MIP

MARKETING INNOVATIVE PRODUCTS

2021

03

ANALOG ELECTRONICS

EBV Elektronik
I An Avnet Company I

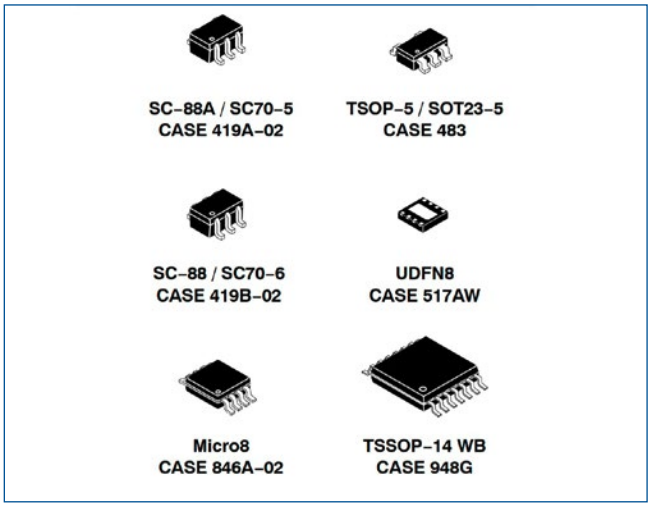
CONTENTS BY PRODUCT GROUPS

CONTENTS BY MANUFACTURERS

Product order code
- NCS21802DMR2G
- NCS21802MUTBG

NCS2180x OpAmp

Precision Operational Amplifier, 10 µV Offset Voltage, Zero-Drift



NCx2180x

The NCS21801/2/3/4* are precision operational amplifiers featuring low input offset voltage and low offset drift over time and temperature. That makes them ideal for applications where accuracy is needed, such as current sensing and sensor interfaces.

The NCS2180x family includes single, dual, and quad-channel configurations. All versions are specified for operation from -40 °C to 125 °C. In addition, NCV prefix parts are automotive-grade 1 qualified and offer performance over the extended temperature range, from -40 °C to 150 °C.
* NCSV21804 will be released in early Q1 2022.

- **Low Input offset voltage: 10 µV**
- **Zero-drift offset voltage: 0.075 µV/°C (max)**
- **Supply voltage range: 1.8 V to 5.5 V**
- **Quiescent current: 95 µA (max)**

Features

- Common-mode input voltage range:
  - V_{SS} - 0.1 V to V_{DD} + 0.1 V
- Extended Supply Voltage Range:
  - 1.6 V to 5.5 V for T_A = 0 °C to 85 °C
- Unity gain bandwidth: 1.5 MHz
- Quiescent current consumption:
  - 100 µA (max.) per channel, V_S= 1.8 V to 5.5 V, no load
  - 90 µA (max.) per channel, V_S= 1.6 V, no load
- Enable function available on NCS21803
- NCV prefix for automotive and other applications requiring unique site and control change requirements
- AEC-Q100 qualified and PPAP capable
- Pb-free, halogen-free/BFR free, and RoHS compliant

Product	Compliance	Channels	Package	Availability
NCS21801	PB-free, Halogen free	1	SOT23-5 / SC70-5	now
NCS21802	PB-free, Halogen free	2	Micro8 / UDFN-8	now
NCS21803	PB-free, Halogen free	1	SC70-6	now
NCS21804	PB-free, Halogen free	4	TSSOP-14	Q1/2022
NCV21801	PB-free, Halogen free, AECQ qualified, PPAP Capable	1	SOT23-5 / SC70-5	now
NCV21802	PB-free, Halogen free, AECQ qualified, PPAP Capable	2	Micro8	now
NCV21804	PB-free, Halogen free, AECQ qualified, PPAP Capable	4	TSSOP-14	Q1/2022

Key Applications

- High-side current sensing
- Low-side current sensing
- Difference amplifier
- Instrumentation amplifier
- Power management
- Automotive

The NCS2180x family is an excellent, precision, low-power, and low-noise operational amplifier alternative with a rich set of features and a large and expanding product family.

life.augmented

Product order code
- TSU112IYQ3T
- TSU112IYST

TSU112IY

Nanopower (900 nA) High Accuracy (150 µV) 5 V CMOS Auto Op-Amp

TSU112 in DFN Package

The TSU112IY operational amplifier (op-amp) offers an ultra-low-power consumption per channel of 920 nA typical and 1.3 µA maximum when supplied by 3.3 V. In combination with a supply voltage range of 1.5 V to 5.5 V, these features allow the TSU112IY to be efficiently supplied by a coin-type lithium battery or a regulated voltage in low-power applications.
The high accuracy of 150 µV max. and 9 kHz gain bandwidth make the TSU112IY ideal for sensor signal conditioning, battery management systems, onboard (OBC), and wireless chargers.

- **AEC-Q100 qualified**
- **Sub-micro ampere current consumption: I_{CC} = 920 nA typ. at 25 °C**
- **Low offset voltage: 150 µV max. at 25 °C, 400 µV max. over full temp range (-40 to 125 °C)**
- **Low noise over 0.1 to 10 Hz bandwidth: 4.6 $µV_{PP}$**

Features

- AEC-Q100 qualified
- Sub-micro ampere current consumption: I_{CC} = 920 nA typ. at 25 °C
- Low offset voltage: 150 µV max. at 25 °C, 400 µV max. over the full temperature range (-40 to 125 °C)
- Low noise over 0.1 to 10 Hz bandwidth: 4.6 $µV_{PP}$
- Low supply voltage: 1.5 V to 5.5 V
- Rail-to-rail input and output
- Gain bandwidth product: 9 kHz typ.
- Low input bias current: 10 pA max. at 25 °C
- High tolerance to ESD: 4 kV HBM
- More than 25 years of typical equivalent lifetime supplied by a 220 mA.h CR2032 coin type Lithium battery
- High accuracy without calibration
- Tolerance to power supply transient drops

Key Applications

- Battery management system: ultra-low power op-amp detects when the battery is charging/ discharging and wakes up CPU
- On-board chargers
- Signal conditioning for energy harvesting
- Wireless chargers

ST-OPAMPS-APP

- Free operational amplifier and comparator application for smartphones and tablets
- Get it here: www.st.com/opamps-app

The ultra-low-power consumption of TSU112IY guarantees extended battery life and thus is ideally suited for low power applications. Due to the high accuracy achieved without calibration TSU112IY operational amplifier (op-amp) offers high precision. Moreover, the tolerance to power supply transient drops allows for a short recovery time.

Product order code

- XS3A1T3157GM
- XS3A1T3157GS
- XS3A1T5157GM
- XS3A1T5157GS
- XS5A1T4157GW

New Low Ohmic Analog Switches

A Range of High-Performance, Low Ohmic Analog Switches

SOT 363

From speaker selection in cell phones to sensor selection in industrial process monitoring, our analog switches offer low switching losses and low THD for high-quality switching.

The XS3A & XS5A are low-ohmic single-pole double-throw analog switches suitable for use as analog or digital 2:1 multiplexer/demultiplexer. They have a digital select input (S), two independent inputs/outputs (Y1 and Y2) and a common input/output (Z). Low ON resistance (0.5 Ω) and flatness (0.13 Ω) ensures minimal attenuation and distortion of transmitted signals.

- **Reduced signal attenuation results in low switching losses**
- **Zero (typ.) overshoot at switching**
- **Bidirectional signal path**
- **Low ON resistance and ON resistance flatness**

Features

- Enables multiplexing of analog sensor signals
  - Allows for reduced number of ADCs
- Integrated level shifting of control signals interface to lower voltage controllers
- Low ON resistance
- ON resistance flatness
- Low switch leakage
- Wide supply voltage range
- Low input threshold input options
- Over-voltage tolerant options
- High ESD protection per IEC61000 Standard

Key Applications

- Mobile phone
- Tablet/ Notebook
- Wearables
- Factory automation
- Industrial process controls

Two new families of low R_{ON} Analog Switches ranging from 1.4 to 5.5 V. Low R_{ON}, ΔR_{ON}, and R_{FLAT} result in low-loss switching and reduced signal attenuation for precision measurement applications. Enabling full data exchange in environments where I/O resources are constrained. Break-before-make switching eliminates risk of momentary short between channels.

Product order code

- DGQ4051EEQ-T1-GE4
- DGQ4052EEQ-T1-GE4
- DGQ4053EEQ-T1-GE4

DGQ4051E, DGQ4052E, DGQ4053E

Low Capacitance, Low Charge Injection, 4-/8-Channel Analog Multiplexers

DGQ40

The DGQ4051E, DGQ4052E, and DGQ4053E are high-precision CMOS analog multiplexers. The DGQ4051E is an 8-channel multiplexer, the DGQ4052E is a dual 4-channel multiplexer and the DGQ4053E is a triple 2-channel multiplexer or triple SPDT.
These devices feature low leakage, parasitic capacitance, and low charge injection of 0.3 pC over the full voltage range. They are ideal for high-precision signal switching and multiplexing.
All switches conduct equally well in both directions, offering rail to rail analog signal switching and can be used both as multiplexers as well as de-multiplexers.
The devices are available in a 16-pin TSSOP package.

- **3 V to 16 V single supply or ±3 to ±8 V dual supply operation**
- **Less than 0.3 pC charge injection over the full signal swing range**
- **Bi-directional rail to rail signal switching**
- **Low leakage: less than 50 pA, typ.**

Features

- Automotive product AEC-Q100 qualified (Grade 1)
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- 3 V to 16 V single supply or ±3 to ±8 V dual supply operation
- Low parasitic capacitance (DGQ4053E):
  - $C_{D(ON)}$: 8.5 pF (typ.)
  - $C_{S(OFF)}$: 2.0 pF (typ.)
- Less than 0.3 pC charge injection over the full signal swing range
- Low leakage: less than 50 pA (typ.)
- Fast switching t_{ON}: 35 ns (typ.)
- 3 V logic compatible for control
- Bi-directional rail to rail signal switching

Key Applications

- Automotive applications:
  - Battery Management Systems (BMS)
  - Infotainment and Telematics
  - Analog and digital signal multiplexing and demultiplexing

DGQ4051E, DGQ4052E, and DGQ4053E offer a wide operation voltage range, low charge injection, and low parasitic capacitance in a small package.

That makes these parts the ideal choice for applications requiring a small footprint and high-precision signal switching and multiplexing.

life.augmented

Product order code

- BLUENRG-345AC
- BLUENRG-355MC
- BLUENRG-355MT
- STEVAL-IDB011V1

BlueNRG-LP

BlueNRG-LP Programmable Bluetooth® Low Energy 5.2 SoC

BlueNRG-LP Front View

The BlueNRG-LP is an ultra-low-power programmable Bluetooth® Low Energy wireless SoC solution. It embeds STMicroelectronics state-of-art 2.4 GHz RF radio IPs combining high performance with an extremely long battery lifespan. In addition, it is compliant with Bluetooth® Low Energy SIG core specification version 5.2, addressing point-to-point connectivity and Bluetooth Mesh networking. Thus, it allows large-scale device networks to be established in a reliable way.

- **Bluetooth® 5.2 specifications**
- **256 kB Flash / 32 kB - 64 kB RAM**
- **Up to 128 connections**
- **Ultra-Low power consumption**

Features

- Bluetooth® Low Energy system-on-chip:
  - 2 Mbps data rate
  - Long range (Coded PHY)
  - Advertising extensions
  - Channel selection algorithm #2
  - GATT caching
- Radio:
  - RX sensitivity level: -97 dBm at 1 Mbps, -104 dBm at 125 kbps (long range)
  - Programmable output power up to +8 dBm (at antenna connector)
  - Data rate supported: 2 Mbps, 1 Mbps, 500 kbps, and 125 kbps
  - 128 physical connections
  - Integrated balun
  - Support for external PA
  - BlueNRG core coprocessor (DMA based) for Bluetooth Low Energy timing critical operation
  - 2.4 GHz proprietary radio driver
  - Suitable for systems requiring compliance with the following radio frequency regulations: ETSI EN 300 328, EN 300 440, FCC CFR47 part 15, ARIB STD-T66
- Ultra-low-power radio performance
  - 10 nA in SHUTDOWN mode (1.8 V):
  - 0.6 uA in DEEPSTOP mode (with external LSE and BLE wake-up sources, 1.8 V)
  - 0.9 uA in DEEPSTOP mode (with internal LSI and BLE wake-up sources, 1.8 V)
  - 4.3 mA peak current in TX (at 0 dBm, 3.3 V)
  - 3.4 mA peak current in RX (at sensitivity level, 3.3 V)
- High performance and ultra-low power Cortex-M0+ 32-bit, running up to 64 MHz
- Operating supply voltage: from 1.7 to 3.6 V
- -40 °C to 105 °C temperature range

Key Applications

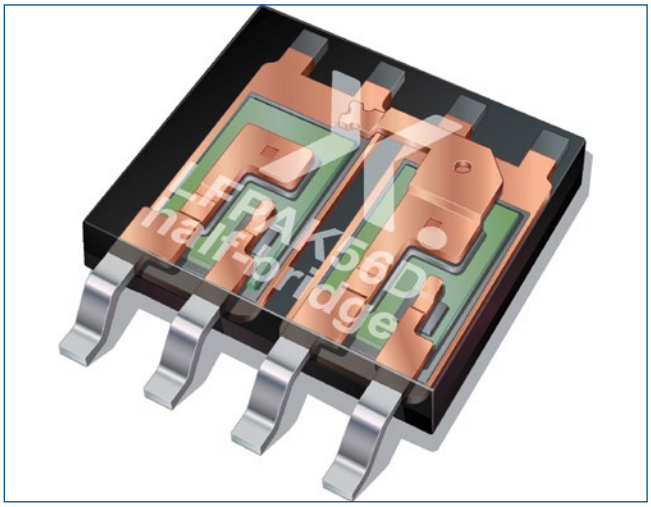
- Home and industrial automation
- Smart lighting
- Fitness, wellness and sports
- Healthcare, consumer medical
- Security/proximity
- Remote control
- Assisted living
- Mobile phone peripherals
- PC peripherals

The BlueNRG-LP embeds a Cortex®-M0+ microcontroller that can operate up to 64 MHz and the BlueNRG core coprocessor (DMA based) for Bluetooth® Low Energy timing critical operations in an extended temperature range of up to -40 °C – 105 °C.

Product order code
- PSMN013-40VLD
- PSMN4R2-40VSH

LFPAK56D Half-Bridge

60 % Lower Parasitic Inductance and Improved Thermal Performance



LFPAK56D

A series of half-bridge (high side & low side) MOSFETs constructed in the space-saving LFPAK56D package format. Occupying 30 % lower PCB area compared to dual MOSFETs for 3 phase motor control topologies due to the removal of PCB tracks whilst permitting simple automated optical inspection (AOI) during production. The package format uses flexible leads to improve overall reliability. An internal copper clip connection between the MOSFETs simplifies PCB designs and brings a plug-and-play style solution with exceptional current handling capability.

Part numbers:
- PSMN013-40VLD
- PSMN4R2-40VSH

- **60 % lower parasitic inductance due to internal clip connection**
- **High performance I_D max more than 60 A**
- **30 % space saving on PCB compared to LFPAK56D dual**
- **Low thermal resistance**

Features

- LFPAK56D package with half-bridge configuration
  - Enables reduced PCB layout complexity
  - Module shrinkage through reduced component count
  - Improved system-level $R_{TH(J-AMB)}$ due to optimized package design
  - Lower parasitic inductance to support higher efficiency
  - Footprint compatibility with LFPAK56D Dual package
- NextpowerS3 technology
- Low power losses, high power density
- Superior avalanche performance
- Repetitive avalanche rated
- LFPAK copper clip packaging provides high robustness and reliability
- Gullwing leads support high manufacturability and Automated Optical Inspection (AOI)

Key Applications

- Handheld power tools, portable appliances and space-constrained applications
- Brushless or brushed DC motor drive
- DC-to-DC systems
- LED lighting

Dual, standard level N-channel MOSFET in an LFPAK56D package (half-bridge configuration), using NextpowerS3 technology. An internal connection is made between the source of the high-side FET to the drain of the low-side FET, making the device ideal to use as a half-bridge switch in high-performance PWM and space-constrained motor drive applications.

TOSHIBA

Product order code | • GT20N135SRA,S1E(S

GT20N135SRA

1350 V IGBT Device for Domestic Appliance Applications

Toshiba GT20N135SRA

The GT20N135SRA showcases the latest design improvements that translate into higher system efficiency and safer operation while reducing the design headaches of engineers by making it easier to fulfil radiated emissions tests and attained optimal thermal design.
While the GT20N135SRA is optimized for 220 V_{AC} voltage-resonance appliances, future products will expand the portfolio to support higher currents for higher cooking capacities and voltage resonance solutions.

- **Collector-emitter saturation voltage $V_{CE(SAT)}$ 1.60 V (typ.)**
- **Diode forward voltage (V_F) 1.75 V**
- **Industry standard TO-247 package**
- **129 A peak short circuit current**

Features

- Collector-emitter saturation voltage and diode forward voltage offer reductions of around 10 % and 21 % respectively compared with conventional products
- 129 A peak short circuit current is almost a third lower than existing products
- Improved maximum junction-to-case thermal resistance allows for easier thermal design with less heatsinking
- Widened Safe Operating Area (SOA) gives designers greater flexibility

Key Applications

- Dedicated to voltage-resonant inverter switching applications
- Dedicated to soft switching applications
- Dedicated to induction cooktops and home appliance applications

This IGBT features a low saturation voltage of 1.60 V and operates at a maximum of 175 °C high junction temperature and 0.25µs of high-speed switching. The GT20N135SRA Silicon N-Channel IGBT is ideal for voltage-resonant inverter switching, soft switching, induction cooktops and home appliance applications.

TOSHIBA

Product order code

- TK065U65Z,RQ(S
- TK090U65Z,RQ(S
- TK110U65Z,RQ(S
- TK155U65Z,RQ(S
- TK190U65Z,RQ(S

TKxxxU65Z

650 V Superjunction Power MOSFETs Housed in the New TOLL Package

Toshiba TKxxxU65Z

The five 650 V super-junction power MOSFETs are housed in the new compact SMD package in TO-leadless (TOLL) format. Measuring just 9.9 × 11.68 × 2.3 mm³ (W × L × H), the TK065U65Z, TK090U65Z, TK110U65Z, TK155U65Z, and TK190U65Z devices have a 27 % smaller footprint than the conventional D2PAK package.
The new TOLL packaged MOSFETs offer $R_{DS(ON)}$ down to 65 mΩ.
Deploying the latest generation of the DTMOS VI series of 650V super-junction power MOSFETs with the TOLL package will help engineers reduce the size of their end equipment and improve efficiency. DTMOS VI is targeting the highest efficiency switching with best in class FOM: $R_{DS(ON)} \times Q_{GD}$ at TOLL packaged MOSFETs.

- **Compact outline**
- **Equipped with DTMOS 6 silicon chips**
- **Kelvin source pin**
- **$R_{DS(ON)}$ down to 65 mΩ**

Features

- High power density
- Due to DTMOS VI low $R_{DS(ON)} \times Q_{GD}$ FOM
- Highest efficiency switching operation (e.g., for PFC)
- Kelvin source use can reduce E_{ON} & E_{OFF} losses
- Smaller PSU units and power conditioners possible
- Less cooling requirements
- Reducing cost vs. performance

Key Applications

- Switching power supplies

The DTMOS series has a super junction structure capable of reducing the resistance of the drift layer even though it has a high withstand voltage. In addition, the TKxxxU65Z devices offer ultra-low FOM (Figure of Merit; $R_{DS(ON)} \times Q_{GD}$)

Product order code
- XLXSM-K26-XCL2GC
- XLXSM-K26-XCL2GI
- XLXSK-KV260-G

Kria™ K26 SoM

Adaptive System-on-Modules Optimized for Vision AI Applications

Kria™ K26 SoM

With the credit-card-sized form factor, the Kria™ K26 SOM is the fastest path to achieving whole application acceleration at the edge. Based on the Zynq® UltraScale+™ MPSoC architecture, the K26 SOM is capable of up to 1.4 TOPS AI processing and has an integrated H.264/265 video codec. The K26 SOM can adapt to virtually any requirement - you can connect up to 15 cameras across multiple interfaces, connect to networks at up to 40Gb/s. Developed with software developers in mind, the K26 SOM is out-of-the-box ready and enabled by pre-built accelerated applications for common vision functions.

- **Out-of-the-box ready for software developers**
- **App store with pre-built accelerated applications for common vision applications**
- **Future proof - stay deployed longer**
- **Performance and power advantages versus most competing SOMs**

Features

- Application Processor: 64-bit Quad-Core Arm®Cortex®-A53
- Real-Time Processor: 32-bit Dual-Core Arm® Cortex®-R5F
- Graphics processor: Arm Mali™-400MP2
- Deep learning processor: 4 K INT8 (upgradeable to INT4)
- Programmable logic: 256 K system logic cells
- Video Codec (H.264/H.265): up to 32 streams (total resolution ≤ 4 Kp60)
- Memory: 26.6 MB On-Chip SRAM
- Security: TPM 2.0 supporting IEC62443
- Camera: 11 x 4 full MIPI or sub-LVDS interfaces, 1 x 4 SLVS-EC interfaces
- 4 × USB 2.0/3.0
- DisplayPort, HDMI
- 1 Gb up to 40 Gb Ethernet (w/GigE Vision)
- Memory interface: 4 GB 64-bit DDR4
- Transceivers: 4 × 12.5 Gb/s, 4 x 6 Gb/s
- 77 × 60 × 11 mm with dual 240-pin connectors

Key Applications

- Security cameras
- Smart city
- Retail analytics
- Machine vision
- Vision-guided robotics

The newest path to Whole Application Acceleration, the K26 SOM, is optimized for edge vision applications requiring flexibility to adapt to changing requirements. Available in Commercial and Industrial Grade variants for production deployment.

life.augmented

Product order code

- STSPIN32G4
- STSPIN32G4TR
- EVSPIN32G4
- EVSPIN32G4NH

STSPIN32G4

High-Performance 3-Phase Motor Controller with Embedded STM32G4 MCU

STSPIN32G4

The STSPIN32G4 is a highly integrated and flexible motor controller for driving 3-phase brushless motors, helping designers to choose the most suitable driving mode and reduce PCB area. It embeds a triple half-bridge gate driver able to drive power MOSFETs.
The high- and the low-side switches of the same half-bridge cannot be simultaneously driven high thanks to an integrated interlocking function. An additional protection feature is represented by hardware VDS monitoring circuitry that constantly monitors each of the six external MOSFETs and in case an overvoltage is detected, switches off all gate driver outputs.

- **Motor supply voltage from 5.5 V to 75 V**
- **Three-phase gate drivers with 1 A sink/source current capability**
- **V_{DS} monitoring of the power stage MOSFETs**
- **STM32G431 microcontroller with 32-bit Arm® Cortex®-M4 MCU+FPU core**

Features

- Motor supply voltage from 5.5 V to 75 V
- Three-phase gate drivers:
  - 1 A sink/source current capability
  - VDS monitoring of the power stage MOSFETs
  - Integrated bootstrap diodes
  - I²C accessible configuration and status registers for best application fit
  - Cross-conduction prevention
- STM32G431 microcontroller with 32-bit Arm® Cortex®-M4 MCU + FPU core:
  - Up to 170 MHz clock frequency
  - CORDIC mathematical hardware accelerator for trigonometric functions
  - 128 kB Flash memory with proprietary code readout protection (PCROP), securable memory area, 1 kB OTP
  - 32 kB SRAM memory with HW parity check
  - 2 × advanced times for motor control, 16-bit with up to 6 × PWM channels
  - 8 × general-purpose timers
  - 2 × ADCs 12-bit resolution (up to 19 channels) with 4 Msps conversion rate
  - 4 × 12-bit DAC channels
  - 4 × ultra-fast rail-to-rail comparators
  - 3 × rail-to-rail operational amplifiers usable also in PGA mode
  - Internal high precision voltage reference
  - Up to 40 GPIOs
  - Full set of interfaces: I²C, SPI, UART, and CAN
- Self-supplied thanks to embedded flexible power management

Key Applications

- Industrial and home automation
- Home appliances
- Servo drives and e-bikes
- Service and automation robots
- Power and garden tools

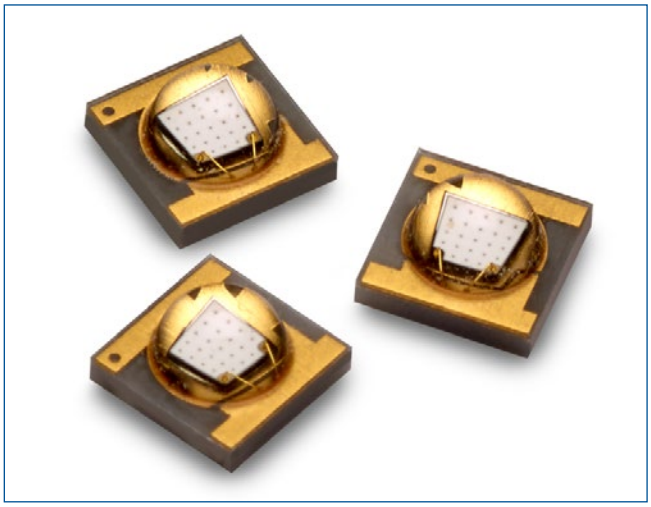
The STSPIN32G4 all in one package solution results in smaller BOM and PCB area and reduced design time. In addition, you will profit from high flexibility, enabling seven control methods and full compatibility with the STM32 ecosystem and SW libraries. The STSPIN32G4 supports an extended temperature range of -40 °C to +125 °C, on-chip debugging via SWD or JTAG, and standby mode for reduced power consumption.

Product order code

- AUV4-PSD0-0MP0H
- AUV4-PTD0-0MP0H
- AUV4-PUD0-0MP0H
- AUV4-PVD0-0MP0H
- AUV4-PWD0-0MP0H

AUV4-Pxx0

1W 3535 UV-A LEDs



AUV4-PxD0

The Broadcom® 1 W 3535 UV LED family consists of energy-efficient LEDs that can be driven at a high driving current and dissipate heat efficiently, resulting in better performance and reliability.

Their low-profile package design addresses a wide variety of applications where superior robustness and high efficiency are required. In addition, they are compatible with the reflow soldering process, and the silicone encapsulation ensures product superiority and longevity.

To facilitate easy pick-and-place assembly, the LEDs are packed in tape and reel. Every reel is shipped in a single flux and colour bin to provide close uniformity.

- **High-reliability package with enhanced silicone resin encapsulation**
- **Available in 380-nm to 430-nm wavelength range**
- **Wide viewing angle at 130°**
- **Compatible with the reflow soldering process**

Features

- JEDEC MSL 3
- Peak Wavelength, λp (nm) at TJ = 25°C, IF = 350 mA
  - AUV4-PSD0-0MP0H: typ. 385
  - AUV4-PTD0-0MP0H: typ. 395
  - AUV4-PUD0-0MP0H: typ. 405
  - AUV4-PVD0-0MP0H: typ. 415
  - AUV4-PWD0-0MP0H: typ. 425

Key Applications

- Industrial curing
- Photocatalyst purification
- Horticulture
- Fluorescence

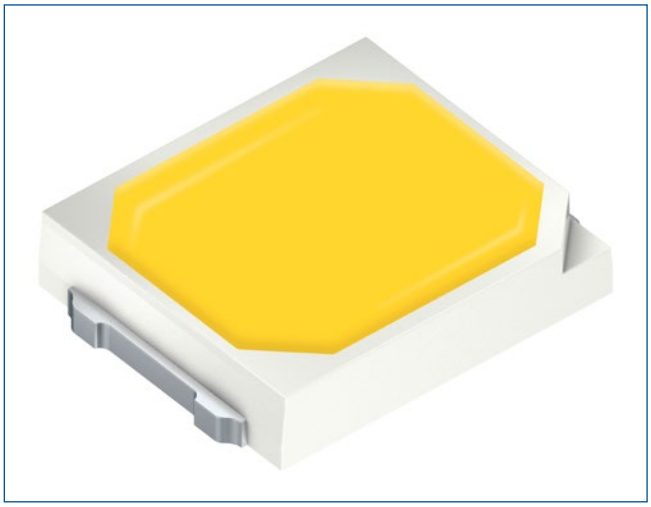
The AUV4-PxD0-0xx0H 1W 3535 Surface Mount UV LEDs can be driven at high currents while effectively dissipating heat, resulting in exceptional performance, reliability, and energy efficiency.

Product order code

- Q65113A3379
- Q65113A3378
- Q65113A3381
- Q65113A3380
- Q65113A3377
- Q65113A3376

OSCONIQ® E 2835

Adding Premium Features to the 2835 Mid-Power Package Standard



OSCONIQ® E 2835

Available in two different versions, OSCONIQ® E 2835 offers a comprehensive premium 2835 line-up with key features only available in 3030 packages today whilst providing system-level advantages versus comparative 3030 package solutions.
The OSCONIQ® E 2835 CRI 90 QD (quantum dot) includes a specially developed QD phosphor with ams OSRAM proprietary that enables CRI 90 to achieve high efficacy and an excellent value for 0.5 W mid-power LED.
OSCONIQ® E 2835 Cyan features a cyan-enhanced spectrum, which can suppress the production of melatonin, leading to increased productivity of humans. Circadian lighting is now possible in a 2835 package.

- **Quantum Dot technology with outstanding efficacy even at high CRI values**
- **Cyan-enhanced spectrum for Human-Centric Lighting (HCL) applications**
- **Elevated lifetime and reliability for mid-power application needs**
- **Standardized 2835 footprint PCT package**

Features

OSCONIQ® E 2835 CRI 90 QD

- Package: white SMT package, coloured diffused silicone resin
- Typ. Radiation: 120° (Lambertian emitter)
- Color temperature: 2200 K - 6500 K
- CRI: 90 (min.)
- Luminous Flux: typ. 34 lm @4000 K
- Luminous efficacy: typ. 195 lm/W @ 4000 K

OSCONIQ® E 2835 Cyan

- Package: white SMT package, coloured diffused resin
- Typ. Radiation: 120° (Lambertian emitter
- Color temperature: 3000K - 6500K
- ESD: 2 kV acc. to ANSI/ESDA/JEDEC JS-001 (HBM, Class 2)
- Luminous Flux: typ. 144 lm @4000 K
- Luminous efficacy: typ. 157 lm/W

Key Applications

- Office lighting
- Research and educational facilities
- Premium/ high-end Residential lighting
- Retail lighting
- Hospital and care facilities
- Hospitality lighting
- Human-centric lighting – plane interior
- Interior lighting
- Industrial lighting (increased productivity)

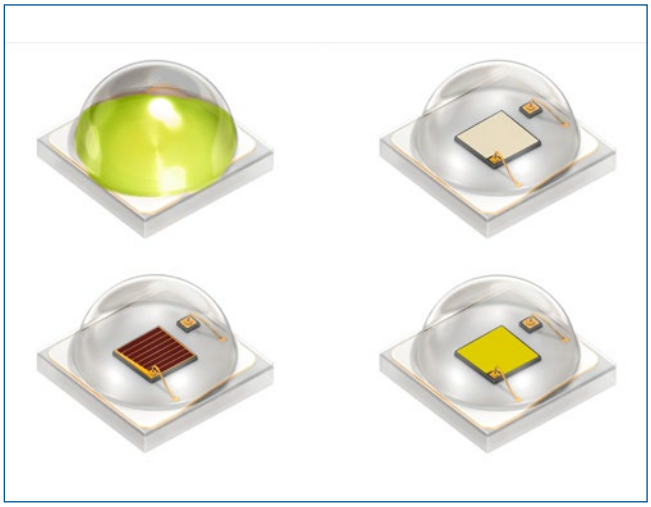
The OSCONIQ® E 2835 portfolio is highly versatile and offers a multitude of design solutions for interior lighting applications in the premium segment for but not limited to professional applications like office, retail, hospitality, residential or hospital lighting.

Product order code

- Q65113A2453
- Q65112A9298
- Q65112A9297
- Q65112A9296
- Q65112A9260
- Q65112A9257

OSLON® Signal Family

Next Generation of High Power Signalling LED



OSLON® Signal Gen2 Family

The next generation of OSLON® Signal LED introduces a new 120° lens design for improved light extraction, brightness and efficacy improvements with the latest chip technologies and a reflective titanium dioxide casting. This new generation is fully compatible in footprint and solder pad design to the previous generation ensuring an easy design-in process for this high-performance LED. OSLON® Signal LED are available in various colours and performance classes making the family the perfect fit for traffic lights, aviation, marine, rail, industrial, transportation or other signalling applications (matching national and international standards).

- **Broad colour portfolio with bin selections matching CIE, SAE, EN & ITE specifications**
- **120° silicone lens with a universal radiation pattern for a consistent optical performance**
- **Electrically insulated thermal pad for stable performance at high power levels**
- **LM-80 reports available – long lifetime through the usage of silicone and ceramic materials**

Features

- Package: reliable and robust ceramic package with silicone lens
- Typ. Radiation: 120° (Lambertian emitter)
- OSLON® Signal White:
  - Luminous Flux: typ. 171 lm @ 25 °C
  - Luminous efficacy: typ. 168 lm/W
- OSLON® Signal Blue:
  - Luminous Flux: typ. 43.9 lm @ 25 °C
  - Luminous efficacy: typ. 43.3 lm/W
- OSLON® Signal Verde:
  - Luminous Flux: typ. 113 lm @ 25 °C
  - Luminous efficacy: typ. 113 lm/W
- OSLON® Signal True Green:
  - Luminous Flux: typ. 145 lm @ 25 °C
  - Luminous efficacy: typ. 156 lm/W
- OSLON® Signal Converted Yellow:
  - Luminous Flux: typ. 114 lm @ 25 °C
  - Luminous efficacy: typ. 112 lm/W
- OSLON® Signal Red:
  - Luminous Flux: typ. 78 lm @ 25 °C
  - Luminous efficacy: typ. 104 lm/W

Key Applications

- Industry, automation, man-machine interface
- Transportation, work lights
- Signalling, traffic lights
- Emergency vehicle lighting (EVL)
- Airfield navigation lights, marker lights
- Aircraft warning lights

OSLON® Signal LEDs offer cutting edge signalling design solutions with a significantly reduced number of LEDs per signal.

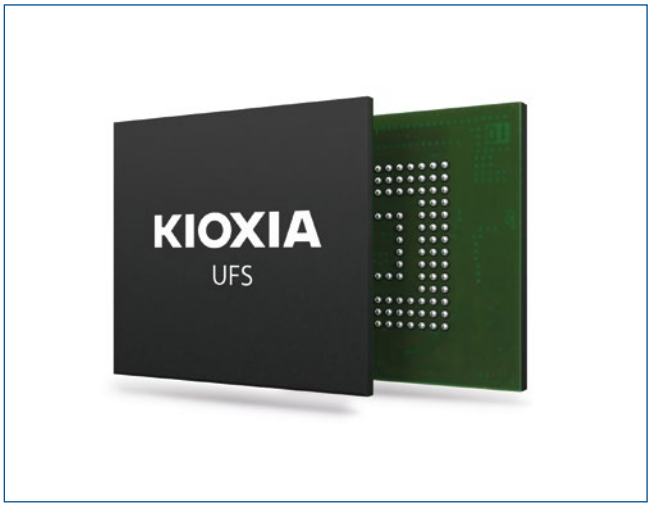
The tiny ceramic-based high-performance package from OSRAM Opto Semiconductors sets new standards in terms of electro-optical efficiency even at high temperatures. OSLON® Signal is available in various colours and performance classes, offering bin selections that comply with many national and international standards (like CIE, SAE, EN and ITE).

Product order code

- THGJFAT0T44BAIL_TRAY
- THGJFAT1T84BAIR_TRAY
- THGJFAT2T84BAIR_TRAY
- THGJFHT3TB4BAIF_TRAY

New Generation UFS Ver. 3.1

KIOXIA introduces a New Family of UFS supporting JEDEC 3.1



KIOXIA UFS 3.1

KIOXIA is now introducing a new family of UFS Memory products for applications demanding superior interface performance and higher densities. Utilizing a full-duplex serial high-speed interface, it is compliant with the latest UFS Version 3.1.

In combination with embedded memory management, it offers a highly efficient and excellent performing storage solution. UFS memory with Version 3.1 enables next-generation mobile devices and other industrial applications to take full advantage of the connectivity benefits of 5G and IoT, leading to faster data transmission and reduced access time.

- **Utilizing 3D BiCS FLASH™**
- **WriteBooster**
- **Host Performance Booster (HPB) Ver. 1.0**
- **UFS-DeepSleep Power Mode**

Features

- Densities from 128 GByte up to 1 Tera-Byte available
- WriteBooster:
  - Enables significantly faster write speeds by approximately 2 to 3 times than the normal write performance
- Sequential Read Performance:
  - Improved by approximately 30 % over KIOXIA's existing Ver. 3.0 product
- Host Performance Booster (HPB) Ver. 1.0:
  - Improves random read performance by utilizing the host side memory
- UFS-DeepSleep Power Mode:
  - Achieves power consumption reduction in sleep mode compared to the existing UFS-Sleep Power Mode
- Performance Throttling Event Notification:
  - The UFS may throttle performance if the internal temperature reaches its upper limit, to avoid overheating and damage to the internal device circuits

Key Applications

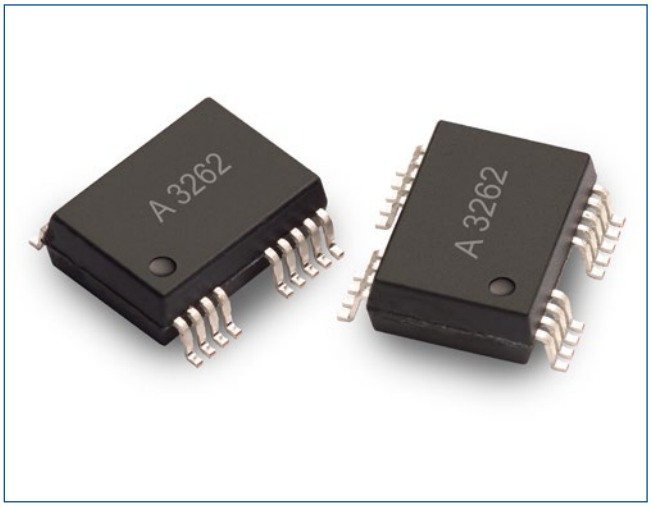
- 5G, HMI, CoM, STB, security camera
- POS, PLC, IPTV, industrial PC
- Customised USB/SD, GPON
- Smart metering hub, base station
- GPS tracker, intelligent audio speaker
- Machine control, data logger, TOF

Broad line up from 128 GB - 1 TB UFS, using leading-edge 3D Flash Technology called BiCS FLASH™ in combination with ultra-high-speed serial interface supporting UFS 3.1 specifications.

Product order code | • ACFJ-3262-000E

ACFJ-3262

10 A Dual-Channel Gate Drive Optocoupler in 600 V CTI SO-24 Package



ACFJ-3262

The ACFJ-3262 is a 10 A dual-channel gate drive optocoupler device in the SO-24 package designed for high voltage, space-constrained industrial applications like motor drives and inverters. The new package features a 600 V CTI mould, reducing the creepage requirement due to increased insulation voltage in a compact footprint. It features transient immunity (CMTI) greater than 100 kV/µs, preventing erroneous gate driver failures in noisy environments. The new device has less than 95 ns propagation delay, enabling high frequency switching to improve MOSFET and GaN transistor/FET driving efficiency.

- **10 A max peak output current**
- **Dual-channel with 2.8 mm creepage between channels**
- **600 V CTI mould**
- **Dual rail-to-rail outputs for separate source and sink**

Features

- Industry's first 10 A gate drive optocouplers
- 95 ns max propagation delay
- 100 kV/µs minimum common mode rejection (CMR) at V_{CM} = 1000 V
- I_{CC} = 4.0 mA max supply current
- Wide operating V_{CC} range: 10 to 25 V
- 600 V CTI SO-24 package
- Industrial temperature range:
  - From -40 to +125 °C
- Safety approvals:
  - UL recognized: 5000 V_{RMS} for 1 minute.
  - CSA approved
  - IEC/EN/DIN EN 60747-5-5 V_{IORM} = 1.230 V_{PEAK}

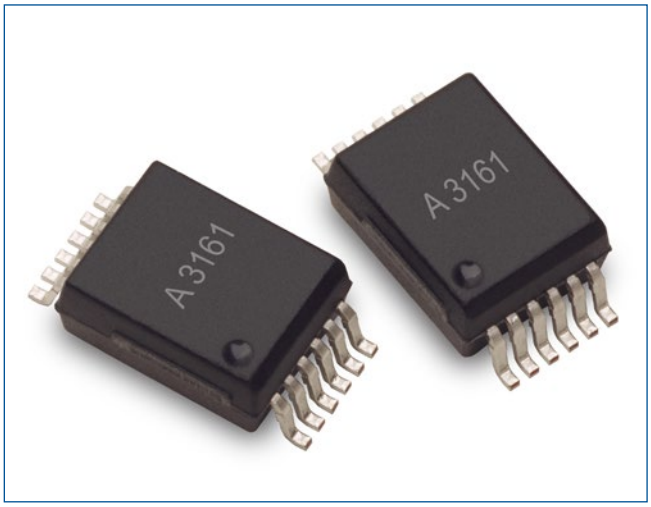
Key Applications:

- MOSFET and GaN transistor/FET gate drive
- AC and brushless DC motor drives
- Renewable energy inverters and storage
- Industrial inverters
- Switching power supplies

Broadcom® gate drive optocouplers are used extensively in driving silicon-based semiconductors like IGBT and power MOSFETs. Optocouplers are used to provide reinforced galvanic insulation between the control circuits from the high voltages and the power semiconductors. Today, Broadcom´s next generation of gate drive optocouplers can also be used to protect and drive SiC and GaN power devices.

ACFL-3161

10 A Gate Drive Optocoupler in 600 V CTI SSO-12 Package



ACFL-3161

The ACFL-3161 is a 10 A gate drive optocoupler device in the SSO-12 package designed for high-voltage, space-constrained industrial applications like motor drives and inverters. The new package features a 600 V CTI mould which reduces the creepage requirement due to high insulation voltage in a compact footprint.
It features common-mode transient immunity (CMTI) greater than 100 kV/µs, preventing erroneous gate driver failures in noisy environments. Furthermore, the new device has less than 95 ns propagation delay, enabling high frequency switching to improve IGBT and SiC/GaN MOSFET driving efficiency.

- **10 A max peak output current**
- **600 V CTI mold**
- **Dual rail-to-rail outputs for separate source and sink**
- **UVLO with V_s reference for negative power supply**

Features

- Industry's first 10 A smart gate drive
- 95 ns max propagation delay
- 100 kV/µs minimum common mode rejection (CMR) at V_{CM} = 1000 V
- I_{CC} = 4.0 mA max supply current
- Wide operating V_{CC} range: 15 to 30 V
- 600 V CTI SSO-12 package
- Industrial temperature range:
  - From -40 to +125 °C
- Safety approvals:
  - UL recognized: 5000 V_{RMS} for 1 minute
  - CSA approved
  - IEC/EN/DIN EN 60747-5-5 V_{IORM} = 1.230 V_{PEAK}

Key Applications

- IGBT/SiC gate drives
- AC and brushless DC motor drives
- Renewable energy inverters and storage
- Industrial inverters
- Switching power supplies

The ACFL-3161 is a single channel, high peak driving current, rail-to-rail output isolated SiC MOSFET/ IGBT gate driver in a compact SO-12 package. It can operate over a wide V_{DD} range of 15 V to 30 V with under-voltage lock-out protection. The ACFL-3161 has a pair of source and sink outputs to facilitate tuning of turn-on and turn-off gate resistors. Direct LED input allows flexible logic configuration and differential current mode driving with low input impedance, significantly increasing noise immunity.

Product order code

- AFBR-5813QZ
- AFBR-5813TQZ
- AFBR-5823QZ
- AFBR-5823TQZ

AFBR-58x3xxZ Family

125 MBd Fiber Optic Fast Ethernet Transceivers

AFBR-5823TQZ

With the AFBR-5823xxZ, Broadcom offers an integrated diagnostic monitoring interface (DMI) compatible with the SFF-8472 standard for mission-critical applications for the first time in this form factor. In addition, the new transceivers offer a 50 % savings in power consumption compared to the current generation products and are designed for industrial communication systems.

The AFBR-58x3xxZ transceivers family is available in the industry standard 1 × 9 and 2 × 9 package style with either a duplex SC or a duplex ST1 connector interface. Other SFF and SFP form factors are also available.

- **Full compatibility with 100 BASE-FX version IEEE802.3u**
- **Integrated diagnostic monitoring interface**
- **Full compatibility with FDDI**
- **Multisource 1 × 9 package style with choice of duplex SC or duplex ST1 receptacle**

Features

- Single 3.3 V power supply operation
- DCPECL differential input and output data connections
- DCPECL signal detect output
- Industrial temperature range from -40 to 85 °C
- Wave solder and aqueous wash process compatible
- RoHS compliant

Key Applications

- Multimode 50 µm or 62.5 µm core fibre backbone links up to 2 km
- Multimode fibre wiring closet to desktop links
- Very low-cost multimode fibre links from wiring closet to desktop
- Multimode fibre media converters

The Broadcom® AFBR-58x3xxZ transceivers provide the system designer with products to implement a range of 125-MBd Fast Ethernet and FDDI as well as 100-Mb/s Asynchronous Transfer Mode (ATM) designs. In addition, the new transceivers offer up to 50 % savings in power consumption.

AFBR-FS13B25

Transceiver for Optical Wireless Communications up to 1.25 Gb/s

AFBR-FS13825

The Broadcom® AFBR-FS13B25 is a transceiver that communicates data over free space allowing connector-less and cable-less communication in a variety of applications. Full-duplex bidirectional communication, together with a small form factor, allows for a compact system design. The device keeps full functionality over a 360° rotation around the optical axis, which reduces the complexity of alignment on the system level.
The AFBR-FS13B25, a Laser Class 1 product, is RoHS-compliant and is designed for SMT solderability standard processes.

- **Data rate: up to 1.25 Gb/s**
- **Distance range: 30 mm to 60 mm**
- **Bidirectional full-duplex**
- **Full function over 360° rotation**

Features

- Single 3.3 V power supply
- Bidirectional full-duplex communication
- Full functionality over 360° rotation
- Operational temperature range: –10 °C to +85 °C
- Maximum total power dissipation: 100 mW
- Spectral wavelength: 850 nm typically
- Small form factor (W × L × H):
  - 5.25 × 5.25 × 4.90 mm
- SMT solderability
- Laser Class 1
- RoHS compliant

Key Applications

- Healthcare & Wearables:
  - Medical Instruments
- Industrial:
  - Human Machine Interface (HMI)
  - Robotics
  - Optical wireless communication
  - Though-window optical wireless communication
  - Rotary optical data feedthrough
  - Board-to-board communication

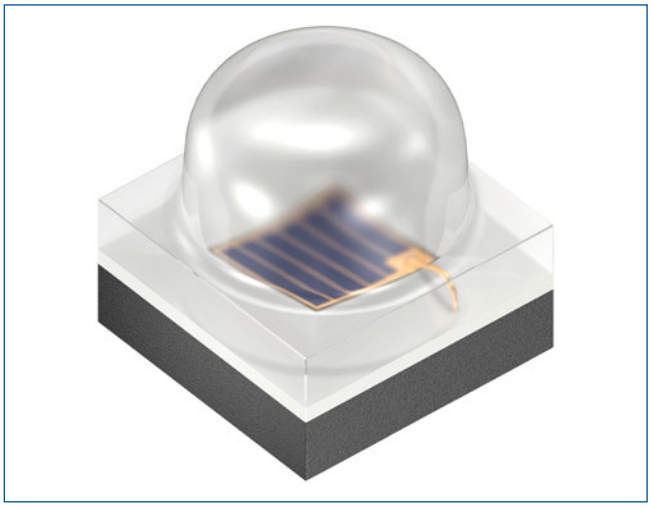
The Broadcom® AFBR-FS13B25 enables wireless data communication over short distances, utilizing VCSEL emitter operating at 850 nm typically. It enables up to 1.25 Gb/s in both directions (full-duplex) to a distance of 30 to 60 mm.

The main advantage of the device is keeping its full functionality over 360° of rotation around the optical axis (or less), eliminating the need for connectors or cabling, preventing entanglement and wear in many applications with moving parts.

Product order code
- Q65113A1098
- Q65113A1097

OSLON® P1616 Lens

High power IR Emitter (850 nm/940 nm) with integrated Lens (+/-35 °)



OSLON P1616 Lens

The OSLON® P1616 Products are the smallest high power infrared LEDs in the product portfolio of OSRAM Opto Semiconductors. With a package size of only 1.6 × 1.6 mm² and a best in class intensity, the devices are among the industry's smallest high power (near) infrared devices.
SFH 4171S and SFH 4181S – the newest additions to the P1616 portfolio – already have an integrated lens with a viewing angle of ±35° and are available as a stack version. Therefore they are the perfect fit for applications requiring high radiant power and a homogenous bright illumination area, such as 2D Face Recognition for user authentication in laptops and smart doorbells.

- **Small footprint (1.6 mm × 1.6 mm) with integrated lens (height 1.71 mm)**
- **850 nm and 940 nm wavelength available**
- **Fast switching times (rise time 9 ns, fall time 16 ns)**
- **Max. DC output power 1.15 W @ 1 A**

Features

- 850 nm and 940 nm wavelength available
- Package dimensions 1.6 × 1.6 × 1.71 mm³
- Radiant Flux of 1150 mW @ 1 A (850 nm)
- Max. DC output power 1.15 W @ 1 A
- Rise time 9 ns, fall time 16 ns
- Temperature range -40 ... 105 °C

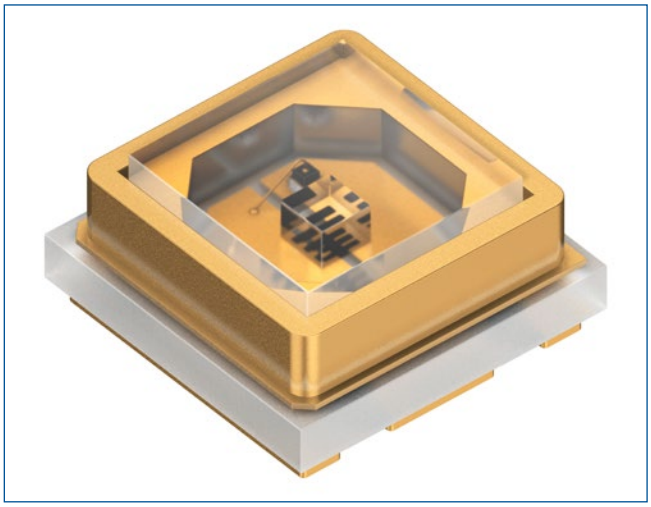
Key Applications

- **IRED**
  - IR illumination for security applications, e.g. smart doorbells
  - 2D face recognition, e.g. user authentification in laptops and mobiles
  - Eye tracking
  - Gesture sensing
- **Broadband emitter**
  - Near-infrared spectroscopy in
    - Consumer devices
    - Industrial applications

The small OSLON® P1616 high power infrared LEDs deliver superior package size to performance ratio with 450 mW/mm² (1150 mW out of 1.6 × 1.6 mm² footprint) along with low package height and fast switching times.

OSLON® UV 3636

SU CULCN1.VC: The newest mid-power UV-C LED from OSRAM Opto Semiconductors



OSLON UV 3636

The OSLON® UV series is designed to provide efficient UV-C radiation for but not limited to medical, home goods and consumer applications. It allows for flexible designs for various types of UV-C applications in the areas of air, water and surface disinfection and purification, as well as treatment or sensing. Design possibilities are endless and range from point-of-use water treatment, automotive interior disinfection to air purification in portal devices or air conditioning systems. This new addition to the OSLON® UV family bridges the power output between low and mid-power in a new and improved 13.5 mW version.

- **Colour: λ_{PEAK} = 275 nm (UV-C)**
- **Purification and disinfection without the use of chemicals**
- **Radiant Flux: typ. 13.5 mW (mid-power)**
- **Radiant Efficiency: typ. 2.4 % (mid-power)**

Features

- Package: Ceramic package with integrated glass cover
- Chip technology: AlGaN based Flip chip
- Typ. Radiation: 120° (Lambertian emitter)
- Color: λpeak = 275 nm (ultraviolet (UV-C))
- ESD: 2 kV acc. to ANSI/ESDA/JEDEC JS-001 (HBM)
- Radiant Flux: typ. 13.5 mW
- Radiant Efficiency: typ. 2.4 %

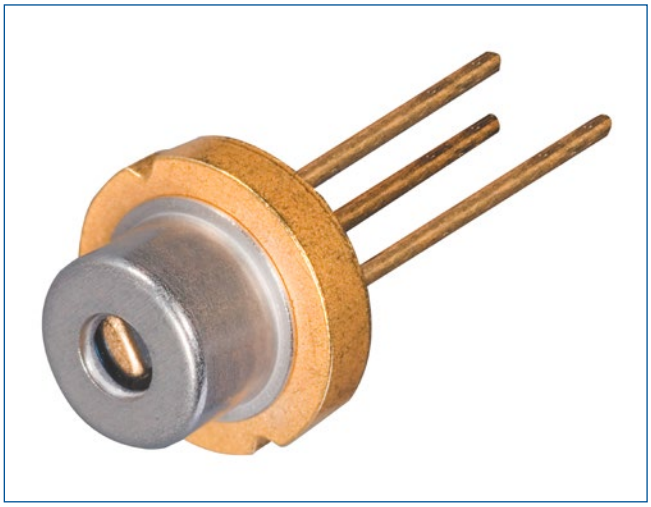
Key Applications

- Equipment illumination (e.g. Curing, Endoscope)
- Smoke/ dust/ particle sensing
- UV-C air disinfection
- UV-C surface disinfection
- UV-C water disinfection

UV-C radiation has a highly disinfecting effect, as it is absorbed by the DNA of pathogens, inactivating their reproduction process. Mercury lamps are traditionally used as UV sources. However, unlike mercury lamps, UV-C LEDs do not contain hazardous materials and provide much greater design flexibility. The new OSLON® 3636 UV mid-power LED offers typ. radiant flux of 13.5 mW in a compact 3.6 × 3.6 mm package with a common footprint, high WPE (Wall Plug Efficiency), and a robust design for an extended lifetime.

PLT5 522EA_P

20 mW Single Mode Green Laser in TO56 Package



PLT5 522EA_P Green Laser

Direct green lasers have a high operating temperature range of up to 85 °C without active cooling compared to frequency-doubled lasers. Their excellent efficiency allows a long lifetime up to 10,000 hours at 40 °C. Thanks to their excellent beam quality, our lasers are ideally suited for the optical imaging of light. The latest Green (520 nm) single-mode laser diode in TO56 package PLT5 522EA_P emits 20 mW optical output power and is designed for highly reliable operation. The integrated monitor diode allows controlling the optical power making the laser diode an ideal option for industrial applications.

- **20 mW optical power in CW operation**
- **Wavelength range from 510 nm – 530 nm with 5/10 nm fine binning available**
- **Wall Plug Efficiency: 6 %**
- **Low thermal Resistance 34 K/W**

Features

- Optical output power (continuous wave): 20 mW (TC = 25 °C)
- Typical emission wavelength: 520 nm
- Efficient radiation source for cw and pulsed operation
- Single mode semiconductor laser
- High modulation bandwidth
- TO56 package with photo diode

Key Applications

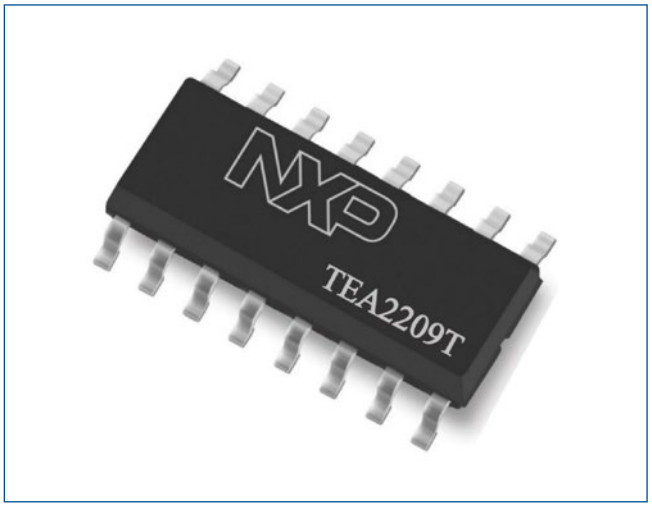
- Architecture/garden lighting (LED & laser)
- Area lights
- Downlights/spotlights
- Mood lighting
- Street, tunnel and outdoor

Thanks to their excellent beam quality, these direct green lasers are ideally suited for the optical imaging of light. They feature 20 mW high-efficiency CW operation with integrated monitor diode and wavelength binning option.

Their small package size is particularly beneficial to highly compact systems, such as pico projectors.

TEA2209T

Active Bridge Rectifier Controller



TEA2209T

The TEA2209T is a product of a new generation of active bridge rectifier controllers replacing the traditional diode bridge.

Using the TEA2209T with low-ohmic high-voltage external MOSFETs significantly improves the efficiency of the power converter as the typical rectifier diode-forward conduction losses are eliminated. Efficiency can improve up to about 1.4 % at 90 V (AC) mains voltage. The TEA2209T is designed in a silicon-on-insulator (SOI) process.

- **Integrated high-voltage level shifters**
- **Very low external part count**
- **Integrated X-capacitor discharge (2 mA)**
- **Forward conduction losses of the diode rectifier bridge are reduced**

Features

- Integrated high-voltage level shifters
- Directly drives all four rectifier MOSFETs
- Very low external part count
- Integrated X-capacitor discharge (2 mA)
- Self-supplying
- Full-wave drive improving total harmonic distortion (THD)
- S016 package
- Disable function for all external power FETs
- Undervoltage lockout (UVLO) for high-side and low-side drivers
- Drain-source overvoltage protection for all external power MOSFETs
- Gate pull-down currents at start-up for all external power MOSFETs
- Forward conduction losses of the diode rectifier bridge are eliminated
- Very low IC power consumption (2 mW)

Key Applications

- Any AC/DC power supply needing high efficiency
- Power supplies for home appliances
- Power supplies for servers
- Power supplies for desktop PC and all-in-one PC

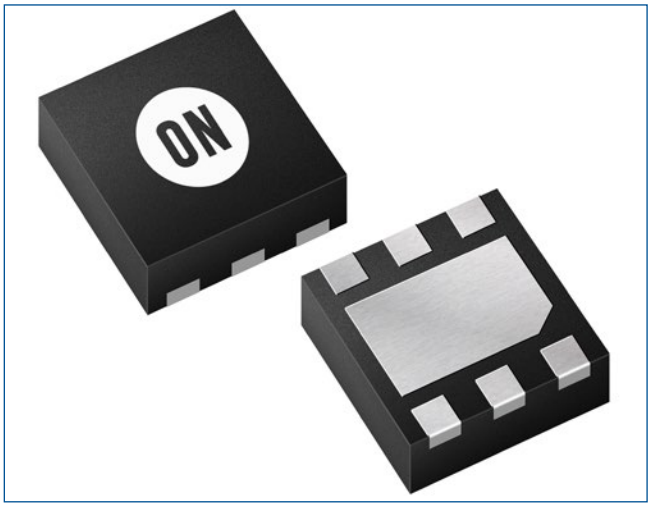
The TEA2209T is intended for power supplies with a boost-type power-factor controller as a first stage. The second stage can be a resonant controller, a flyback controller, or any other controller topology. It can be used in all power supplies requiring high efficiency.

Product order code

- NCP187AMT120TAG
- NCP187AMT330TAG
- NCP187AMTW080TAG
- NCP187AMTWADJTAG

NCP187/NCV8187

Low Dropout Voltage Regulator, 1.2 A with Low Quiescent Current and Low Noise



WDFN6−2x2

The NCP187 is a 1.2 A Low Dropout Linear Voltage Regulator (LDO). It is a very stable and accurate device with low quiescent current consumption (typically 30 A over the full temperature range). It features low dropout, low output noise, and a very good Power Supply Rejection Ratio (PSRR).
The regulator incorporates several protection features such as Thermal Shutdown, Soft Start, Current Limiting, and also Power Good Output signal for easy MCU interfacing. There is also an automotive−grade version with the NCV prefix (NCV8187) that is AEC−Q100 qualified and PPAP capable.

- **High output current: 1.2 A**
- **Low quiescent current: typically 30 μA over temperature**
- **Low noise: typically 15 μV_{RMS} from 10 Hz to 100 kHz**
- **PSRR: 75 dB at 1 kHz**

Features

- Operating input voltage range: 1.5 V to 5.5 V
- Fixed and adjustable voltage options available: 0.8 V to 5.2 V
- ±2 % accuracy over full load, line, and temperature variations
- Stable with a small 10 μF ceramic capacitor
- Soft−start to reduce inrush current and overshoots
- Thermal shutdown and current limit protection
- Power Good signal extends applications range
- NCP187: available in WDFN6 and WDFNW6 2 × 2 packages
- NCV8187: available in WDFN6 and WDFNW6 2 × 2, DFN6 3 × 3, DFNW6 3 × 3, DFNW8 3 × 3, and DPAK−5 with wettable flank
- Pb−free, Halide−Free

Key Applications

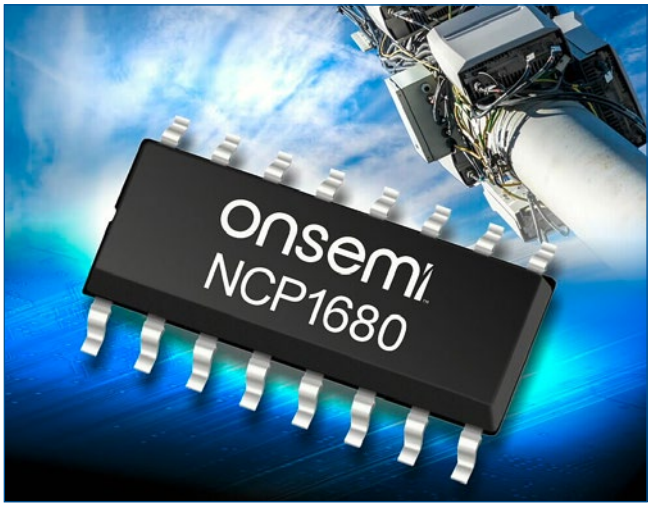
- Wireless chargers
- Portable equipment
- Smart camera and robotic vision systems
- Telecommunication and networking systems
- General purpose automotive (NCV8187)

The NCP187/NCV8187 devices offer low power dissipation at low output voltages, are very well suited for noise−sensitive applications and power−sensitive devices. In addition, these LDOs can operate from a low voltage rail and feature Power Good signal for easy MCU interfacing and power sequencing.

Product order code
- NCP1680AAD1R2G
- NCP1680ABD1R2G

NCP1680 PFC Controller

Bridgeless Totem Pole PFC Controller



NCP1680

The NCP1680 Critical Conduction Mode (CRM) Totem Pole Power Factor Correction (PFC) controller employs novel current limit architecture and line phase detection while incorporating proven control algorithms to deliver a cost-effective Totem Pole PFC solution without compromising on performance.
The bridgeless architecture consists of a fast switching leg driven at the PWM switching frequency and a second leg that operates at the AC line frequency. This topology eliminates the diode bridge present at the input of a conventional PFC circuit, allowing significant improvement in the power stage efficiency.

- **Totem pole PFC topology eliminates input diode bridge**
- **Frequency foldback in DCM with 25 kHz minimum**
- **Discontinuous Conduction Mode (DCM) with valley turn on under light load condition**
- **Digital voltage loop compensation**

Features
- Skip mode in very light load condition
- Proprietary current sense scheme
- AC line monitoring circuit & AC phase detection
- The near-unity power factor in all operating modes
- PFC OK indicator

Key Applications
- Power factor correction
- Offline power supply
- Industrial power supplies
- Telecom 5G power
- Networking power
- Gaming console power supplies
- UHD TV power supplies
- Computing power supplies

Eliminating rectifier bridge diodes with switches in a 'totem pole' configuration and pulling in the boost PFC function reduces losses and improves overall efficiency. NCP1680 can accommodate any switch type, including super junction silicon MOSFETs or Wide Bandgap switches. Design and control with the NCP1680 PFC are simplified. Customers do not need to write their own firmware in MCU/ DSP.

A proprietary current control scheme allows a cycle-by-cycle current limit without a Hall effect sensor.

Product order code

- LNK3302D-TL
- LNK3304D-TL
- LNK3306D-TL
- LNK3307D-TL
- LNK3316D-TL
- LNK3317D-TL

LinkSwitch™-TNZ

LinkSwitch-TNZ Saves 60 % of Standby Power in Smart Home and Building Products

LinkSwitch-TNZ

The LinkSwitch-TNZ offline switching power supply IC family reduces standby consumption by up to 60 % in smart home and building applications and white goods. It combines offline power conversion, lossless zero-cross detection and optional X-capacitor discharge functions in a compact SO-8C package. The highly efficient switcher can be used for non-isolated buck and buck-boost power supplies up to 575 mA output current. It can provide up to 12 W output for universal input isolated flyback designs.

LinkSwitch-TNZ ICs enable ±3 % regulation across line and load, no-load consumption of less than 30 mW, and an IC standby current of less than 100 µA.

- **Lossless zero-cross detection and signal generation**
- **Supports buck, buck-boost and flyback topologies**
- **Optional X-capacitor discharge function**
- **Easily meets all global energy efficiency regulations**

Features

- Selectable device current limit
- Reduces size and cost of magnetics and output capacitor
- Allows the use of low-cost off-the-shelf inductors
- Frequency jittering reduces EMI
- 725 V MOSFET rating for excellent surge withstand
- Comprehensive safety and reliability features
- Less than 150 µA leakage in 2-wire no neutral designs
- No-load consumption less than 30 mW with external bias

Key Applications

- Home and building automation
- Dimmers, switches and sensors with and w/o neutral wire
- Appliances
- IoT and industrial controls

LinkSwitch-TNZ ICs consume <100 µA current in standby, resulting in power supply designs that can meet no-load and standby regulations worldwide. MOSFET current limit modes can be selected through the BYPASS pin capacitor value. The high current limit level provides maximum continuous output current, while the low level permits low-cost and small surface mount inductors. A full suite of protection features enables safe and reliable power supplies protecting the device and the system against input and output overvoltage faults, device over-temperature faults, lost regulation, and power supply output overload or short-circuit faults.

Product order code

- L6981CDR
- L6981NDR
- L6982CDR
- STEVAL-L6981CDR
- STEVAL-L6981NDR
- STEVAL-L6982CDR

L6981/2

38 V, 1.5 A and 2 A Synchronous Step-Down Converters with Low Quiescent Current

L6981

L6981 and L6982 are easy-to-use synchronous monolithic step-down regulators capable of delivering up to 2 A DC to the load (up to 1.5 A for the L6981). The wide input voltage range makes them suitable for a broad range of applications. The devices are based on a peak current mode architecture. L6981 and L6982 are packaged in SO8 package.
L6981 and L6982 are available in low consumption mode (LCM) and low noise mode (LNM) versions.
LCM maximizes the efficiency at light-load with controlled output voltage ripple.
LNM makes the switching frequency constant and minimizes the output voltage ripple.

- **1.5 A to 2 A DC output current**
- **LCM for high efficiency at light-loads and LNM for noise sensitive applications**
- **400 kHz fixed frequency**
- **Internal Compensation Network**

Features

- 3.5 V to 38 V operating input voltage
- Output voltage from 0.85 V to V_{IN}
- 1.5 A for L6981 and 2 A for L6982 DC output current
- Internal compensation network
- Two different versions: LCM for high efficiency at light-loads and LNM for noise sensitive applications
- 2 µA shutdown current
- Internal soft-start
- Enable pin
- Overvoltage protection
- Output voltage sequencing
- Thermal protection
- Synchronization to an external clock for LNM devices
- L6981 and L6982 are packaged in SO8 package

Key Applications

- Factory automation
- Home and professional appliances
- Home, building and city automation
- Industrial power and tools
- Metering
- Designed for 24 V buses industrial power systems
- 24 V battery powered equipment
- Decentralized intelligent nodes
- Sensors and always-on applications
- Low noise applications

L6981 and L6982 offer exceptionally high efficiency from light to full load operation. In addition, these synchronous step-down converters support minimizing the board size and number of external components through high integration.

The wide input and output voltage range make these devices a perfect fit for any industrial bus standard.

Product order code

- MASTERGAN3
- MASTERGAN3TR
- MASTERGAN4
- MASTERGAN4TR
- MASTERGAN5
- MASTERGAN5TR

MASTERGAN Family

High Power Density 600 V Half-Bridge Driver with Two Enhancement Mode GaN HEMTs

MasterGaN

MasterGaN1/2/3/4/5 are advanced power Systems-in-Package (SiP), integrating a gate driver and two enhancement-mode GaN power transistors in (asymmetrical for MasterGan2 and 3) half-bridge configuration.
The integrated power GaNs have 650 V drain-source blocking voltage and $R_{DS(ON)}$ from 150 mΩ to 450 mΩ (depending on MasterGaN version), while the integrated bootstrap diode can easily supply the high side of the embedded gate driver.
The MasterGaN family features UVLO protection on both the lower and upper driving sections, preventing the power switches from operating in low efficiency or dangerous conditions and the interlocking function.

- **QFN 9 × 9 × 1 mm package**
- **$R_{DS(ON)}$ from 150 mΩ to 450 mΩ**
- **$I_{DS(MAX)}$ from 4 A to 10 A**
- **UVLO protection on low-side and high-side**

Features

- 600 V SiP integrating half-bridge gate driver and high-voltage power GaNs (in an asymmetrical configuration for MasterGan2 and 3):
  - QFN 9 x 9 x 1 mm package
  - $R_{DS(ON)}$:
    - MASTERGAN1: 150 mΩ
    - MASTERGAN2: 150 mΩ (LS) + 225 mΩ (HS)
    - MASTERGAN3: 225 mΩ (LS) + 450 mΩ (HS)
    - MASTERGAN4: 225 mΩ
    - MASTERGAN5: 450 mΩ
  - $I_{DS(MAX)}$:
    - MASTERGAN1: 10 A
    - MASTERGAN2: 10 A (LS) + 6.5 A (HS)
    - MASTERGAN3: 6.5 A (LS) + 4 A (HS)
    - MASTERGAN4: 6.5 A
    - MASTERGAN5: 4 A
- Reverse current capability
- Zero reverse recovery loss
- UVLO protection on low-side and high-side
- Internal bootstrap diode
- Interlocking function
- Dedicated pin for shutdown functionality
- Accurate internal timing match
- 3.3 V to 15 V compatible inputs with hysteresis and pull-down
- Overtemperature protection
- Reduced Bill of Materials (BoM)
- Very compact and simplified layout
- Flexible, easy, and fast design

Key Applications

- Telecom/server power
- Power supply for 5G communication infrastructure
- EV/HEV charging stations
- Energy storage systems (UPS)
- Solar DC-AC converters
- PC power, OLED TV
- High-density AC-DC adapters, fast charging, USB-PD

Reference Boards

- EVALMASTERGAN1
- EVLMG1-250WLLC
- EVALMASTERGAN2
- EVALMASTERGAN3
- EVALMASTERGAN4
- EVALMASTERGAN5

ST's MasterGaN exploits GaN potential thanks to its high level of integration. That enables a quantum leap towards ultra-high-speed and efficiency. At the same time, BOM and weight are reduced, which results in flexible, easy, fast design and reduced time to market.

BittWare
a molex company

Product order code

- RFX-8440-43DR-2P-01
- RFX-8440-43DR-2P-Q1
- RFX-8441-43DR-2P-01

RFX-8440/RFX-8441

Xilinx RFSoC-Based PCIe Cards with 4-channel Analogue In/Out

RFX-8440/RFX-8441

BittWare's RFX-8440 and RFX-8441 data capture cards are designed around the Xilinx Zynq UltraScale+ RFSoC, combining multi-gigasample RF data converters, an Arm® Cortex®-A53 processing subsystem and UltraScale+ programmable logic onto a single SoC sitting on a convenient PCIe card.

Building upon the RFSoC's flexible four-channel analogue inputs/outputs with features like variable gain down to -40 dBm, the RFX-8440/8441 implement critical analogue circuitry to match the performance needs for a clean signal to/from the RFSoC's 14-bit interfaces.

- **Latest generation single-chip RFSoC Gen 3 from Xilinx: Zynq ZU43**
- **4 channels analog in/out on a PCIe card**
- **Digital data path options with up to 200 Gb/s Bandwidth: OCuLink 8 × 25 Gb/s interface or 2 × 100 GbE (RFX-8440) or PCIe Gen4 x 8 (RFX-8441)**

Features

Xilinx Zynq UltraScale+ RFSoC Gen 3

- XCZU43 in an E1156 package
- Core speed grade -2
- 16GB DDR4 processing system (ARM) memory with ECC
- 8 GB DDR4 programmable logic memory with ECC

High performance RF:

- Four ADC channels, 14-bit, 5 GSPS
- Four DAC channels, 14-bit, 10 GSPS
- Variable gain input: -40 to 0 dBm (L-band only)
- Variable gain output: -40 to 0 dBm (default)
- Analogue front end options:
  - L-Band 1 GHz – 2 GHz – Includes several signal conditioning components including variable gain
  - Direct 3 GHz Balun - Eliminates amplifier distortion and the L-band signal conditioning
  - Direct 4 GHz Balun – Similar to 3 GHz option, but with extended input range to 4 GHz
- External reference and triggers
- Programmable clocks

Form factor

- 3/4-length, standard-height PCIe dual-slot card (× 16 mechanical)
- Supports standalone operation

Key Applications

- 5 G and LTE wireless infrastructure
- Test & measurement
- Radar (Phased Array Radar/Digital Array RADAR – Radar On A Chip)
- Satellite communication

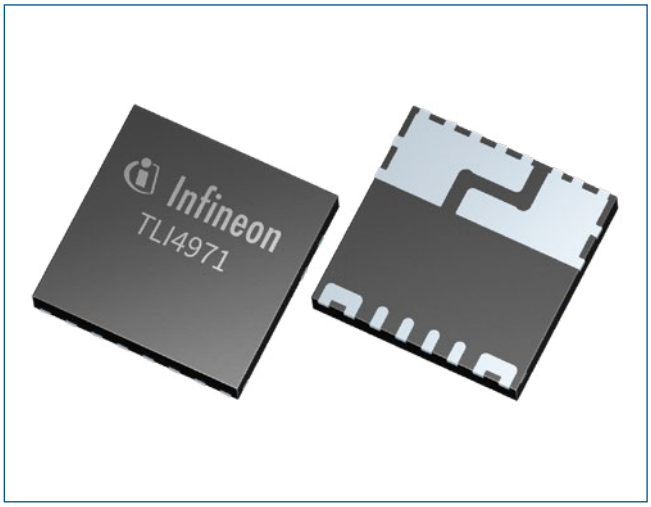
The RFX-8440 and RFX-8441 RFSoCbased cards are intended for high-end data acquisition and data processing systems, leveraging Xilinx RFSoC's single-chip analogue multi-channel ADC and DAC, powerful data processing subsystem and programmable logic.

Product order code

- SP005446644
- SP005446646
- SP005446648
- SP005446651
- SP005446653
- SP005446655

TLI4971 Current Sensor

XENSIV™ – TLI4971 High-Precision Coreless Current Sensors



TLI4971

Infineon expanded their highly precise current sensor family by six more pre-programmed derivatives for even more applications such as industrial drives-electric drives up to 30 kW, PV inverters, and charging. The highest flexibility is offered by individually programmable parameters such as current range, overcurrent threshold, or output mode. The new sensors offer an accurate and stable current measurement, provided as an analogue output voltage. Based on market-proven temperature and stress compensation technology, the sensitivity error is as low as 2 % at room temperature. It can be reduced even below with a single point in-system calibration.

- **Three additional measurement ranges (120 A already available) up to 25 A peak, 50 A peak, 75 A peak at 690 VRMS**
- **Typical error at 25 °C: less than 2 %**
- **Two separate programmable overcurrent thresholds with fast response time**
- **UL certification available for each measurement range**

Features

- Resistance of integrated current-rail 225 µΩ (typ.)
- Ultra-low-power loss due to the low resistance of current rail reduces cooling efforts
- Analogue output signal with typical 240 kHz bandwidth
- OCD
  - Programmable overcurrent detection threshold up to 2 times of measurement range
  - Fast response time for overcurrent detection (< 1µs typ.)
  - Two separate independent output pins for overcurrent detection (OCD) feature
  - OCD thresholds to define pre-warning and shut-off current
  - Integrated OCD safes external circuitry
- Small TISON-8 package: 8 × 8 × 1 mm
- Version with UL certification available
- Reliable current measurement over temperature and lifetime (no re-calibration)
- Very low sensitivity error over temperature (max. 2.5 %)
- Galvanic functional isolation up to 1150 V peak for high voltage applications
- Differential sensor principle ensures superior magnetic stray field suppression
- Programmable sensor to cover multiple frame sizes for drives

Key Applications

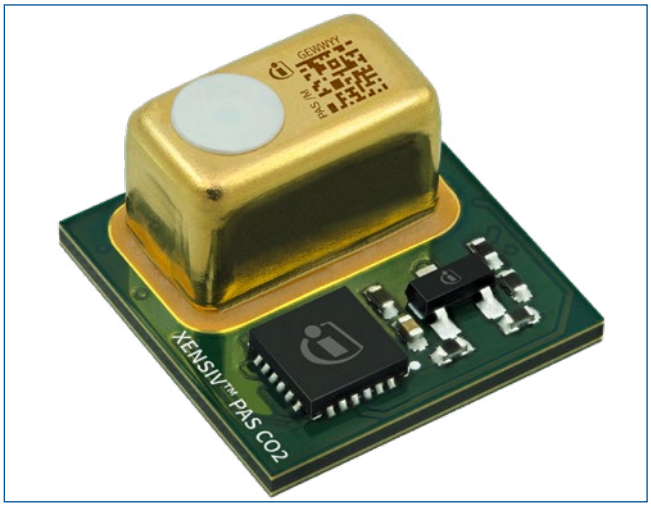
- Electrical drives
- General-purpose inverters
- Chargers
- Current monitoring
- Overload and over-current detection
- Power supplies
- Photovoltaic inverters

TLI4971 is a high precision miniature coreless magnetic current sensor for AC and DC measurements with analogue interface and two fast over-current detection outputs.

Two separate interface pins (OCD) provide a fast output signal if a current exceeds a pre-set threshold. The sensor is shipped as a fully calibrated product without requiring any customer end-of-line calibration. All user-programmable parameters such as OCD thresholds, blanking times and output configuration modes are stored in an embedded EEPROM memory.

XENSIV™ PAS CO_2 sensor

High Performance in a Small Size – Disruptive CO_2 PAS Sensor



XENSIV™ PAS CO2

Increasingly efficient building insulation can help to mitigate the effects of climate change, but heavily insulated buildings are not always good for human health. Poor ventilation can result in lower oxygen levels and a build-up of carbon dioxide (CO_2). Even moderate levels of CO_2 can have a negative impact on health and productivity. Already at 1000 ppm, people begin to experience drowsiness and have difficulty concentrating. Consequently, there is a growing demand for smart indoor air quality sensors that can "smell" rising levels of CO_2 and either alert the user or trigger a system response.

- **Real CO_2 sensor ensuring high data quality**
- **High accuracy (±30 ppm ±3% of reading) and robust performance**
- **Small form factor in SMD package for easier assembly**
- **Plug & Play for fast customer design-to-market**

Features

- Exceptionally small form factor (14 x 13.8 x 7.5 mm)
- Operating range: 0 ppm to 10000 ppm
- Accurate and robust performance at ppm level (±30 ppm ±3 % of reading)
- SMD package delivered in tape and reel
- Advanced compensation and self-calibration algorithms
- Various configuration options (e.g. sampling rate, baseline calibration)
- and interfaces (UART, I²C, PWM)
- Operating temperature: 0-50 °C
- Operating relative humidity: 0 % to 85 % (Non-condensing)
- Supply voltage: 12.0 V for the emitter and 3.3 V for other components
- Average power consumption: Typically, 30 mW at 1 measurement/minute
- Plug & Play for fast customer design-to-market

Key Applications

- HVAC (heating, ventilation and air conditioning) systems
- Smart home & building appliances like air purifiers and IoT devices
- Air quality monitors

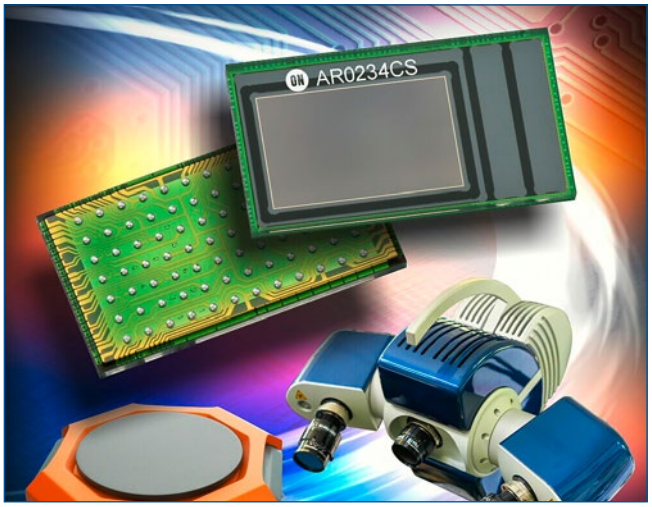
By leveraging photoacoustic spectroscopy (PAS), XENSIV™ PAS CO_2 overcomes the size, performance and assembly challenges of existing CO_2 sensor solutions. The sensor comes in an exceptionally miniaturized module (14 x 13.8 x 7.5 mm) that is four times smaller and three times lighter than its NDIR counterparts. That enables more than 75 per cent space-saving in customer systems.

Product order code

- AR0234CSSC00SUKA0-CP
- AR0234CSSC00SUKA0-CR
- AR0234CSSC28SUKA0-CP
- AR0234CSSC28SUKA0-CP1
- AR0234CSSC28SUKA0-CR
- AR0234CSSC28SUKA0-CR1

AR0234CS

CMOS Digital Image Sensor with Global Shutter, 1/2.6-inch, 2.3 Mp



AR0234CS

The AR0234CS is a 2.3 MPix image sensor. Its industry leading global shutter efficiency minimizes frame-to-frame motion and ghosting artefacts under any light conditions.

The sensor's pixel architecture delivers excellent Image Quality under any lighting conditions from low light to bright sunlight. The AR0234CS produces extraordinarily clear, sharp digital pictures and its ability to capture both continuous video and single frames makes it the perfect choice for a wide range of applications, including scanning, industrial inspection and outdoor video capture.

- **Excellent shutter efficiency**
- **2.3 MP resolution, active-pixel array of 1920 (H) × 1200 (V)**
- **Low noise images in both low-light and bright scenes**
- **Includes sophisticated camera functions such as row & col skip modes, pixel binning**

Features

- Excellent shutter efficiency
- 1/2.6" optical format
- 2.3 MP resolution
- An active-pixel array of 1920 (H) × 1200 (V)
- Low dark current/hot pixels
- High linear full well
- Built-in statistics engine
- Multiple functional modes - row & col skip modes, pixel binning
- AP1302 ISP support
- Low operational power
- Small form factor

Key Applications

- Gesture recognition
- 3D scanning
- Position tracking
- Machine vision
- AR/VR/MR/XR
- Home/ building access control
- Barcode scanning
- Autonomous mobility
- Biometrics
- Commercial surveillance

The AR0234CS features a global shutter sensor, reducing motion artefacts significantly. With the same outstanding pixel performance as AR0144, but higher resolution, speed of up to 120 fps, active–pixel array of 1920 (H) × 1200 (V), 1080 p video, and low power modes, this device is perfect for IoT & AMRs (Autonomous Mobile Robots) applications.

In addition, this image sensor offers AP1302 support.

RAA239101

Photoelectric Smoke Detector AFE IC

RAA239101

The highly integrated RAA239101 low-power Analog Frontend (AFE) IC includes peripherals & features required for a photoelectric smoke detector system, mainly focused on residential smoke detector designs. Therefore, it is very simple and straightforward to realize a complete photoelectric smoke detector electronics circuitry with only two key components: MCU + AFE. The RAA239101 provides a driver to switch between two LEDs to pulse the smoke detection LED emitters with a DAC adjustable current. Two photodiode receiver channels with programmable gain amplification using an ADC allow the detection of smoke by sensing the LED light scattered off of smoke in a detection chamber.

- **Extended battery life due to ultra-low-power consumption in sleep mode**
- **Reduced overall BOM cost through integrating multiple functions that are usually done by discrete devices**
- **Dual-Channel allows two different IR wavelength LEDs/photodetectors to increase accuracy**
- **10-bit ADC for measuring the voltage on 7 analogue pins**

Features

- Ultra-low power consumption
- 9 V or 3.3 V battery operation
- LDO for microcontroller supply
- 10-bit ADC for measuring voltage on 7 analogue pins
- Drives two LED emitters with 8-bit current DAC control from 45 mA to 600 mA
- Two photodiode receivers with programmable gain amplifiers
- General-purpose I/O (GPIO)
- Horn driver with clamp diodes
- SPI interface

Key Applications

- Photoelectric smoke detectors

The RAA239101 is a low-power Analog Front-End (AFE) IC; combined with a microcontroller, photoelectric emitter/detector(s), horn, and minimal external components, it forms a complete smoke detector.

The Renesas Winning Combination "EU070 - Household Smoke Detector" demonstrates the simplicity & functionality of such a compact smoke detector design:

www.renesas.com/us/en/application/home-building/household-smoke-detector

Users can instantly test and evaluate this Board via Lab on the Cloud: www.renesas.com/labonthecloud

EBV European Headquarters

EBV Elektronik GmbH & Co. KG I DE-85586 Poing | Im Technologiepark 2-8 | Phone: +49 8121 774 0

EBV Regional Offices | Status November 2021

AUSTRIA
1120 Wien
Grünbergstraße 15/1, 4. Stock
Phone: +43 1 89152 0
Fax: +43 1 89152 30

BELGIUM
1831 Diegem
De Kleetlaan 3
Phone: +32 2 716001 0
Fax: +32 2 72081 52

BULGARIA
1505 Sofia
48 Sitnyakovo Blvd., Serdika
offices,10th floor, Unit 1006
Phone: +359 2 9264 337
Fax: +359 2 9264 133

CZECH REPUBLIC
18600 Prague
Amazon Court, Karolinska 661/4
Phone: +420 2 34091 011
Fax: +420 2 34091 010

DENMARK
8230 Åbyhøj
Ved Lunden 10-12, 1. sal
Phone: +45 8 6250 466
Fax: +45 8 6250 660

ESTONIA
80042 Pärnu
Suur-Jõe 63
Phone: +372 5 8864 446

FINLAND
02180 Espoo
Klovinpellontie 1-3, 6th floor
Phone: +358 9 2705279 0
Fax: +358 9 27095498

FRANCE
91300 Massy Cedex (Paris)
Le Copernic bât B
12 rue Jean Bart
Phone: +33 1 644729 29

35700 Rennes
16, Rue de Jouanet
Phone: +33 2 998300 51
Fax: +33 2 998300 60

67400 Illkirch Graffenstaden
35 Rue Gruninger
Phone: +33 3 904005 92
Fax: +33 3 886511 25

31500 Toulouse
8 chemin de la terrasse
Parc de la plaine
Phone: +33 5 610084 61
Fax: +33 5 610084 74

69693 Venissieux (Lyon)
Parc Club du Moulin à Vent
33, Av. du Dr. Georges Lévy
Phone: +33 4 727802 78
Fax: +33 4 780080 81

GERMANY
85609 Aschheim-Dornach
Einsteinring 1
Phone: +49 89 388 882 0
Fax: +49 89 388 882 020

10553 Berlin
Kaiserin-Augusta-Allee 14
Phone: +49 30 747005 0
Fax: +49 30 747005 55

31275 Lehrte
Gaußstr. 10
Phone: +49 5139 8087 0
Fax: +49 5139 8087 70

59439 Holzwickede
Wilhelmstraße 1
Phone: +49 2301 94390 0
Fax: +49 2301 94390 30

41564 Kaarst
An der Gümpgesbrücke 7
Phone: +49 2131 9677 0
Fax: +49 2131 9677 30

71229 Leonberg
Neue Ramtelstraße 4
Phone: +49 7152 3009 0
Fax: +49 7152 759 58

90471 Nürnberg
Lina-Ammon-Straße 19B
Phone: +49 911 817669 0
Fax: +49 911 817669 20

04435 Schkeuditz
Frankfurter Straße 2
Phone: +49 34204 4511 0
Fax: +49 34204 4511 99

78048 VS-Villingen
Marie-Curie-Straße 14
Phone: +49 7721 99857 0
Fax: +49 7721 99857 70

65205 Wiesbaden
Borsigstraße 36
Phone: +49 6122 8088 0
Fax: +49 6122 8088 99

HUNGARY
1117 Budapest
Budafoki út 91-93, West Irodahaz
Phone: +36 1 43672 29
Fax: +36 1 43672 20

ISRAEL
4581500 Bnei Dror
Tirosh 1
Phone: +972 9 77802 60
Fax: +972 3 76011 15

ITALY
20095 Cusano Milanino (MI)
Via Alessandro Manzoni, 44
Phone: +39 02 660962 90
Fax: +39 02 660170 20

50019 Sesto Fiorentino (FI)
Via Lucchese, 84/B
Phone: +39 05 543693 07
Fax: +39 05 542652 40

41126 Modena (MO)
Via Scaglia Est, 31
Phone: +39 059 292 4211
Fax: +39 059 292 9486

00139 Roma (RM)
Via de Settebagni, 390
Phone: +39 06 4063 665/789
Fax: +39 06 4063 777

35030 Sarmeola di Rubano (PD)
Piazza Adelaide Lonigo, 8/11
Phone: +39 049 89747 01
Fax: +39 049 89747 26

10144 Torino (TO)
Via Treviso, 16
Phone: +39 011 26256 90
Fax: +39 011 26256 91

IRELAND
Fitzwilliam Hall
Fitzwilliam Place
Dublin 2
D02 T292
Phone: +353 1 4097 802
Fax: +353 1 4568 544

NETHERLANDS
Zonnebaan 9
3542 EA Utrecht
Phone: +31 346 5830 10
Fax: +31 346 5830 25

NORWAY
1181 Oslo
Brannfjellveien 11
Phone: +47 22 67 17 80
Fax: +47 22 67 17 89

POLAND
80-838 Gdansk
Targ Rybny 11/12
Phone: +48 58 30781 00

P02-676 Warszawa
Postepu 14
Phone: + 48 22 209 88 05

50-062 Wroclaw
Pl. Solny 16
Phone: +48 71 34229 44
Fax: +48 71 34229 10

PORTUGAL
4400-676 Vila Nova de Gaia Unipessoal
LDA / Edifício Tower Plaza
Rotunda Eng. Edgar Cardoso, 23 - 14ºG
Phone: +351 22 092026 0
Fax: +351 22 092026 1

ROMANIA
020334 Bucharest
4C Gara Herastrau Street
Building B, 2nd Floor - 2nd District
Phone: +40 21 52816 12
Fax: +40 21 52816 01

RUSSIA
620028 Ekaterinburg
Tatischeva Street 49A
Phone: +7 343 31140 4
Fax: +7 343 31140 46

127486 Moscow
Korovinskoye Shosse 10,
Build 2, Off. 28
Phone: +7 495 730317 0
Fax: +7 495 730317 1

197374 St. Petersburg
Atlantic City, Savushkina str 126,
lit B, premises59-H, office 17-2
Phone: +7 812 635706 3
Fax: +7 812 635706 4

SERBIA
11070 Novi Beograd
Milentija Popovica 5B
Phone: +381 11 40499 01
Fax: +381 11 40499 00

SLOVAKIA
82109 Bratislava
Turcianska 2 Green Point Offices
Phone: +421 2 3211114 1
Fax: +421 2 3211114 0

SLOVENIA
1000 Ljubljana
Dunajska cesta 167
Phone: +386 1 5609 778
Fax: +386 1 5609 877

SOUTH AFRICA
7700 Rondebosch, Cape Town
Belmont Office Park, Belmont Road
1st Floor, Unit 0030
Phone: +27 21 402194 0
Fax: +27 21 4196256

3629 Westville
Forest Square,11 Derby Place
Suite 4, Bauhinia Building
Phone: +27 31 27926 00
Fax: +27 31 27926 24

2128 Rivonia, Sandton
Johannesburg
33 Riley Road
Pinewood Office Park
Building 13, Ground Floor
Phone: +27 11 23619 00
Fax: +27 11 23619 13

SPAIN
08014 Barcelona
c/Tarragona 149 - 157 Planta 19 1º
Phone: +34 93 47332 00
Fax: +34 93 47363 89

39005 Santander (Cantabria)
Racing nº 5 bajo
Phone: +34 94 22367 55
Phone: +34 94 23745 81

28760 Tres Cantos (Madrid)
c/Ronda de Poniente 14 - 2ª planta
Phone: +34 91 80432 56
Fax: +34 91 80441 03

SWEDEN
16440 Kista
Isafjordsgatan 32B, Floor 6
Phone: +46 859 47023 0
Fax: +46 859 47023 1

SWITZERLAND
8953 Dietikon
Bernstrasse 394
Phone: +41 44 74561 61
Fax: +41 44 74561 00

TURKEY
06520 Ankara
Armada Is Merkezi
Eskisehir Yolu No: 6, Kat: 14
Ofis No: 1406, Sogutozu
Phone: +90 312 2956 361
Fax: +90 216 528831 1

34774 Ümraniye / Istanbul
Tatlısu Mahallesi Pakdil Sokak 7
Phone: +90 216 528831 0
Fax: +90 216 528831 1

35580 Izmir
Folkart Towers
Manas Blv. No 39 B Blok
Kat: 31 Ofis: 3121
Phone: +90 232 390 9196
Fax: +90 216 528831 1

UKRAINE
03040 Kiev
Vasilovskaya str. 14
off. 422-423
Phone: +380 44 496222 6
Fax: +380 44 496222 7

UNITED KINGDOM
Maidenhead (South)
Berkshire, SL6 7RJ
2, The Switchback
Gardner Road
Phone: +44 16 28778556
Fax: +44 16 28783811

Manchester (North)
M22 5WB
Manchester International Office Centre
Suite 3E (MIOC) Styal Road
Phone: +44 16 149934 34
Fax: +44 16 149934 74