectifiers.

The different constructions of a Schottky and a PN rectifier are shown in Figure 1. Limited by the low bandgap of the metal-semiconductor junction, the reverse voltage ratings of Schottky rectifiers range up to 150V. The PN junction of a PN rectifier, on the other hand, provides a much higher reverse-voltage capability of up to 1,200V.

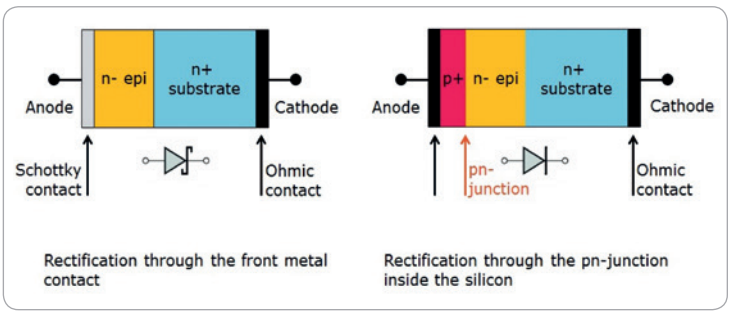

Fig. 1: The structure of a Schottky rectifier (left) and a PN rectifier (right)

The reverse-recovery time of a Schottky rectifier is much shorter than that of a PN rectifier. Again, this is caused by the small space-charge region, as there is no charge stored in metal, only in the semiconductor material. Thus the switching frequency of a Schottky rectifier can be higher than that of a PN rectifier. This makes the Schottky rectifier a suitable solution in high-frequency switching applications which need to consume little power.

Described next are some examples of applications for Schottky rectifiers.

Power supplies: boost converter

Electrical appliances include a wide variety of switch-mode power supplies, from small chargers for smartphones to high-voltage on-board-chargers for electric vehicles. Charging requires Power Factor Correction (PFC) at high frequencies of 50 to 100kHz, a function which calls for a rectifier with a fast switching capability. A typical PFC circuit is shown in Figure 2.

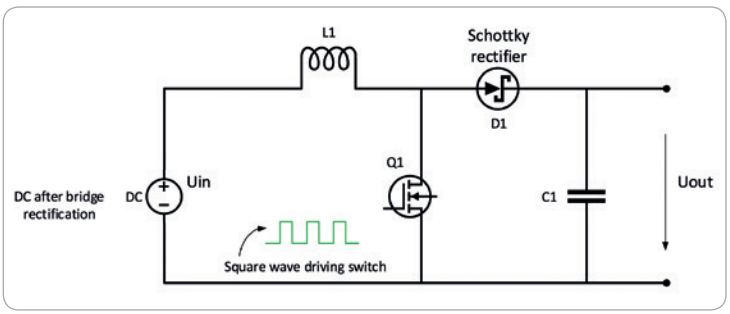

Fig. 2: Typical boost converter circuit for which a PMEG series Schottky rectifier is ideal

Schottky rectifiers in the Nexperia PMEG series are suited to this function, since they offer a low forward voltage drop and low leakage current: this gives high power efficiency. PMEG series rectifiers can supply up to 15A in the forward direction and handle reverse voltages of up to 100V. Rectifiers under development by Nexperia will extend these power ratings in future.

Likewise in an automotive power system containing a 48V power distribution bus, DC-DC power conversion is required to supply board-level systems operating in the 12V and 5V power domains. Here too, a high-frequency PFC circuit can benefit from the use of a PMEG Schottky rectifier.

Reverse polarity battery protection

Another application for Schottky rectifiers in automotive applications is reverse polarity battery protection, which protects circuit components from damage in the event of a faulty battery connection, as shown in Figure 3.

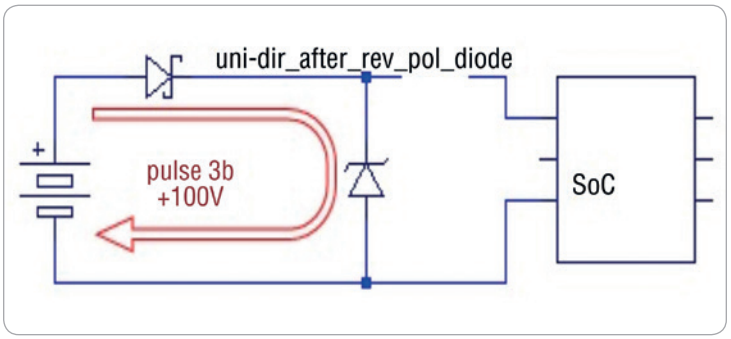

Fig. 3: Reverse polarity protection using a Schottky rectifier and a Zener diode

Here, the rectifier is only called into action in exceptional circumstances. This means that in selecting the rectifier, the designer should put the emphasis on low forward voltage and a reasonably high reverse-voltage capability; low leakage current in reverse operation mode is of little importance. For this application, the Nexperia PMEG6030ELP is ideal: it offers 60V reverse voltage and 3A forward current, and can withstand pulses as specified in the ISO7637-2 standard.

est Schottky rectifier device and

New technology extends Schottky capabilities

Schottky rectifiers are most commonly based on planar technology, which is notable for its low capacitance. An alternative to the planar architecture is trench technology: implanted isolating trenches are etched into the silicon, as shown in Figure 4.

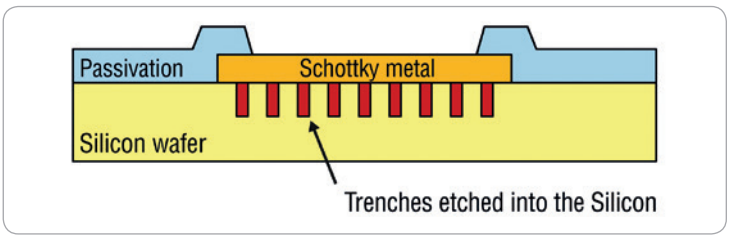

Fig. 4: A trench technology Schottky rectifier

The trenches increase the density of the electric field lines, and this has the effect of reducing both the forward voltage drop and reverse leakage current. Trench devices can also support a higher maximum junction temperature. The principal trade-off is that the capacitance of a trench device will be higher than that of a planar device.

New Schottky technology is under development now with the goal of overcoming the reverse-voltage limitation to which both planar and trench technology are subject, the result of the metal-semiconductor transition. Nexperia's roadmap forecasts that the reverse-voltage range of Schottky rectifiers will be extended first to 200V, and eventually up to 600V.

Package improvements

One of the most important innovations in Schottky rectifier design has been to package them in a Clip-bonded Flat Power (CFP) package, which is very thermally efficient. The package design has a solid copper clip and exposed heat-sink to reduce the package's thermal resistance and to optimize the transfer of heat into the ambient environment: this helps the power-system designer to create smaller and thinner board designs, as shown in Figure 5.

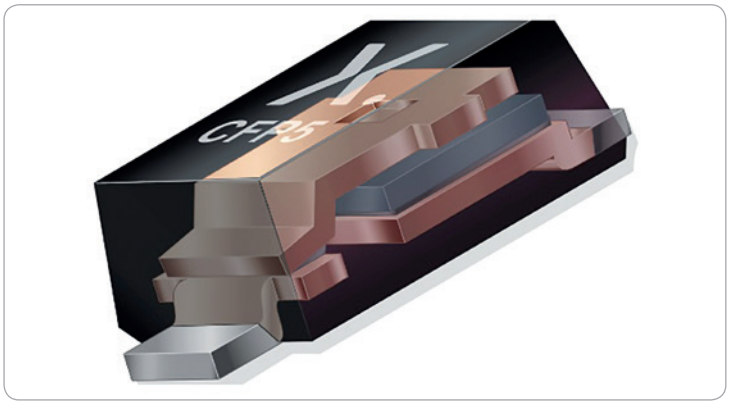

Fig. 5: A cut-away illustration of the inside of a CFP package

The CFP package is currently available in three versions:

- CFP3 or SOD123W
- CFP5 or SOD128
- CFP15 or SOT1289

These packages are rated for forward current up to 15A. According to the Nexperia roadmap, rectifiers in CFP packages will in future be able to handle currents above 30A. The CFP3 packages deliver a footprint saving of 50% when compared to earlier SMA-packaged devices.

Nexperia portfolio overview

In addition to planar silicon technology, Nexperia offers a growing range of alternative silicon rectifier technologies, trimmed to suit the requirements of specific applications, as shown in Table 1.

- *Trench Schottky rectifiers*: these high-performance parts build on Nexperia' s existing portfolio of planar types, offering a combination of low reverse current and low forward voltage. This increases thermal stability and reduces the risk of thermal run-away. The trench Schottky rectifiers offer a maximum junction temperature of 175°C, and are AEC-Q101 qualified.
- *Schottky rectifiers with low reverse current*: these Schottky rectifiers are optimized for low reverse current, and are suitable for applications which require thermal stability at high temperature.

Product Group	Maximum Reverse Voltage (V)	Maximum Forward Current (A)	Benefits	Examples of Use
Planar Schottky rectifiers with low forward voltage	20-60	1-15	Optimized for low power loss and high efficiency	Reverse polarity protection DC-DC buck converters
Trench Schottky rectifiers with low forward voltage and low reverse current	40-60 (100 in Q1 2019)	1-15	High efficiency at high ambient temperature	Polarity protection Blocking and ORing
Low leakage planar Schottky rectifiers with ultra-low reverse current	60-100	1-10	Strong protection against thermal run-away	DC-DC boost converter in automotive systems
Rectifiers under development	120-200	1-3	High performance at low cost Low forward-voltage replacement for PN rectifiers	Freewheeling DC-DC boost/buck converters EMI filtering

Table 1: Summary comparison of Schottky rectifier types

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Rapid prototyping kit accelerates design of secure IoT end nodes

NXP SEMICONDUCTORS

NXP Semiconductors has launched a board which provides a development platform for Internet of Things (IoT) nodes.

The Rapid IoT Prototyping Kit, which has the orderable part number SLN-RPK-NODE, is supplied with a comprehensive suite of tools and software, including a real-time operating system, drivers, middleware, applications for the iOS and Android™ mobile operating environments, and IoT cloud connectivity.

NXP has also introduced an online Integrated Development Environment (IDE) to support the prototyping kit. Rapid IoT Studio offers a fast and simple way to create, deploy and manage complete embedded-to-cloud solutions for a wide range of IoT applications. Offering a graphical drag-and-drop programming interface, it relieves the developer of the need to write any code, and enables the simultaneous creation of firmware for the embedded device, mobile app and cloud connectivity.

The Rapid IoT Prototyping Kit has a Kinetis K64F microcontroller as its central element: it has a 120MHz Arm® Cortex®-M4 core and 256kbytes of SRAM. The board also features a KW41Z wireless MCU, providing Bluetooth® Low Energy and Thread RF capability for connection to a mobile phone or gateway.

The kit also provides for strong security: it features an A1006 secure authentication and anti-counterfeiting IC, and an NT3H2211 NFC NTAG plus wireless identification IC.

The kit is supplied with various pre-programmed applications, including:

- Weather station with air quality monitoring
- Thermostat
- Low-power motion detection
- Tilt/fall detection
- Tap counter
- RBG LED control

NXP's IoT kit: Easy expansion with click boards modules

Multiple sensor options are offered, including a gyroscope, accelerometer, barometer, temperature sensor, air quality sensor, ambient light sensor and capacitive touch sensor. The kit can be easily expanded by using compatible MikroElektronika click boards™ add-on modules.

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APPLICATIONS
- IoT end nodes
- Wireless sensors

FEATURES
- MC34671 battery charger IC
- PCF2123 real-time clock
- NX3P191 power switches
- NX3L2267GU analogue switch

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Orderable Part Number: SLN-RPK-NODE

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Fast-track board request code: FTM811A

Integrated transceiver enables design of compact KNX nodes

STMICROELECTRONICS

STMicroelectronics has introduced a highly integrated transceiver which helps to streamline the design of end nodes that support KNX, the popular network communications protocol for building-automation systems.

The STKNX is a certified KNX transceiver and is approved for use in KNX TP1-256 twisted-pair networks. Housed in a small 4mm x 4mm QFN package and requiring few external components, the STKNX can be used to implement compact KNX node designs.

Because the STKNX provides a simple interface to a host microcontroller, users can easily develop a smaller, simpler circuit to replace existing designs based on the use of discrete components for the physical layer.

The STKNX device features two integrated voltage regulators for external use in the application: a selectable 3.3V/5V linear regulator supplying a maximum of 20mA, and an adjustable switching DC-DC step-down converter supplying a maximum of 150mA.

The STKNX guarantees safe coupling to the KNX bus. It monitors the bus and provides a warning signal when it detects a loss of bus power.

STKNX features two voltage regulators to power the application

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APPLICATIONS
- Devices operating on a KNX twisted-pair network

FEATURES
- KNX bus power extractor supports bus current up to 30mA
- Adjustable KNX bus-current slew rate
- No crystal required
- Operating-temperature range: -40°C to 85°C

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The EVALKITSTKNX kit is a board integrating the STMicroelectronics miniature STKNX transceiver. This kit includes all the necessary components required to evaluate the performance of the STKNX circuit and to develop a KNX device for operation on twisted-pair cabling.

Orderable Part Number: EVALKITSTKNX

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Fast-track board request code: FTM811A

Low-power 868MHz transceiver provides robust air interface for use in Sigfox networks

STMICROELECTRONICS

STMicroelectronics' S2-LP, a low-power RF transceiver operating at frequencies below 1GHz, enables designers to implement wireless equipment designs intended for use in Sigfox networks. The S2-LP also supports the Wireless M-Bus protocol and includes an embedded packet handler to implement proprietary wireless protocols.

The S2-LP is suitable for use in the licence-free ISM and Short-Range Devices (SRD) frequency bands at 433MHz, 868MHz and 920MHz, but can also be programmed to operate at other frequencies in the 430-470MHz or 860-940MHz bands.

This frequency coverage is suitable for use in Sigfox networks: Sigfox uses ultra-narrowband technology operating in 200kHz of bandwidth in licence-free spectrum: 868-869MHz or 902-928MHz depending on the region. The S2-LP is capable of supporting narrow channel spacing down to 12.5kHz.

The S2-LP transceiver also provides built-in support for Frequency-Shift Keying (FSK) modulation, which is one of the two modulation schemes that may be applied to Sigfox transmissions. The other is phase-shift keying.

System designers will find the S2-LP's low-power operation ideal for use in battery-powered Sigfox nodes: it draws less than 7mA when receiving, and 10mA when transmitting at an output power of +10dBm. It also has a very efficient power-management circuit. An integrated switching regulator provides for operation from a 1.8V to 3.6V input at a power-conversion efficiency of 90%.

The S2-LP offers an RF link budget of more than 140dB for long-range communication in many applications. It meets the regulatory requirements applicable in territories worldwide, including Europe, Japan, China and the US.

ST supplies small baluns which feature Receive and Transmit matching impedance optimized for the S2-LP RF transceiver. Each balun is a single-component solution with a board footprint of <3.2mm². By comparison, the equivalent discrete circuit occupies 154mm².

Customers who use the S2-LP can choose from two optimized baluns:

- **BALF-SPI2-01D3: 50Ω nominal input, integrated harmonic filter for 868-927MHz.**
- **BALF-SPI2-02D3: 50Ω nominal input, integrated harmonic filter for 433-470MHz.**

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- IoT devices
- Smart metering
- Home energy-management systems
- Wireless alarm systems
- Smart home systems
- Building automation equipment
- Industrial monitoring and control
- Smart lighting systems

FEATURES

- -130dBm receiver sensitivity
- Excellent receiver selectivity and blocking
- Programmable RF output power up to 16dBm
- Programmable digital filter at receiver
- 500kbits/s maximum data rate
- Battery indicator and low-battery detector
- Antenna diversity algorithm

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FREE BOARDS **FTM Board Club**

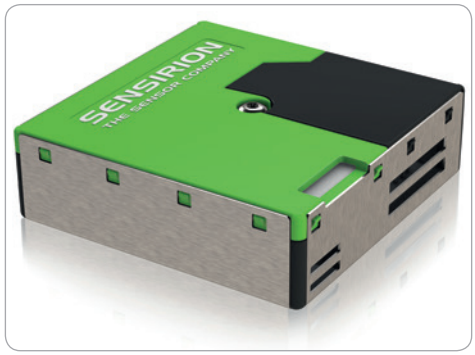
Orderable Part Number: X-NUCLEO-S2868A1

Apply now at my-boardclub.com
Fast-track board request code: FTM811A

Stable, accurate new particulate matter sensor

SENSIRION

The introduction by Sensirion of its new SPS30 particulate matter sensor marks a breakthrough in optical sensor technology, offering more stable performance and a longer operating lifetime thanks to greatly improved resistance to contamination.



SPS30: Laser scattering measurement method

The SPS30 uses a laser scattering method for measuring the concentration of particulates in the atmosphere. Comprised of high-quality and long-lasting components, the SPS30 provides accurate measurements from its first operation and throughout its lifetime of more than eight years of continuous operation.

In addition, Sensirion's advanced algorithms provide accurate measurement results for different types of particulates. Higher-resolution particle size binning enables new use cases and device-specific actions based on the detected particle composition of various types of environmental dust and other particles.

The SPS30 also benefits from Sensirion's proprietary contamination-resistance technology. Traditional optical particulate matter sensors suffer from contamination, which impairs the sensor's performance. Contamination results from dust and particle accumulation on the sensor's light source and photodetector. The SPS30's contamination resistance ensures long-term stability and high accuracy.

The SPS30 measures 41mm x 41mm x 12mm, which means that it is suitable for use in wall-mounted or compact air-quality devices.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- Air purifiers
- HVAC equipment
- Demand-controlled ventilation systems
- Air conditioners
- Air quality and environmental monitors
- Smart home and IoT devices

FEATURES

- ±10% mass concentration accuracy
- Measures concentrations up to 1,000µg/m3
- 1s minimum sampling interval in continuous mode
- UART and I²C interfaces

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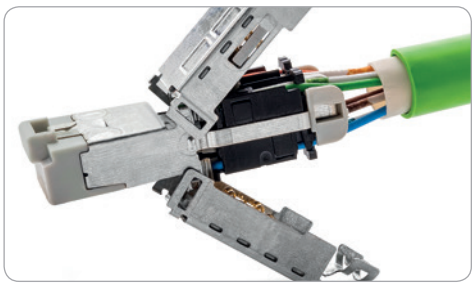
Robust industrial RJ45 Cat6A plug is easy to install

TE CONNECTIVITY

The Industrial RJ45 Cat6A plug from TE Connectivity (TE) can be used to provide for quick and error-free field installation of IP20 Cat6A Ethernet connections.



TE's RJ45 plug enables error-free installation

The RJ45 plug is based on the common core specification, a platform technology used across the family of industrial RJ45 products. Its rugged design and special features, such as a metal latch, make the plug well suited to demanding industrial applications. This RJ45 Cat6A plug extends the TE family of field-installable common core designs, which already includes Cat5e connectors.

The Industrial RJ45 Cat6A plug includes an automatic wire cut-off function, enabling error-free installation and optimal performance in the field. The installer opens the core housing to insert the wires to be terminated in the plug. On closing the core housing, the excess wire is cut off at the same time as the wires are connected to the plug contacts. The plug can terminate the most commonly used Cat6A wire variant. It is rated for data transmission at rates up to 10Gbits/s, supporting bandwidths of up to 500MHz.

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APPLICATIONS
- Control cabinets
- Robotics
- Motors
- Industrial machinery

FEATURES
- Tool-less installation
- Optional sealed housing offers IP65/67 performance
- Minimum 750 mating cycles

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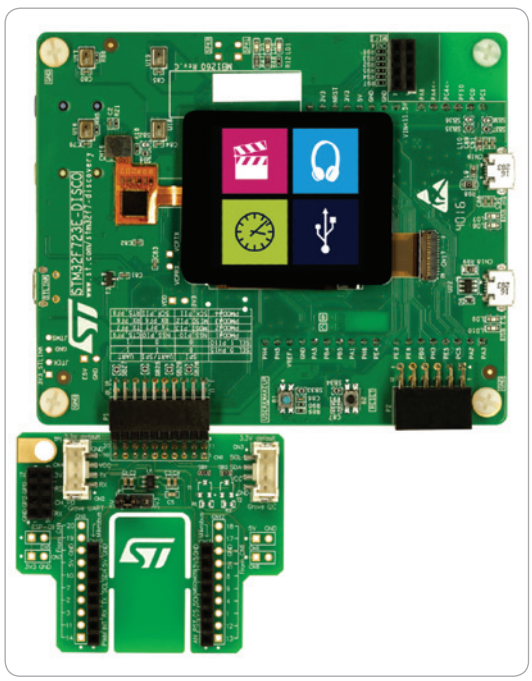
Arm Cortex-M7-based MCU includes Hi-Speed USB 2.0 controller and PHY for fast data transfers

STMICROELECTRONICS

The STM32F723 microcontroller from STMicroelectronics provides a high-performance hardware platform for embedded systems, including a selection of analogue and high-speed connectivity features.



STM32F723 Discovery Board features touchscreen LCD

At the heart of the STM32F723 is an Arm® Cortex®-M7 processor running at a frequency of up to 216MHz. The core features a floating-point unit, ART Accelerator™ engine for real-time response, and an L1 data and instruction cache.

Supporting the high-performance core, a Hi-Speed USB 2.0 On-The-Go controller with on-chip USB transceiver enables data transfers at high speeds of up to 480Mbits/s. The MCU also includes a Full-Speed USB 2.0 On-The-Go controller.

Memory provision includes up to 512kbytes of Flash with protection mechanisms, 528 bytes of one-time programmable memory and 256kbytes of SRAM, as well as a flexible external memory controller.

The STM32F723 offers various peripherals to support operation in the analogue domain, including two 12-bit, two-channel DACs, three 12-bit ADCs with up to 24 channels, and a temperature sensor. Audio signals are catered for with two serial audio interfaces.

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APPLICATIONS
- Motor drives
- Medical equipment
- Programmable logic controllers
- Inverters
- Circuit breakers
- Printers and scanners
- Alarm systems
- Video intercom
- Heating, ventilation and air-conditioning
- Home audio appliances
- Internet of Things devices
- Smart watches

FEATURES
- Two 16-bit AC motor control timers
- Dual-mode Quad SPI Flash memory interface
- Sleep, stop and stand-by modes
- General-purpose DMA controller
- Real-time clock and calendar offering sub-second accuracy
- CAN 2.0B interface

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The STM32F723 Discovery Board enables demonstration of the STM32F723's audio and video capabilities, featuring a 240px x 240px touchscreen LCD, as well as a stereo 3.5mm jack connector for an audio line input, a stereo 3.5mm jack connector for headphones, stereo speaker outputs and four ST MEMS microphones.

Orderable Part Number: STM32F723E-DISCO

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Fast-track board request code: FTM811A

Fully compliant components ease implementation of USB Type-C connectivity

ON SEMICONDUCTOR

ON Semiconductor has introduced new USB Type-C™ devices which are fully compliant with the latest specifications. The new devices include two controllers and a switch.

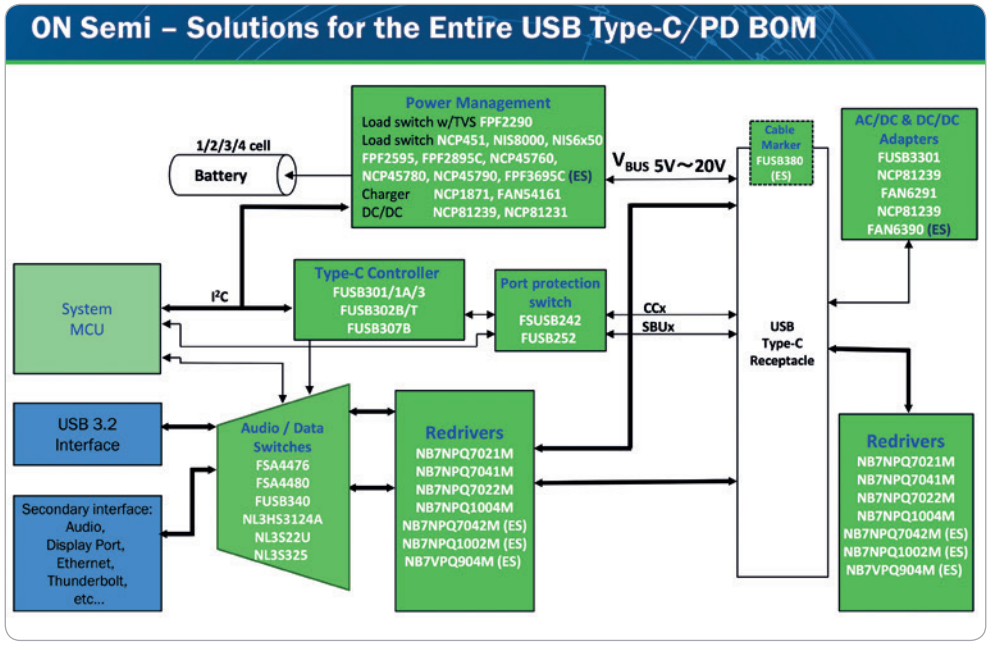
The **FUSB303** port controller can convert existing and new systems to a USB-C interface, supporting applications that are to operate in Source (SRC), Sink (SNK), or Dual Role Port (DRP) modes. The device offers autonomous detection, and requires minimal processor interaction and firmware support.

The low-power operation of the FUSB303 is particularly attractive to mobile and ultra-portable applications: in stand-by mode, it draws less than 10µA.

The controller is housed in a QFN package measuring 1.6mm x 1.6mm x 0.375mm which is thinner than standard CSP packaging, allowing use in the most space-constrained designs.

The **FSUSB242** is a USB-C compliant port protection switch which blocks high and surge voltages. As required by the USB-C standard, the switch allows for multiplexing of two USB sources on to the common DP/DM positive and negative data terminal pins, while maintaining signal integrity.

Redriver Part Number	Description	Channel	Package
NB7NPQ701M	3.3V 5Gbits/s and 10Gbits/s redriver	Single	2mm x 2mm WDFN8
NB7VPQ701M	1.8V, 5Gbits/s and 10Gbits/s redriver	Single	1.6mm x 1.6mm UQFN12
NB7NPQ702M	3.3V 5Gbits/s and 10Gbits/s redriver	Dual, bi-directional	3mm x 3mm UQFN16
NB7VPQ702M	1.8V, 5Gbits/s and 10Gbits/s redriver	Dual, bi-directional	3mm x 3mm UQFN16



The device offers IEC 64000-4-5-compliant surge protection up to ±20V, without the use of an external transient voltage suppressor. The FSUSB242's low power consumption makes it suitable for mobile applications.

The **FUSB302BV** controller is intended for use in automotive USB Power Delivery (PD) applications. While other solutions are only for consumer applications, this device is AEC-Q100 qualified. It supports detection functions including attach and orientation, making it one of the most efficient and flexible products on the market.

Unlike other solutions, the FUSB302BV communicates via an I²C interface and does not integrate a microprocessor. This ensures the device meets the automotive requirements for minimal energy consumption and low levels of self-heating.

ON Semiconductor also supplies a portfolio of USB redrivers which reduce signal losses in long cable runs.

APPLICATIONS

- Smartphones
- Tablets
- Laptop computers
- Wearable devices
- Multi-function printers
- Servers
- Games consoles
- Digital video recorders
- Industry 4.0 equipment
- Automotive audio and infotainment systems
- Power adapters

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

FTM Boards

Orderable Part Number: FSUSB242GEVB

Apply now at my-boardclub.com
Fast-track board request code: FTM811A

3G smart terminal with 2G fall-back offers seamless global connectivity

GEMALTO

The Cinterion® EHS6T terminal from Gemalto offers highly efficient 3G connectivity with seamless fall-back to 2G networks. It operates across five 3G bands at 800/850/900/1900/2100MHz, and four GSM bands at 850/900/1800/1900MHz.

EHS6T: Plug-and-play industrial connectivity

The plug-and-play terminal works out of the box to enable OEMs to quickly connect industrial equipment to the internet. It is supplied with Full Type Approval (FTA) and certifications for use on the main mobile networks globally. The EHS6T transfers data at a download speed of 10Mbits/s, and uploads at 5Mbits/s.

Embedded Java speeds application development, offering a broad choice of tools, reusable code, proven security, on-device debugging and multi-threading. The IoT terminals also enable on-device pre-processing and analytics to optimise wireless network efficiency.

Products	EHS6T USB	EHS6T LAN
Cinterion module	EHS6	EHS6
RS-232 (Sub-D)	•	•
USB (USB-B)	•	-
Weidmüller connector (GPIOs, SPI, I²C)	•	•
Ethernet (RJ45)	-	•
Power supply (RJ11)	•	•
RF antenna	•	•

The EHS6T is available in two variants, a USB and a LAN terminal.

Gemalto also supplies the PLS62-W terminal for global multi-band LTE Cat1 connectivity.

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APPLICATIONS
- Industrial automation
- Vending machines
- Security systems
- Smart city solutions

FEATURES
- Power-over-Ethernet power supply capability
- Flexible mounting options:
  - DIN rail mounting
  - C-rail mounting
  - Screw fixing
  - Cable tie mounting

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Wireless module provides high-speed LTE Cat4 connectivity with 2G/3G fall-back

GEMALTO

The Gemalto Cinterion® ELS81 IoT wireless module marries high speed and high throughput with rugged IoT durability, providing Cat4 LTE (4G) connectivity with seamless fall-back to 2G and 3G networks. Enabling data speeds of 150Mbits/s download and 50Mbits/s in the uplink, the ELS81 IoT module is ideal for data-intensive applications.

The ELS81 module comes in variants for the European and North American markets. The module offers a built-in TCP/IP stack which supports a range of IP services protected by advanced security. In addition, a powerful Java® embedded system benefits from the Arm11 applications processor architecture and the Java client runtime platform.

The ELS81 shares the common industrial footprint for ease of integration into legacy system designs.

ELS81: Built-in TCP/IP stack

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APPLICATIONS
- Digital signage
- Video security monitoring
- Advanced retail point-of-sale terminals
- Smart grid
- Agriculture
- Fleet and asset tracking
- Smart city equipment
- Healthcare
- Industrial sensors

FEATURES
- LTE (FDD) 3GPP Release 9 compliant protocol stack
- Frequency Bands:
  - ELS81-E: five-band LTE, dual-band 3G, dual-band GSM
  - ELS61-US: quad-band LTE, tri-band UMTS
- Dimensions: 27.6mm x 25.4mm x 2.2mm
- Operating-temperature range: -40°C to 85°C
- Advanced temperature management
- Hi-Speed USB 2.0 interface up to 480Mbits/s
- High-speed serial modem interface up to 3Mbits/s

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Cat1 LTE wireless SoC module includes powerful Arm11 processor

GEMALTO

Gemalto's Cinterion® ELS61 wireless module provides highly efficient Cat1 LTE (4G) connectivity for Machine-to-Machine (M2M) and IoT devices, and offers seamless fall-back to 2G and 3G networks.

The data-transfer rates enabled by the ELS61 in Cat1 LTE mode include download speed of 10Mbits/s and upload speed of 5Mbits/s. The module is ideal for use in M2M and industrial IoT applications that can benefit from the longevity of LTE networks, while still providing 3G and 2G connectivity to ensure complete coverage in areas that are not well provided with LTE service.

ELS61: Can run application code

The Cinterion ELS61 module comes with a Java embedded virtual machine, and is based on an Arm11 applications processor core, enabling integration of application code. The latest Java ME 3.2 client run-time platform reduces total cost of ownership and time to market by sharing internal resources such as memory, a large existing code base and proven software building blocks. The module uses Multi MIDlet Java execution to host and run multiple applications and protocols simultaneously.

Security provision includes the latest TLS/SSL engine for reliable TCP/IP connectivity.

The ELS61 module is available in three variants:

- ELS61-E for Europe: five-band LTE operating at 700/800/900/1800/2100MHz
- ELS61-US/USA: quad-band LTE operating at 700/850/1700/2100MHz
- ELS61-AUS for Australasia: quad-band LTE operating at 700/850/900/1800MHz

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APPLICATIONS

- Metering
- Track and trace
- Remote surveillance
- Connected signs
- Fleet management
- Mobile health equipment

FEATURES

- 3GPP release 9 compliant protocol stack
- Standard and extended AT command set
- Full type approval
- Hi-Speed USB 2.0 interface
- Operating-temperature range: -40°C to 85°C

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Integrated wireless module provides global 3G coverage for IoT devices

GEMALTO

The EHS6 from Gemalto is an efficient wireless module for 3G network connectivity, offering data transfers at maximum rates of 7.2Mbits/s in the downlink, and 5.76Mbits/s in the uplink.

EHS6: Supports firmware over-the-air updates

The EHS6 is an ideal choice for Machine-to-Machine (M2M) applications which will benefit from 3G technology because it is future-proof and offers guaranteed long-term availability. The module supports Multi MIDlet Java execution to host and run multiple applications and protocols simultaneously. Comprehensive security features include the latest TLS/SSL engine to provide reliable TCP/IP connectivity. An enhanced internal Flash file system enables royalty-free firmware over-the-air updates when required.

Sophisticated sandbox modeling and layered architectures simplify development, allowing simultaneous implementation of hardware and software design.

The EHS6 is available as a module for use globally supporting the following frequencies:

- Five bands of 3G operating at 800/850/900/1900/2100MHz
- Quad band 2G operating at 850/900/1800/1900MHz

It is supplied with worldwide RF and network approvals:

- R&TTE, GCF, CE, FCC, PTCRB, IC, UL
- AT&T and other local approvals and provider certifications

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- M2M communications
- IoT end nodes

FEATURES

- 3GPP release 7 compliant protocol stack
- RLS monitoring for jamming detection
- Voice call capability
- Hi-Speed USB 2.0 interface
- Real-time clock with alarm
- 27.6mm x 25.4mm x 2.3mm LGA package
- Java ME 3.2 secure data transmission with HTTPS/SSL
- Multi-threading programming and multi-application execution
- 10Mbytes of RAM and 10Mbyte Flash file system

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New dual-band Wi-Fi and Bluetooth radio module provides high data rates and low-power operation

PANASONIC

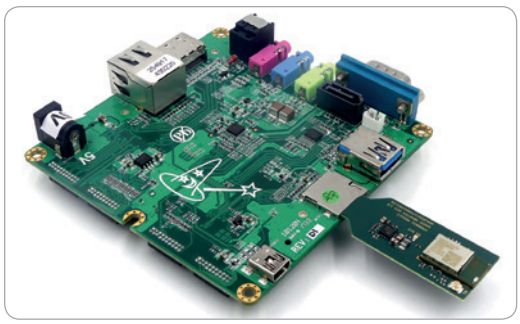
Panasonic Industry Europe has introduced a dual-band 2.4GHz/5GHz 802.11a/b/g/n Wi-Fi® radio module with integrated Bluetooth® wireless functionality. The PAN9026 implements the Bluetooth 5.0 core features including Bluetooth Basic Rate, Enhanced Data Rate and Low Energy functions.

The simultaneous and independent operation of the two protocols provides applications with a combination of a high data rate via the Wi-Fi radio and low-power operation via the Bluetooth Low Energy radio.

The PAN9026 provides a complete, integrated platform for running wireless applications. It includes power-management support for the 802.11i security protocol, and for the 802.11mc specification. Data interfaces include SDIO 3.0 and a high-speed UART.

Panasonic stores Transmit power calibration data and Wi-Fi/Bluetooth system parameters on the PAN9026's one-time programmable memory during production. This simplifies the certification process for the OEM. The module requires far less design, testing and calibration effort than discrete solutions, helping OEMs to achieve a faster time to market with new product designs.

The PAN9026 is supplied in a version for the European market with the part number ENWF90202A1EF, and for North America with the part number ENWF920A1EF.



PAN9026 Evaluation Kit with i.MX6 Wandboard

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS
- Smart meters
- Home gateways

FEATURES
- 98dBm sensitivity at a data rate of 1Mbit/s
- 17dBm maximum Transmit power
- 400mA Transmit current at 11Mbits/s data rate
- 70mA Receive current at 11Mbits/s data rate
- 17.5mm x 10.0mm x 2.6mm surface-mount package
- Operating-temperature range: -30° to 85°C

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FREE BOARDS **FTM Board Club**

The PAN9026 Evaluation Kit demonstrates the integration of Wi-Fi and Bluetooth radio capabilities in a host processor platform, the Wandboard featuring an NXP Semiconductors i.MX6 applications processor.

Orderable Part Number: ENWF90202A1EF

Apply now at my-boardclub.com
Fast-track board request code: FTM811A

Bluetooth Low Energy SoC includes embedded microcontroller

STMICROELECTRONICS

The BlueNRG-2 from STMicroelectronics is a very low-power Bluetooth® Low Energy (BLE) System-on-Chip (SoC), offering a wider range of features than the earlier BlueNRG network processor. In particular, the BlueNRG-2 enables the use of an embedded Arm® Cortex®-M0 processor core for running user application code.

The BlueNRG-2 includes 256kbytes of programming Flash memory and 24kbytes of SRAM with retention. UART, I²C and serial peripheral interfaces provide for off-chip communication. The SoC also features multi-function timers, a watchdog timer, a real-time clock and DMA controller.

A 10-bit ADC is available for interfacing with analogue sensors, and for reading the measurements of the integrated battery monitor. A digital filter can process a PDM stream.

The BlueNRG-2 offers the same excellent RF performance with which users of the BlueNRG radio will be familiar. Its integrated high-efficiency DC-DC converter keeps the same ultra-low power characteristics, but the BlueNRG-2 draws a lower sleep-mode current than the BlueNRG, to extend battery run-times.

ST has recently extended the package options for users of the BlueNRG-2, which is now available in 32-pin QFN, 48-pin QFN and 34-pin wafer-level chip-scale packaging formats.

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Orderable Part Number: STEVAL-IDB008V2

Apply now at my-boardclub.com
Fast-track board request code: FTM811A

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS
- Watches
- Fitness, wellness and sports equipment
- Consumer medical devices
- Security systems
- Remote controls
- Home and industrial automation
- Assisted living
- Lighting
- PC peripherals

FEATURES
- Conforms to Bluetooth 5.0 specifications
- Supply-voltage range: 1.7V to 3.6V
- Operating-temperature range: -40°C to 105°C
- 14, 15 or 26 GPIOs
- Battery voltage monitor and temperature sensor
- Up to 8dBm Transmit power at antenna connector
- Up to 96dB RF link budget
- 8.3mA Transmit current at -2dBm, 3.0V

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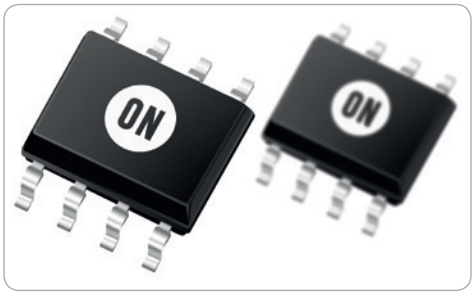
EEPROM features NFC RF interface for contactless and batteryless data monitoring

ON SEMICONDUCTOR

ON Semiconductor has released the N24RF family of NFC EEPROM products, providing a scalable design solution which combines conventional EEPROM functionality with an integrated NFC interface for contactless reading and writing of data.



N24RF: Range up to 1.5m

Like a conventional non-volatile EEPROM device, the N24RF includes a digital I²C interface. The NFC interface provides an additional option for contactless reading and writing via an NFC reader such as a smartphone equipped with an NFC radio. The device can communicate with a reader over a range of up to 1.5m.

The N24RF can power itself from the energy of the reader's RF field during communication, which enables the implementation of batteryless designs.

The N24RF is available in two package options: a SOIC-8 measuring 4mm x 5mm x 1.75mm, and a TSSOP-8, which is 3.1mm x 4.5mm x 1.2mm.

Density	Part Number, SOIC-8 Package Option	Part Number, TSSOP-8 Package Option
64kbits	N24RF64DW	N24RF64DT
16kbits	N24RF16DW	N24RF16DT
4kbits	N24RF04DW	N24RF04DT

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- Predictive maintenance
- Contactless data monitoring
- Contactless firmware updating

FEATURES

- 2,000,000 Program/Erase cycles
- 200 years' data retention
- Supply-voltage range: 1.8V to 5.5V
- Operating-temperature range: -40°C to 105°C
- ISO15693/ISO18000-3 Mode 1 compliant at 13.56MHz
- Anti-collision support

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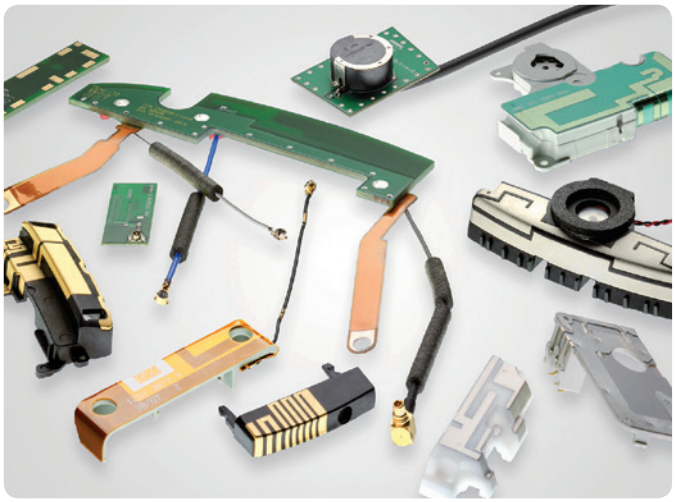
Custom and standard antennas support wide range of frequencies and radio protocols

TE CONNECTIVITY

TE Connectivity's (TE) portfolio of standard and custom antennas features technologies including two-shot moulding, stamped metal, Flexible Printed Circuit (FPC), PCB and Laser Direct Structuring (LDS).



TE supplies embedded and multi-element external antennas

Available as embedded or multi-element external antennas, these solutions provide clear transmission in wireless devices over a wide variety of frequencies, including the bands used by Bluetooth®, Wi-Fi®, LTE™ and ZigBee® radio systems.

Antennas supplied by TE may be tested before shipping for near- and far-field patterns, scattering parameters, specific absorption rate, vibration, humidity, temperature shock, salt fog, throughput and acoustic characteristics.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS

- Wearable devices
- Wireless printers
- Smart meters
- Power distribution equipment
- Data communications equipment
- Connected cars and trucks
- Remote radio equipment

FEATURES

- Antennas for wireless networking and voice applications
  - IEEE 802.11a/b/g/n/ac/ad at 2.4GHz and 5GHz
  - LTE bands 700-2700MHz with multi-band and MetaSpan antenna technology
  - GSM/UMTS bands 850-2170MHz, single and multiband
  - WiMax bands 2300 to 3800MHz
- Antennas for other technologies
  - ISM ZigBee band 902-928MHz
  - Bluetooth wireless technology band 2400-2483.5MHz
  - ZigBee band 2400-2483.5MHz
  - UWB band 3100-6000MHz
  - DVB-H band 1670-1675MHz
  - NFC band 13.56MHz

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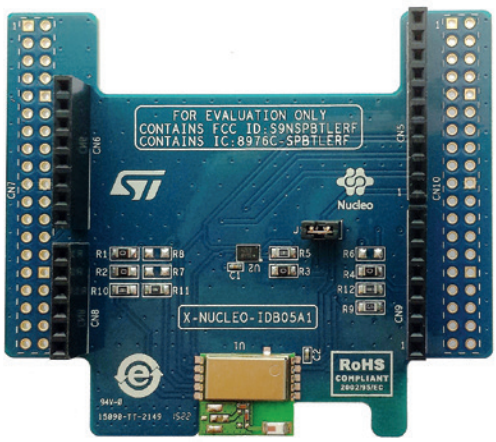
Firmware package simplifies implementation of Bluetooth mesh networking

STMICROELECTRONICS

STMicroelectronics' X-CUBE-BLEMESH1 expansion firmware package for the STM32Cube software library, which runs on STM32 microcontrollers, enables the simple implementation of mesh networking capability based on the Bluetooth® Low Energy wireless protocol stack.



ST's X-NUCLEO-IDB05A1 board features BlueNRG-MS Bluetooth module

X-CUBE-BLEMESH1 provides easy-to-use Application Programming Interfaces (APIs) for mesh networking based on a Bluetooth Mesh profile library. Because the expansion software operates within the framework of the STM32Cube software technology, it is easy to port mesh networking code from one STM32 MCU to another.

The firmware includes a lighting reference design running on the X-NUCLEO-IDB05A1 Bluetooth expansion board connected to a NUCLEO-L152RE, NUCLEO-L476RG or NUCLEO-F401RE development board. Mobile phone apps for the Android™ and iOS operating system platforms are available, allowing the user to provision, un-provision, create groups and control nodes in the mesh network from any Bluetooth Low Energy-enabled smartphone.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS
- Bluetooth mesh networking

FEATURES
- Network coverage for up to 32,767 nodes and 126 hops
- Two-layer security against replay, bit-flipping, eavesdropping, man-in-the-middle and trashcan attacks
- Free, user-friendly licence terms

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FREE BOARDS **FTM Board Club**

The X-NUCLEO-IDB05A1 is a Bluetooth Low Energy evaluation board based on the SPBTLE-RF BlueNRG-MS RF module. The SPBTLE-RF module is FCC and IC certified.

Orderable Part Number: X-NUCLEO-IDB05A1

Apply now at my-boardclub.com
Fast-track board request code: FTM811A

Range of RF connectors operates at frequencies up to 60GHz

TE CONNECTIVITY

The range of RF connectors from TE Connectivity (TE) forms a cohesive set of RF products focused on wireless applications in communications, automotive and commercial transportation, industrial and aviation applications.

The TE portfolio includes standard and custom RF connector, cable-assembly, and hybrid solutions which provide rugged performance in challenging environments, while offering:

- Low insertion losses
- Excellent voltage standing-wave ratio

TE supplies RF connectors, cable assemblies and hybrid solutions

Rugged RF connectors from TE supporting over-the-air transmission at frequencies up to 60GHz are suitable for use in aerospace, defence and marine systems. They include traditional Mil-Spec BNC and TNC connectors as well as new microminiature designs.

The connectors provide rugged performance in harsh environments, and can be integrated into complete cable assemblies by TE. RF cables from TE are available with tightly specified electrical characteristics, small size and light weight.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS
- Wireless applications
- Base stations
- Telecoms equipment
- Consumer devices
- Appliances
- Antennas
- Factory automation
- IoT
- Avionics
- Test and measurement
- Military communications
- Autonomous vehicles

FEATURES
- Coupling types:
  - Bayonet
  - Threaded
  - Snap-on/slide-on
- Cable-to-cable, cable-to-board and board-to-board options

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FTM Board Club

Future Electronics' Board Club: supporting innovative electronics design

Europe's electronics industry thrives on the application of innovation and creativity, and an essential innovator's tool in design projects is the development board. The Board Club website is a Future Electronics resource for users of development boards. Here, and only here, Board Club members can gain access to exclusive free development boards and development board offers.
If you would like to register for membership, please visit: **www.my-boardclub.com/register.php**

Demo board for design of simple NFC sensor tag system

NXP SEMICONDUCTORS

Future Electronics' new Tap It Keychain is a tiny demonstration board which implements a complete embedded system with NFC capability based on the LPC8N04 microcontroller from NXP Semiconductors.

The Tap It Keychain implements a physical condition-monitoring application using data from sensors mounted on the board. The board periodically measures the temperature and humidity of the ambient air, and logs incidences of shock. The data are stored locally on the Tap It Keychain, and may be read out via the LPC8N04's contactless NFC interface by tapping it with a smart device that has NFC reader capability.

The Tap It Keychain board is based on the LPC8N04, an entry-level 32-bit microcontroller which includes an NFC/RFID ISO14443 Type A interface. This means that, when connected to an NFC antenna, it can operate as a full NFC tag and can be read by any NFC Forum-compatible NFC reader, such as a smartphone.

The LPC8N04 MCU has an Arm® Cortex®-M0+ core running at selectable frequencies up to 8MHz, 32kbytes of Flash, 8kbytes of SRAM and up to 4kbytes of EEPROM. It supports various power-saving modes to reduce consumption when the device is inactive.

The LPC8N04 can connect to input devices such as buttons and keypads via up to 12 general-purpose I/O pins, and features I²C and serial peripheral interfaces.

NXP: LPC8N04 with NFC interface

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS
- Energy-harvesting sensor node
- Data logger with battery
- Batteryless displays
- Button replacement
- Smart manufacturing

FEATURES
- External SPI Flash memory
- IDT HS3003 humidity and temperature sensor
- NXP MMA8652FC three-axis accelerometer
- CR2032 lithium cell
- NFC PCB antenna

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Orderable Part Number: Tap It Keychain

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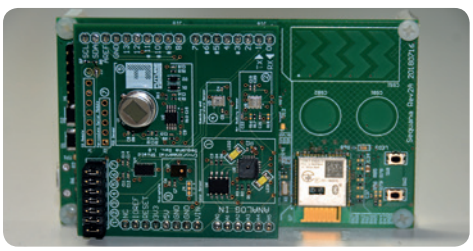
Fast-track board request code: FTM811A

Feature-rich PSoC 6 board includes MEMS motion sensors and advanced memory for data logging

FUTURE ELECTRONICS

Future Electronics has launched Sequana, a hardware and software platform for the rapid prototyping and development of low-power, secure and connected embedded systems. It is based on Cypress Semiconductor's high-performance PSoC® 6 programmable System-on-Chip (SoC).


Sequana: Numerous pre-integrated software features

The Sequana PSoC 6 platform supports the Arm® MBED™ operating system platform: it provides numerous pre-integrated software features, leaving the designer free to concentrate on developing their core application.

The MBED™ OS provides native multi-layer security features, complementing the rich security resources available in the PSoC 6 device. The Sequana board also gives the designer a simple way to access the connectivity capabilities of the board's CYBLE-416045-02, a module incorporating a PSoC 63 SoC, which features an on-chip Bluetooth® Low Energy radio and Bluetooth 5.0 protocol stack.

The Sequana board may be used to develop prototype systems based on inputs from MEMS motion sensors supplied by ROHM Semiconductor. The board offers options for the designer to specify a MEMS accelerometer, or a combination sensor featuring both an accelerometer and a magnetometer.

ENERGY INDUSTRIAL LIGHTING MEDICAL AUTOMOTIVE SECURITY CONSUMER TELECOMS

APPLICATIONS
- Vibration monitoring
- Shock detection
- Electromagnetic field analytics
- Predictive maintenance

FEATURES
- Supports expansion through Arduino- or Mikrobus-compatible add-ons
- Multiple external power-supply options
- Debug and programming interfaces
- Power measurement interface

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Orderable Part Number: Future Sequana Board

Apply now at my-boardclub.com
Fast-track board request code: FTM811A

Precise timing for aerospace and marine low-power approach to high-performanc

By Patrice Brossard
Business Development Manager (Southern Europe), Future Electronics and
Cyril Boissy, Time and Frequency Business Unit Manager, Syrlinks

It is hard to imagine more challenging applications for radio-frequency equipment than space, or deep underwater. System designers have to take great care to specify components that will survive the rigours of these extreme environments, while keeping power consumption to a bare minimum to prolong operation on limited power supplies.

It is common for designers to devise an architecture for these applications around an FPGA because of its high-speed, parallel-processing capability. And downstream from the channel that digitises the radio signal, it is advisable to use a common frequency reference between the components responsible for digital sampling (based around an ADC) and those processing the raw data at the FPGA.

This raises two important questions at the outset of the design of a radio system for aerospace or under the sea:

- Can an FPGA technology provide the performance and the reliability required in these very harsh environments?
- How should the Local Oscillator (LO) for the frequency reference be specified, given the need for a combination of both stable, low-drift timing and low power consumption?

FPGA technologies suitable for aerospace applications

The choice of electronics components for use in aerospace must be capable of tolerating one special phenomenon: in flight, components are subject to a far greater number of particle impacts. Any one of these impacts can create a Single Event Upset (SEU) in an FPGA, which occurs when a particle passes through the component's packaging and circuitry and modifies a sub-micron configuration switch. An SEU can cause in-flight software configuration errors, with potentially catastrophic implications for the safety and operation of the craft and its occupants.

Different FPGAs, however, have different levels of vulnerability to particle impacts. Most FPGAs in use in electronics systems today have configuration switches made with volatile SRAM-based cells, an architecture which is vulnerable to SEUs, and which thus poses a risk to in-flight equipment.

On the other hand, FPGAs from Microsemi, now a Microchip company, have for many years been based on non-volatile technology which is proven to be highly resistant to SEUs over long service life in many aerospace applications. Radiation and reliability reports are available on the Microsemi website.

Microsemi evolved its product families of Flash-technology-based FPGAs through a series of process migrations. It most recently introduced the fifth-generation PolarFire FPGA family, which is built on an advanced 28nm fabrication process, as shown in Figure 1, and incorporates new non-volatile Silicon-Oxide-Nitride-Oxide-Silicon (SONOS) technology for the configuration switches. Products available today from across the three most recent generations of FPGAs can be found to fit the requirements of almost any application, such as aerospace, in which security and safety are of critical importance. In particular, the latest PolarFire FPGAs are an ideal cost-optimized, low-power, mid-range density solution.

Apart from its unbeatable performance in parallel data processing, the other important advantage of FPGAs lies in the fast and deterministic nature of their operation, supporting the safety certification of embedded products. Because of their architecture and construction, FPGAs do not have pre-defined instruction sets or data widths.

Features	SmartFusion, ProASIC3, IGLOO (3rd Gen. 130nm)	SmartFusion2, IGLOO (2nd Gen. 65nm)	PolarFire (5th Gen. 28nm)
Logic Elements	100 - 30K	5K - 150K	100K - 480K
Transceiver Rate	–	1Gbps - 5Gbps	250Mbps - 12.7Gbps
I/O Speeds	400Mbps LVDS	667Mbps DDR3 750Mbps LVDS	1600Mbps DDR4 1.6Gbps LVDS
DSP (18x18 Multipliers)	–	240	1480
Max RAM	144Kb	5Mb	33Mb

Fig. 1: the three most recent generations of FPGAs from Microsemi

FPGAs are therefore the best solution for the parallel processing of single or multiple data streams, as shown in Figure 2.

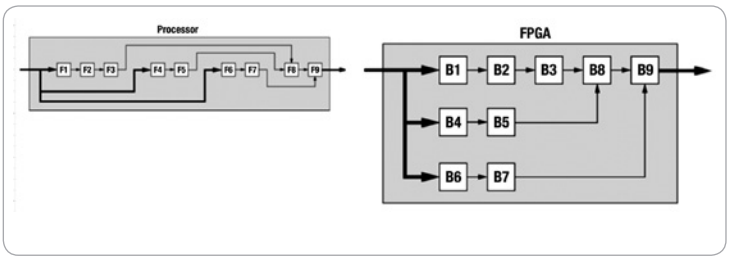


Fig. 2: Parallel processing in an FPGA (right) allows for faster execution of multiple sets of instructions which in a CPU must be performed in sequence (left)

A new processor architecture for the FPGA

Recently, Microsemi created a more integrated solution for FPGA-based designs, adding the option to implement the new RISC-V processor architecture in an FPGA. The implementation gives designers flexibility and cost optimization through the high levels of integration afforded by the presence of a microprocessor sub-system and FPGA on a single chip, helping to simplify circuit designs, reduce component count and save space.

The processor soft core developed by Microsemi for its FPGAs is based on the RISC-V open instruction-set architecture. The designer has access to the Register Transfer Level (RTL) source code for this RISC-V Intellectual Property (IP) core. This is an advantage in equipment designs that must attain safety certification.

The Microsemi RISC-V-based core is available now as soft IP which can run in an IGLOO2 or PolarFire device. Its performance is similar to that of an Arm® Cortex®-M7 microcontroller core.

Future Electronics also offers the 'Creative' Board developed in-house; it is a high-performance development kit featuring a PolarFire 300T device. It is supplied with a full set of software tools for developing RTL and C code.

LO stability over temperature: a key parameter in aerospace applications

RF equipment for aerospace applications, then, benefits from the parallel processing capability of an FPGA. A careful choice of FPGA ensures that it will be resistant to the impact of particles in space or the upper atmosphere.

RF equipment for use in aircraft or in space has to offer very high performance, because of the long range over which signals are transmitted and the many sources of noise which will interfere with these signals on their journey to the receiver. The RF system therefore requires precise, stable and accurate frequency control at both transmitter and receiver.

applications: a new e oscillator design

This means that aerospace designers have to carefully specify the LO's performance in terms of frequency stability and accuracy. At the same time, the power supply in a host device such as a satellite is highly constrained, so power consumption is also a critical parameter.

Choice of oscillator technologies

Faced with this challenge, the system designer has a choice of oscillator technologies which vary in performance, power consumption and price, as shown in Figure 3.

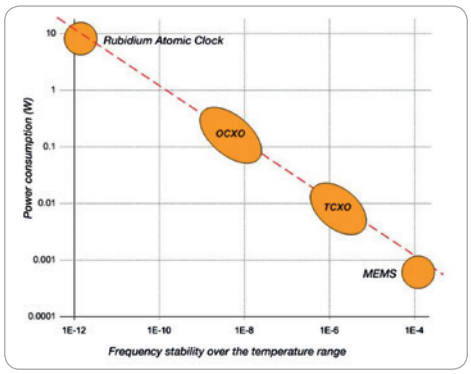


Fig. 3: Conventional oscillator technologies trade off power consumption against stability

Most consumer electronics products use basic oscillators, ranging in price from a few cents to a few euros. The choice in this range includes MEMS-based crystal oscillators (XOs) or in some cases Temperature-Compensated Crystal Oscillators (TCXOs).

In systems that require high frequency stability and low temperature sensitivity, Oven-Controlled Crystal Oscillators (OCXOs) provide the highest frequency stability among the various XO technologies. They are typically more stable than an entry-level XO by three to four orders of magnitude.

OCXOs are complex hybrid components. The frequency stability of an OCXO arises from its precise control of the temperature of the quartz resonator, regardless of the ambient temperature. The frequency of any quartz resonator drifts considerably as the temperature rises or falls. For a 10MHz resonator, the frequency drift between -40°C and 85°C is between ±250Hz and ±500Hz.

By maintaining the quartz at a precise temperature, an OCXO will reduce this drift to between ±0.05Hz and ±2.5Hz.

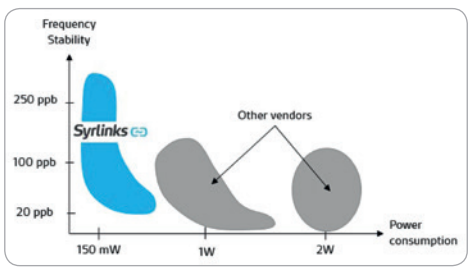


Fig. 4: The Syrlinks EWOS range of OCXOs combines good frequency stability with very low power consumption

OCXOs for battery-powered applications

Power consumption is the main disadvantage of an OCXO compared to a TCXO, because of the power supply to the heating element. Now however, Rennes, France-based Syrlinks has developed OCXOs which combine very small size, low weight and low power consumption while maintaining high frequency stability, as shown in Figure 4. This makes the Syrlinks OCXOs well suited to use in the radios that Syrlinks makes for small satellites, which have a highly constrained power supply.

For instance, the EWOS™ range of OCXOs covers frequencies between 10MHz and 40MHz; thermal sensitivity is between ±5ppb and ±250ppb, and power consumption between 65mW and 400mW at an ambient temperature of 25°C. This power consumption is around ten times lower than that of comparable OCXOs on the market.

EWOS OCXOs are used in all space radios made by Syrlinks, and also in other space applications such as space GNSS (satellite positioning system) receivers, which contain an FPGA. For example, the EWOS0525 is a 10MHz OCXO used in the G-Sphere-S GNSS receiver. It clocks simultaneously the RF digitization stage and FPGAs. The receiver achieves position measurement resolution of <10m at a high velocity of 7.7km/s.

This remarkable performance is achieved thanks to the very low phase noise of the OCXO, especially close to the carrier frequency. The performance of positioning or distance-measurement functions is directly linked to the short-term stability of the LO. This is why OCXOs are widely used in preference to TCXOs, since they provide better results in equipment in which position or distance are computed with a latency of <1µs.

The Syrlinks range of precision LOs also includes the EWOS83x family, which includes a Stress Compensated (SC) cut quartz resonator, as shown in Figure 5.

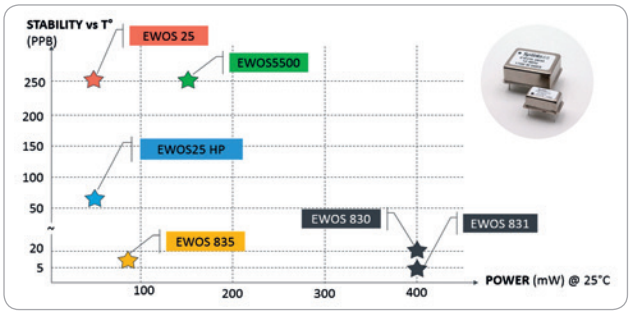


Fig. 5: The Syrlinks family of OCXOs offers a broad choice of characteristics to designers of timing-critical applications

This high-quality resonator type provides better phase noise performance and lower long-term frequency drift. This parameter is crucial for applications requiring precise timekeeping when a GNSS time source is unavailable: this is the case in environments in which GNSS signals are obstructed, and under water. Synchronization here depends solely on the performance of the LO.

The EWOS083x series offers an ageing rate of 0.3ppb/day. The low-power EWOS0835 is specified for underwater applications: it consumes 80mW at 25°C. In some cases it can be considered as a low-cost alternative to a chip-scale atomic clock.

For applications requiring the highest possible timing accuracy, Syrlinks offers its MMAC™ family of MEMS-based miniature atomic clocks, which offer long-term timing stability some 100 times better than that of OCXOs, while keeping power consumption very low: <200mW at -40°C.

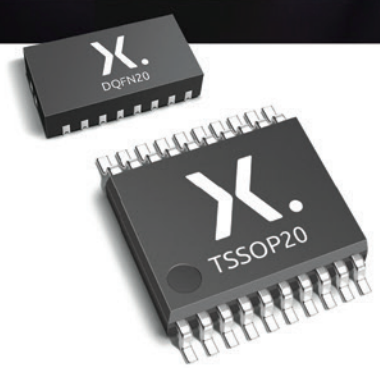
Syrlinks also supplies the SGTM™ series of synchronization modules, as shown in Figure 6. In normal operation, the SGTM modules provide timing signals based on an input from a satellite GNSS signal or an external reference clock. When the GNSS signal or external reference become unavailable, the module continues to provide precise timing to the host system. The jitter between the input and output is approximately 12ns, and the time-domain holdover stability is around ±35µs/24h.

Fig. 6: The SGTM synchronization module from Syrlinks

74LVC8T595 dual-supply translating shift register

Voltage-translating Shift Register for Modular Designs

Ideal for multiple I/O voltages, 74LVC8T595 performs voltage-level translation using an 8-stage shift register and an 8-bit storage register with 3-state outputs. The device operates in the 1.1 to 5.5 V range, enabling newer low-voltage controllers to interface with legacy solutions 74LVC8T595 is suitable for SIPO (serial-in/parallel-out) shift register implementations.

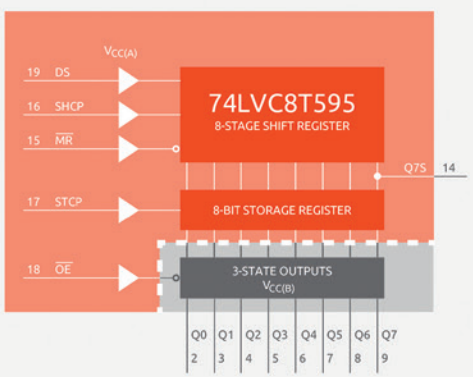


74LVC8T595 benefits from Nexperia's LVC family technology with I_{OFF} circuitry for partial power down-mode operation, which contributes to energy savings.

74LVC8T595's shift and storage register have separate clocks. Data is shifted on the positive edge of the SHCP input and data in the shift register is transferred to the storage register on a positive edge of the STCP input.

Part of our Standard Logic range, 74LVC8T595 is available in 20-pin TSSOP leaded and DQFN leadless packages. Both packages are specified for -40 °C to +125 °C and can be released in our Automotive (-Q100) portfolio.

Circuit Diagram



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