M I P

MARKETING INNOVATIVE PRODUCTS

2021

02

GREEN ENERGY

EBV Elektronik
I An Avnet Company I

GREEN ENERGY

Green Energy is a term used to describe any form of energy produced without pollution. Lately, we can hear this term more often, as atmospheric CO2 concentrations have reached record levels in the last 800,000 years, with almost twice the highest ppm value recorded in history. The sharp rise in CO2 concentrations dates back to around 1800 and coincides with the first industrial revolution, as confirmed by ice samples from Antarctica (Source: Wikipedia, Carbon dioxide in Earth's atmosphere). Now that we have become aware of this fact, it is time to rethink how we produce and use energy. New regulations have already been put in place worldwide, forcing the largest energy consumers in the industrial, automotive, and city infrastructure segments to embrace new technologies and turn towards using green energy.

However, green energy production plants cannot yet provide sufficient capacity to meet the needs of those large energy consumers. Therefore, it is imperative to develop new technologies and solutions that will increase the yield of green power plants and improve their efficiency. Without technological advancements, particularly in the semiconductor industry, green energy cannot be fully commercialized. Only by combining clean energy production and high-efficiency components can we reach the "Green Energy" paradigm.

As discussed in the previous MIP, the automotive industry turns towards electric power as the ultimate solution for CO2 emissions reduction. In this regard, the following example can provide an intuitive illustration: the low efficiency of the battery charging station can be directly compared to a fuel leak in a gas station. Similarly, the low efficiency of a voltage converter and battery management system (BMS) in an electric vehicle (EV) can be compared to a leaky fuel tank in a conventional ICE-driven vehicle. In conclusion, using new technologies that reduce power losses to a minimum is not only environmentally but also economically beneficial since energy losses can be directly translated to increased long-term Total Costs of Ownership (TCO).

Size does matter when trying to reduce the impact on the environment. Using smaller but highly efficient components can significantly reduce CO2 emissions in the manufacturing industry. High-efficiency servo drives dissipate less energy as heat, effectively eliminating the need for an extensive cooling design, thus reducing energy consumption and operating costs. Consequently, they can be mounted directly on the motor itself, reducing the total size of the actuator, which is especially beneficial for applications in robotics. Compact, lightweight actuators can benefit from a reduced moment of inertia, decreasing the peak energy drawn during rapid movements while enabling faster response and less wear. In summary, the use of highly efficient components in the manufacturing industry allows for compact and lightweight machines that last longer, run cooler and faster, require less energy to be driven, and provide significant TCO savings in the long run.

In this MIP edition, experts from EBV Elektronik and its partners bring you a selection of hand-picked components and solutions that deliver disruptive performances with near-perfect energy efficiency in the areas of computing, lighting, sensing, communication, and power management. If you need help with your design, don't hesitate to reach our experts; they can help you create lighter, cooler, and more efficient designs with a reduced CO2 footprint.

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POWER MANAGEMENT

COMMUNICATIONS

DATA CONVERSION

LIGHTING

MEMORY & STORAGE

MICROCONTROLLERS

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NEW TECHNOLOGIES FOR HIGHER EFFICIENCY

It is estimated that more than three terawatt-hours of electricity are lost annually due to conversion in Europe alone. Power electronics are a crucial linchpin for reducing these losses. New semiconductor technologies such as Wide Bandgap (WBG) semiconductors can significantly boost efficiency and power density in a broad range of applications, contributing to the mass adoption of green energy. Due to their near-ideal switching characteristics, silicon-carbide (SiC) and gallium nitride (GaN) have established themselves as breakthrough materials for such applications. Semiconductor technologies based on SiC and GaN materials offer very high breakdown voltage due to their relatively wide-bandgap. Although these two similar yet fundamentally different technologies overlap at certain points, each has its own distinctive features that positioned it as the optimal solution for specific applications.

SiC-based semiconductors have extremely high thermal conductivity, which in combination with their high breakdown voltage and the ability to operate at very high temperatures, makes them perfectly suited for harsh conditions in industrial and automotive applications. SiC MOSFETs target higher voltages than GaN HEMTs and tend to substitute IGBTs in the voltage range of 1200 V and up. In combination with the latest generation of IGBTs, SiC MOSFETs can form highly efficient Si-SiC hybrid Active Neutral Point Connect (ANPC) inverters, widely used in solar energy systems. Such topology provides operation over the entire cos φ range, which is also perfectly suited for energy storage applications.

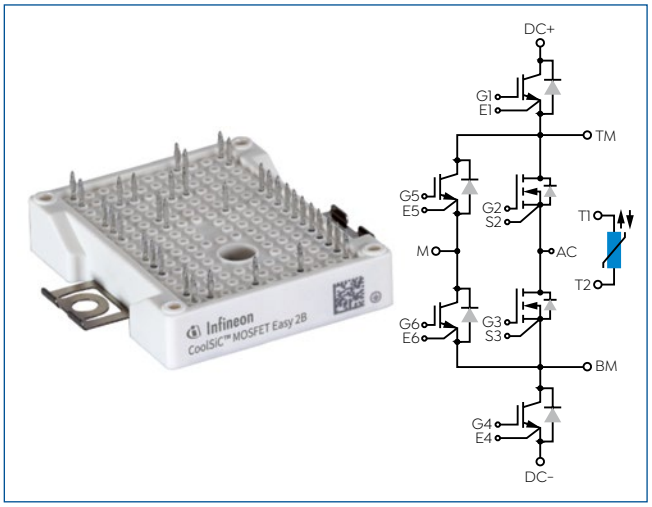
GaN-based semiconductors, such as GaN High Electron Mobility Transistors (GaN HEMTs), are mostly used for high-frequency switching applications due to their zero reverse recovery charge, which is crucial for hard switching applications in bridge topologies. GaN HEMTs can be used in a broad range of industrial, automotive, and consumer applications, such as DC-DC converters, power supplies, USB Power Delivery (USB-PD), energy storage systems, photovoltaic inverters, EV charging stations, and similar applications that can benefit from their incredibly high power density. Thanks to their low output capacitance (CO_{SS}), they are also perfectly suited for Class D audio amplifiers and RF applications.

WBG technologies may hold the key to the CO_2 emissions problem solution, enabling designs that can help us make the green energy transition. Harvesting energy from the sun, wind, water, and other non-polluting renewable energy sources more efficiently is essential to reducing total CO_2 emissions. The immediate advantages of these new technologies in such applications can be illustrated by the following example of a household solar string inverter: suppose we want to install a 75 kW string inverter with a total weight of 77 kg implemented with conventional Si IGBTs. This is equal to a power density of 0.974 kW/kg. By switching to SiC MOSFETs, we can increase the power density up to 1.765 kW/kg, meaning that for the same power of 75 kW, the weight of the equipment is reduced down to 42.5 kg. Conversely, for the same weight of 77 kg, we can increase the installed power rating up to 136 kW. This example clearly illustrates the advantages of higher power density provided by SiC MOSFETs that can operate at higher frequencies with reduced switching losses, thus enabling integration of smaller energy storage components (such as inductors and capacitors), and much simpler and more compact cooling solutions.

Product order code | • SP005408206

EasyPACK™ CoolSiC™ MOSFET

3-level ANPC Power Module 1200 V – F3L11MR12W2M1_B74



F3L11MR12W2M1_B74 – Product Image and Circuit Diagram

The new F3L11MR12W2M1_B74 in Active Neutral Point Clamp (ANPC) topology is developed to support customers in their fast-growing applications. Compared to the predecessor F3L11MR12W2M1_B65, the silicon diode has an increased current rating. This supports the entire cos φ range and makes this module the perfect fit for energy storage systems. Customers benefit from 150 kW power in solar systems when paralleling two modules or 75 kW per module in energy storage systems. In addition, this module is equipped with the best-in-class CoolSiC™ trench MOSFET technology for superior gate-oxide reliability.

- **3-Level module in Active NPC (ANPC) topology with CoolSiC™ MOSFET**
- **Full 1500 V_{DC} capability (with 1200 V switches)**
- **High current density**
- **Low inductive design**

Features

- PressFIT technology
- Broadest Easy portfolio
- Low thermal resistance (R_{THJH}): 0.58 K/W
- Absolute maximum junction temperature ($T_{VJ\ MAX}$): 175 °C
- Operational temperature range ($T_{VJ\ OP}$): -40 to 150 °C
- 3-level IGBT implemented collector current ($I_{D\ NOM}$): 100 A
- 3-level IGBT repetitive peak collector current (I_{CRM}): 200 A
- 3-level diode DC current (I_F): 100 A
- 3-level diode repetitive peak collector current (I_{FRM}): 200 A
- Key Benefits:
  - Superior gate-oxide reliability
  - Short and clean commutation loops
  - Supports the entire cos φ range: a perfect fit for energy storage systems
  - Easy design-in: a high degree of freedom for the inverter design
  - 150 kW power in solar applications when paralleling two modules
  - 75 kW power per module in energy storage systems

Key Applications

- Smart Grid:
  - Energy storage systems
  - Solar energy systems

The electrical properties of the gate oxide are critical to the formation of the conductive channel region below the gate. The F3L11MR12W2M1_B74 power module is developed using the best-in-class CoolSiC™ trench MOSFET technology for superior gate-oxide reliability, offering excellent performances and significantly longer operation time before failure.

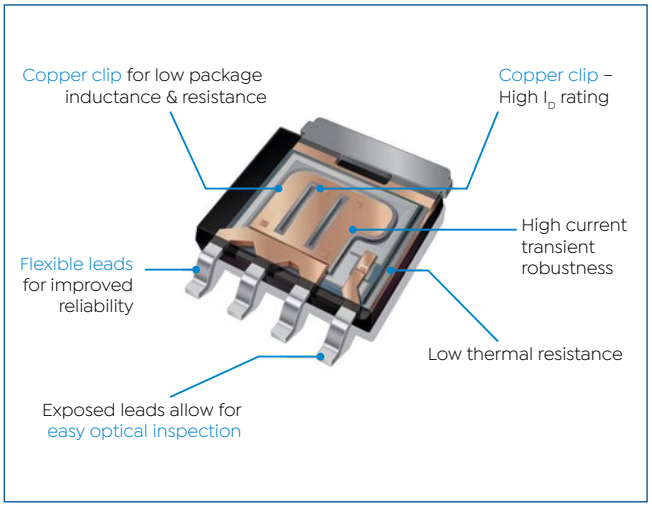
The ANPC module topology enables compact design with higher power density, reducing the components count, while the integrated thermistor provides accurate thermal readings for the end applications.

Product order code

- 934660621115
- 934071219115
- 934071221115
- 934660618115

NextPower 80/100 V MOSFETs

Smaller, Faster, Cooler



NextPower MOSFETs in LFPAK56 – Package Advantages

NextPower 100 V MOSFETs are Nexperia's latest generation devices recommended for high-efficiency switching and high-reliability applications. With 50 % lower $R_{DS(ON)}$ and a strong avalanche energy rating. Ideally suited for power supply, telecom, and industrial designs, especially suiting USB-PD Type-C chargers and adaptors and 48 V DC-DC adaptors. The devices feature low body diode losses with Q_{RR} down to 50 nano-coulombs (nC) - resulting in lower reverse recovery current (I_{RR}), lower voltage spikes (V_{PEAK}), and reduced ringing, which allows for further dead-time optimizations.

- **High efficiency and lowest spiking**
- **Market leading low $R_{DS(ON)}$ and low Q_{RR} performance**
- **SuperSOA types for hot-swapping and soft-start applications**
- **Strong avalanche energy rating (E_{AS}): avalanche rated and 100 % UIS tested**

Features

- Low Q_{RR} for higher efficiency and lower spiking
- Low Q_G X $R_{DS(ON)}$ FoM for high-efficiency switching applications
- SuperSOA types for hot-swapping & soft-start applications
- Strong avalanche energy rating (E_{AS})
- Avalanche rated and 100 % UIS tested
- Wave-solderable LFPAK56 package
- Halogen-free and RoHS compliant
- Devices qualified for up to 175 °C available

Key Applications

- Synchronous rectifiers in AC/DC and DC/DC applications
- Primary side switch - 48 V DC/DC
- BLDC motor control
- USB-PD adapters and chargers
- Full-bridge and half-bridge applications
- Flyback and resonant topologies

The reverse recovery charge of the body diode (Q_{RR}) can significantly impact the performance and the overall efficiency of the MOSFET. However, it is often overlooked in favor of the more widely accepted Figure of Merit (FoM) parameter.

Although FoM is important for calculating losses, Q_{RR} can also significantly impact the performance, causing additional switching losses and increased EMI, forcing designers to select a higher voltage rating device combined with the larger gate resistor in some cases. Nexperia offers very low Q_{RR} devices, which enable reduced BOM cost, better EMI footprint, and increased switching efficiency.

Product order code
- 934661752127
- 934660022127

GaN FETs

Efficient and Effective High-power FETs for Industrial Applications

GaN FETs - Product Image

Efficient power use is a key industrial challenge and a driver for innovation. Societal pressure and legislation are demanding increasing efficiencies in power conversion and control. For some applications power conversion efficiency and power density are critical for market adoption. Prime examples include high-voltage communications and industrial infrastructure sectors. GaN FETs enable smaller, faster, cooler, lighter systems, with lower overall system cost.

- **High efficiency (up to 99 % efficiency)**
- **High switching frequency (up to 1 MHz)**
- **Simple gate driving (0 to 12 V standard gate drive)**
- **Transient over-voltage capability**

Features

- High power conversion efficiency
  - Low and linear E_{OSS}
  - Very low source-drain voltage in reverse conduction mode
  - Low Q_{RR}
- Up to 1 MHz in soft-switching applications
  - High power density
- GaN technology enables smaller size of energy storage elements:
  - Lighter and smaller design footprint
  - Reduced system costs
- Robust gate oxide:
  - ±20 V capability
- Easy to design gate drive
  - 0 to 12 V standard gate drive voltage
- High gate threshold voltage: +4 V
  - Allows for very good gate bounce immunity
- Low body diode forward voltage (V_F)
  - Allows for reduced losses and simplified dead-time adjustments
- Transient over-voltage capability for increased robustness
- GAN063-650WSA: 650 V, 50 mΩ
  - Order code: 934661752127
- GAN041-650WSB, 650 V, 35 mΩ
  - Order code: 934660022127

Key Applications

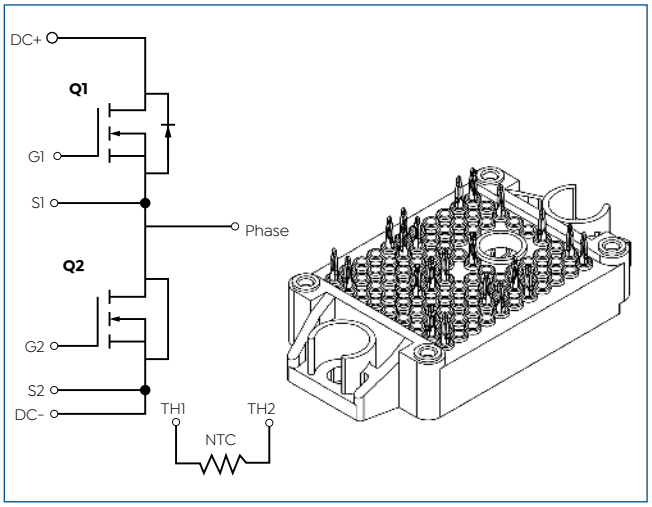
- Uninterruptible Power Supplies (UPS, single-phase, 2 to 10 kW)
- Servo drives (single-phase)
- Power supplies (single-phase, 2 to 10 kW)
- Solar inverters (single phase)

Nexperia's normally-off GaN FET devices combine Nexperia's state-of-the-art high-voltage GaN HEMT and low-voltage silicon MOSFET technologies, offering superior reliability and performance. Nexperia's GaN FET devices are currently offered in the popular TO-247 package. Fully automotive-qualified GaN FET devices in a copper-clip CCPAK1212 package will be released soon, alongside the existing TO-247 devices.

CCPAK is a truly innovative wire bonds-free package that delivers industry-leading thermal and electrical performances and a simplified design of cascode configuration to eliminate the need for complicated drivers and controls.

NXH010P120MNF1

SiC Power Module, 2-PACK Half Bridge Topology, 1200 V, 10 mΩ SiC MOSFET



NXH010P120MNF1.jpg

The NXH010P120MNF1 is a power module containing a 1200 V, 10 mΩ SiC MOSFET half-bridge and a thermistor in an F1 package. Recommended gate voltage for driving the MOSFETs is 18 V to 20 V. The package is equipped with Press-Fit Pins, offers low thermal resistance, and is available in options with Thermal Interface Material (TIM) pre-applied, and without TIM pre-applied.

- **SiC power module, 2-PACK half-bridge topology in F1 package**
- **1200 V, 10 mΩ SiC MOSFET**
- **Recommended gate voltage: 18 to 20 V**
- **Improved efficiency or higher power density**

Features

- Integrated 1200 V, 10 mΩ SiC MOSFET half-bridge solution
  - Integrated thermistor
- Recommended gate voltage: 18 V to 20 V
- Improved $R_{DS(ON)}$ at the higher voltages
- Low thermal resistance
- Improved efficiency or higher power density
- Press-Fit Pins
- Options available with and without pre-applied Thermal Interface Material (TIM)
- Flexible solution for high-reliability thermal interface
- Maximum current capability at T_J = 175 °C:
  - Continuous (I_D): 114 A
  - Pulsed (I_{Dpulse}): 342 A
- Module junction temperature range:
  - From -40 to 150 °C (recommended)
  - From -40 to 175 °C (max)

Key Applications

- Electric Vehicle (EV) charging
- Solar inverters
- Energy storage systems
- Uninterruptible Power Supply (UPS)

The NXH010P120MNF1 SiC Power Modules reduce cooling effort and extend the lifetime by optimized die size and pre-applied TIM. They feature enhanced robustness in harsh environments with the patented termination structure.

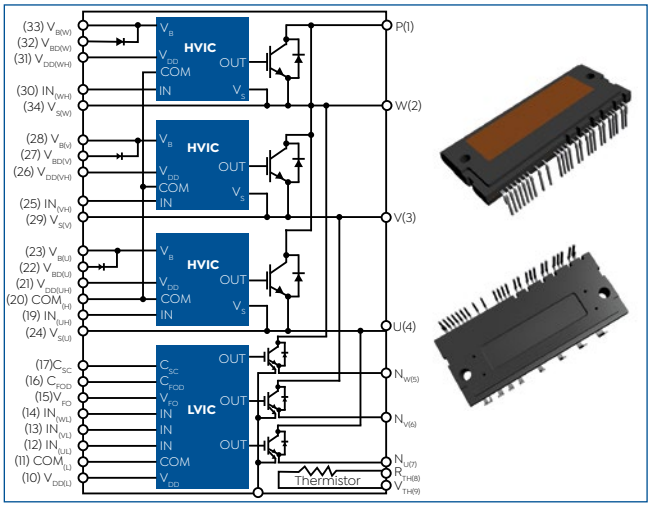
ON Semiconductors provides the full value chain integration, from the substrate to the end product, offering both off-the-shelf and custom-tailored solutions.

Product order code

- NFVA22512NP2T
- NFVA23512NP2T
- NFVA25012NP2T

NFVA2xx12NP2T

ASPM34 Series, Automotive Three-Phase 1200 V, IGBT Intelligent Power Module



ASPM34 Series IPM – Image and Block Diagram

The ASPM34 series advanced automotive Intelligent Power Modules (IPM) provide a fully-featured high-performance inverter output stage for hybrid and electric vehicle applications. These modules integrate optimized gate drives for the built-in 1200 V-rated IGBTs to minimize EMI and losses while also providing protection features enabling minimized EMI, compact system size, and increased reliability. The modules are qualified to AEC-Q100, Q101 & AQG324 and are available with a 25 A, 35 A, and 50 A current rating.

- **Automotive grade Intelligent Power Module (IPM) in 34-pin DIP package**
- **25, 35, or 50 A, 1200 V-rated 3-Phase Inverter with gate drivers and protection**
- **AEC-Q100, Q101 & AQG324-qualified and PPAP capable**
- **Low-loss, short-circuit rated IGBTs**

Features

- Automotive-grade Intelligent Power Module (IPM)
- 34-pin DIP package
- Very low thermal resistance using AlN DBC substrate
- Separate open-emitter pins from low-side IGBTs for three-phase current sensing
- Single-grounded power supply
- Low-loss, short-circuit rated IGBTs
- Built-in bootstrap diodes and dedicated Vs pins simplify PCB layout design
- Built-in NTC thermistor for temperature monitoring and management
- Adjustable Over-Current Protection (OCP) via integrated sense-IGBTs
- Isolation rating: 2500 V_{RMS}/1 min
- AEC-Q100, Q101 & AQG324 Automotive-grade qualified, PPAP capable
- Pb-Free

Key Applications

- Automotive:
  - Automotive HV auxiliary motors
  - Climate E-Compressors
  - Oil and water pumps
  - Super and turbochargers
  - Variety fans
  - Industrial motors
  - Motion control

Automotive qualified (AEC–Q100, 101 & AQG324) Intelligent Power Modules (IPM) utilizing 1200V IGBTs are high-performance integrated solutions with built-in features for optimized EMI, system size, and reliability.

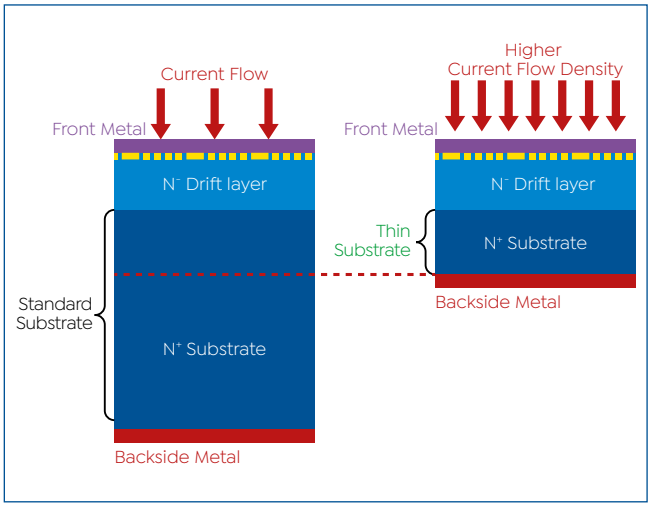
Product order code

- WNSC2D04650TJ
- WNSC2D06650DJ
- WNSC2D08650DJ
- WNSC2D10650XQ
- WNSC2D16650CWQ

More packages available

SiC Diodes

New Gen2 650 V Silicon Carbide (SiC) Diodes



Comparison Between the Traditional and WeEn Thin SiC Manufacturing Process

Silicon carbide is a widely used semiconductor material for medium to high voltage power components. This is due to its inherent properties of wide bandgap and high thermal conductivity. WeEn SiC power diodes have a current range from 2 to 40 A, voltages of 650 and 1200 V, and are available in a variety of industry-standard, SMD, and through-hole power packages. Both single and double SiC diodes are available. SiC diodes feature extremely fast and temperature-independent switching, enabling a higher power density and excellent efficiency in fast switching applications such as Vienna rectifiers, PFC boost converters, or full-bridge inverters.

- **Highly stable switching performance**
- **Extremely fast reverse recovery time**
- **Reduced EMI**
- **Superior in efficiency to Silicon Diode alternatives**

Features

- Highly stable switching performance
- Extremely fast reverse recovery time
- Superior in efficiency to silicon diode alternatives
- Reduced losses in associated MOSFETs
- Reduced EMI
- Reduced cooling requirements
- RoHS compliant

Key Applications

- Power factor correction (PFC)
- Telecom/server SMPS
- Uninterruptible Power Supply (UPS)
- PV inverter
- PC Silverbox
- LED/OLED TV
- Motor drives
- HV DC/DC
- On board chargers
- EV charging pile

Due to the leading manufacturing process and excellent quality control, WeEn SiC products feature a thin wafer design, with only a third of the substrate thickness of the standard products in the market. With the benefit of thin wafer design, WeEn SiC diodes have much better forward current conduction capability and lower thermal resistance.

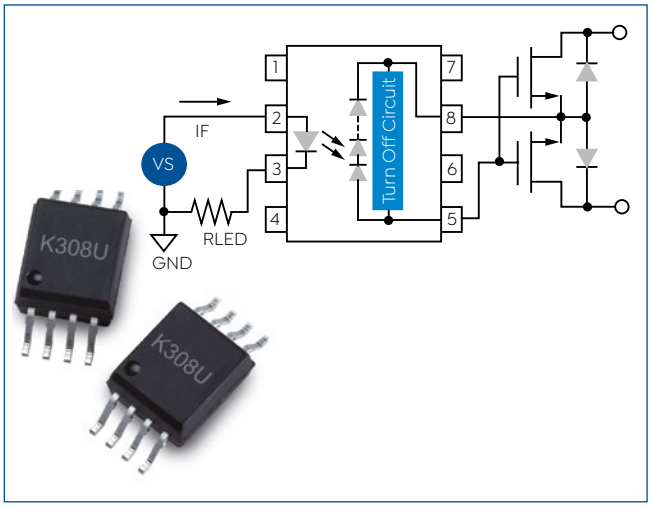
Also, due to the optimal active area design and leading manufacturing process, WeEn SiC Schottky diodes feature leading industry reverse recovery performance in the field, exhibit excellent high operation frequency performance.

Product order code

- ACPL-K308U-500E
- ACPL-K308U-000E

ACPL-K308U

Industrial Photovoltaic MOSFET Driver



ACPL-K308U – Product Image and Typical Application Circuit

The industrial ACPL-K308U photovoltaic driver is a high reliability optical switch designed to drive high voltage MOSFETs. It consists of an AlGaAs infrared light-emitting diode (LED) input stage, optically coupled to an output detector circuit. The detector consists of a high-speed photovoltaic diode array and a turn-off circuit. This photovoltaic driver turns on (contact closes) with a minimum input current of 5 mA through the input LED. It turns off (contact opens) with an input voltage of 0.8 V or less. The ACPL-K308U is ideal for the fast turn ON/OFF in insulation resistance measurement, inrush current prevention, and load switching applications.

- **8 mm creepage and clearance in a compact SSO8 package**
- **Operating temperature range: -40 °C to +125 °C**
- **Photovoltaic driver for high voltage MOSFETs in Solid State Relay (SSR) applications**
- **Typical switching speed: 50 µs (t_{ON}), 23 µs (t_{OFF}) at I_F = 10 mA, CL = 1 nF**

Features

- Open circuit voltage:
  - 8.2 V (typ.) at I_F = 10 mA
- Short circuit current:
  - 70 µA (typ.) at I_F = 10mA
- Logic circuit compatibility
- Configurable to a wide portfolio of high voltage MOSFETs
- Galvanic isolation
- High input-to-output insulation voltage
- Safety and regulatory approvals:
  - IEC/EN/DIN EN 60747-5-5
  - Maximum working insulation voltage V_{IORM} = 1140 V_{PEAK}
  - 5000 V_{RMS} for 1 minute per UL
- Stretched SO-8 package outline footprint:
  - 8 mm (min.) clearance/creepage

Key Applications

- Industrial and Smart Grid applications:
  - Solid State Relay (SSR) modules
  - Inrush current prevention
  - Insulation resistance measurement in battery systems
  - Solar PV inverters
  - EV charging system
  - Motor winding insulation
  - Load switching in railway infrastructure and system
  - 5G power supplies
  - Industrial appliances and test equipments

The ACPL-K308U industrial photovoltaic driver can be configured to drive either a single MOSFET or two back-to-back MOSFETs for bidirectional applications, providing robust galvanic isolation between the input and the output stage.

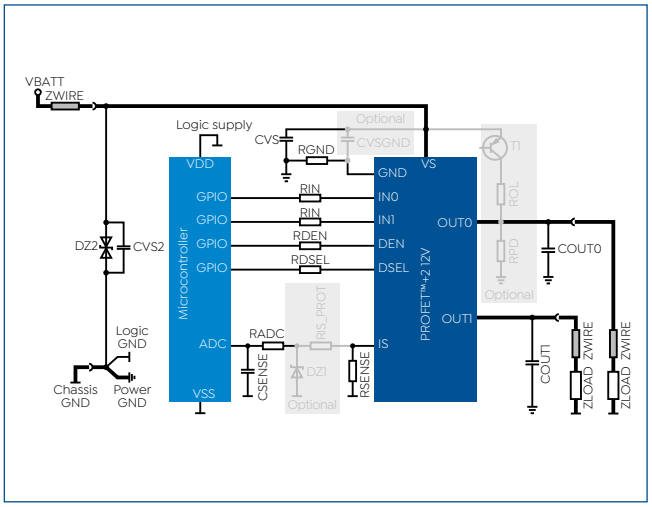
The ACPL-K308U photovoltaic driver features an integrated turn-off circuit, which decreases the turn-off time by discharging the gate capacitance of MOSFETs when the photovoltaic driver is turned off. The turn-off circuit is activated when the photovoltaic voltage is collapsing.

Product order code

- SP001225122
- SP001225144
- SP001225130
- SP001225132
- SP001225124
- SP002746780

PROFET™ +2 12V

Smart High-Side Power Drivers



PROFET™+2 12V – Typical Application Diagram

Infineon's PROFET™ +2 12V smart power switches portfolio includes 27 pin-to-pin compatible devices with $R_{DS(ON)}$ from 1.2 to 200 mΩ, designed to drive resistive, capacitive, and inductive power distribution loads. They also include protection functions and a very accurate load diagnosis. The TSDSO-14 and TSDSO-24 exposed pad packages enable designs with very low power dissipation, modularity, and reduced board space.

Besides the Grade1 family, Infineon also offers single and dual-channel AEC-Q100 Grade0 high-side switches with an extended junction temperature up to 175 °C to drive loads in hot ambient temperature (under the hood or transmission applications).

- **New generation of smart high-side switches based on SMART7 technology**
- **Smallest available package TSDSO-24 to drive loads up to 32 A**
- **Pin-to-pin compatibility within the single and dual-channel family devices**
- **The whole portfolio is qualified according to AEC-Q100 Grade 1 and AEC-Q100 Grade 0**

Features

- Integrated diagnosis and intelligent protection strategy
- ReverseON functionality for low power dissipation in reverse polarity
- Absolute and dynamic temperature limitation with controlled restart
- Undervoltage shutdown
- Overvoltage protection with external components
- Proportional load current sense
- Open load in ON and OFF state
- Short circuit to ground and battery
- Nominal load currents between 0.5 and 32 A
- Current consumption:
  - Less than 2.5 mA/ch.
- Outstanding current sense accuracy (kILIS):
  - Down to 5 % at nominal load current
- Very low output leakage current:
  - Less than 0.5 µA at up to 85 °C
- Small package size enables board space savings
- Benchmark cranking voltage capability able to work down to 3.1 V
  - BTS7200-2EPC – cranking voltage capability down to 2.7 V
- Qualified in accordance with AEC Q100 Grade 1 and Grade 0
- Pin-to-pin compatibility with TSDSO-14/24
- Eval boards available for quick evaluation and simplified design
- Green product (RoHS compliant)

Key Applications

- Automotive:
  - Power distribution
  - Body actuation
  - Heating & high-power
  - Lighting
  - Transmission
  - ADAS

PROFET™ +2 12V family offers a high level of modularity due to pin-pin function and software compatibility for all family members. PROFET™ +2 12V also offers the smallest available package in the market with excellent kILIS and thermal performance, allowing for more compact designs and reduced PCB area.

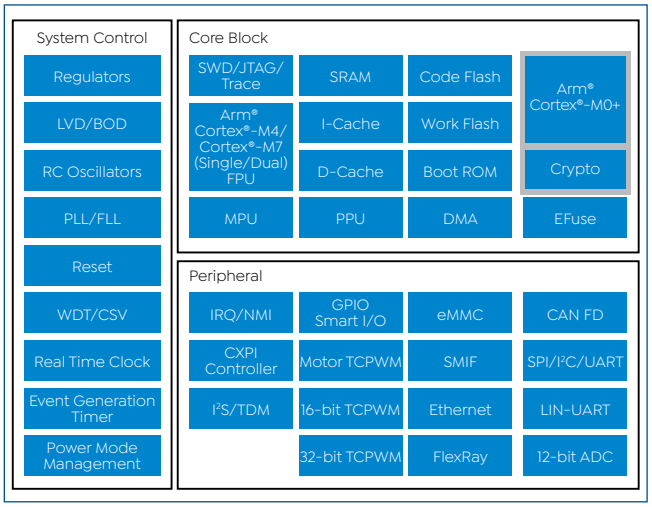
The PROFET™ +2 12V devices switch faster and feature lower $R_{DS(ON)}$, which leads to a total power dissipation reduction by 50 % at the system level, also offering an Intelligent Restart Control, which reduces the MCU effort for short circuit protection.

Product order code

- CYT2B75CADQ0AZEGS
- CYT2B95CACQ0AZEGS
- CYT2B98CACQ0AZEGS
- CYT3BB8CEBQ0AESGS
- CYT4BFCCJDQ0BZEGS
- CYT4BF8CEDQ0AEEGS

Traveo™ II

32-bit Automotive MCUs Based on the Arm® Cortex® Platform



Traveo™ II Family – Feature Overview

Thanks to its special features such as cutting-edge performance, ASIL-B safety compliance, and enhanced security, the Traveo™ II family is the perfect match for connected car applications. With processing power and network connectivity built into a single Arm® Cortex®-M4F and dual Cortex®-M7F, the Traveo™ II family comes up with an enhanced performance up to 1500 DMIPS and a high-performance CPU operating up to 350 MHz. The Traveo™ II family also provides scalability across memory size and pin count. The IP compatibility enables customers to design and develop their system with a single-platform MCU solution.

- **Advanced security features with the introduction of the Hardware Security Module (HSM)**
- **Dedicated Cortex®-M0+ for secure processing and embedded flash for FOTA requirements**
- **Traveo II family also provides the scalability across memory size and pin count**
- **Six power modes that enable ECUs to minimize overall power consumption**

Features

- ISO 26262-compliant (ASIL-B) support for safety
- Variety of interfaces and peripherals: Ethernet, Flexray, eMMC, I²S, CAN-FD
- Memory Protection Unit (MPU)
- Configurable HSM domains with EVITA FULL level security engines
- Scalability to 8 MB Flash and Arm® Cortex®-M7 dual-core
- Read While Write dual bank operations
- Low standby current with quick resume operation

Key Applications

- Automotive:
  - Body application
  - Infotainment
  - ADAS
  - Lighting
  - Body control module
  - HVAC
  - Gateway

Traveo™ II family MCUs feature six power modes that enable ECUs to minimize overall power consumption, which fits perfectly to low-power car body applications (e.g., extending the battery life in fully EVs)

Traveo™ II MCUs support the optimized software platform that is available for AUTOSAR MCAL (Microcontroller Abstraction Layer), self-test libraries, Flash EEPROM emulation, as well as security low-level drivers, combined with third-party firmware.

Product order code

- SP004463784
- SP005349829
- SP004363744
- SP004463788
- SP004463792
- SP004463796

CoolSiC™ MOSFETs 1200 V

CoolSiC™ MOSFETs 1200 V in D2PAK-7L Package

CoolSiC™ MOSFETs 1200 V in D2PAK-7L Package

Infineon presents CoolSiC™ MOSFET 1200 V family in a new D2PAK-7L package. A broad $R_{DS(ON)}$ portfolio of 30 mΩ up to 350 mΩ enables top efficiency in a wide power range of industrial power supplies, chargers, as well as various current ratings in servo drives. CoolSiC™ trench MOSFET technology is optimized to combine performance with reliability in operation, complemented by a 3 µs short-circuit withstand time. Thanks to .XT interconnection technology, the thermal capabilities in a small package form factor are significantly improved.

- **Package creepage and clearance distances, > 6.1 mm**
- **.XT interconnection technology for best-in-class thermal performance**
- **Sense pin for optimized switching performance**
- **Short-circuit withstand time, 3 µs**

Features

- Robustness against parasitic turn-ON:
  - 0 V turn-OFF gate voltage can be applied
- Robust body diode for hard commutation
  - Low reverse recovery charge (Q_{RR})
- .XT interconnection technology for best-in-class thermal performance
- 1200 V optimized SMD package with creepage and clearance distances > 6.1 mm on PCB
- Sense pin for optimized switching performance
- Short-circuit and avalanche robustness
- Superior gate oxide reliability
- Improved efficiency:
  - Best in class switching and conduction losses
- High-frequency operation
- Increased power density
- Reduction of system complexity and cost
- Reduced cooling effort:
  - SMD package enables direct integration onto the PCB, with natural convection cooling
  - No extra heatsink is required
- Comprehensive support including reference designs and EVKs for quick evaluation and easy implementation

Key Applications

- Industrial:
  - Drives
  - Industrial power supplies
  - Industrial UPS
- Smart Grid:
  - Infrastructure - charger
  - Solar string inverter and solar optimizer

Infineon's CoolSiC™ MOSFET 1200 V family in a new D2PAK-7L package is a compact solution that reduces the parts count and enables small form factor designs.

Thanks to their best-in-class switching and conduction losses combined with an innovative SMD package with low thermal resistance, Infineon's CoolSiC™ MOSFETs enable implementing a fanless design with passive cooling, allowing direct integration onto the motor and inverter.

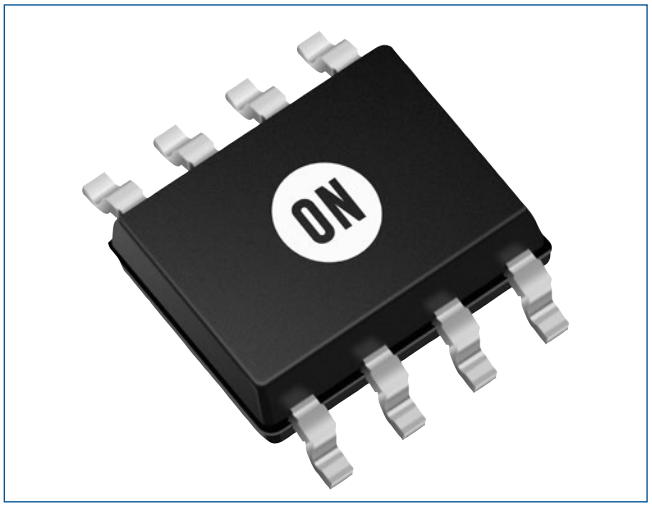
ON Semiconductor®

Product order code

- NCD57080ADR2G
- NCD57080BDR2G
- NCD57080CDR2G
- NCV57080ADR2G
- NCV57080BDR2G
- NCV57080CDR2G

NCD57080

Isolated High Current Gate Driver



NCD57080 in SOIC8 Package

The NCD57080A, NCD57080B, and NCD57080C are high-current single-channel IGBT gate drivers with 3.75 kV_{RMS} internal galvanic isolation, designed for high system efficiency and reliability in high power applications. The devices accept complementary inputs and depending on the pin configuration, offer options such as Active Miller Clamp (NCD57080A), negative power supply (NCD57080B), and separate high and low (OUTH and OUTL) driver outputs (NCD57080C) for system design convenience.

The NCD57080(A/B/C) accommodates a wide range of input bias voltage and signal levels from 3.3 V to 20 V.

- **3.75 kV_{RMS} galvanic isolation**
- **High peak output current (±6.5 A)**
- **Short propagation delays with accurate matching**
- **Tight UVLO thresholds**

Features

- High transient & electromagnetic immunity
- Wide bias voltage ranges
- Wide input voltage range
- Active Miller clamp or negative gate voltage or split outputs
- Improves system efficiency
- Improves PWM signal integrity
- Ruggedness in fast slew rate high voltage and current switching applications
- Saves cost and board space while offering improved performance compared to opto-drivers
- Offers system design flexibility and allows the usage of commonly available system voltage rails
- Offers a choice of features in a compact narrow-body SOIC-8 package
- Automotive-grade versions (with NCV-suffix) available:
  - AEC-qualified
  - PPAP capable
- Pb-Free, Halogen/BFR-Free, and RoHS compliant

Key Applications

- Industrial:
  - Industrial motor drives
  - Industrial power supplies
- Smart Grid:
  - Uninterruptible Power Supply
  - PV solar inverters
- Automotive:
  - EV chargers
  - Automotive On-board Charger
  - Automotive power conversion

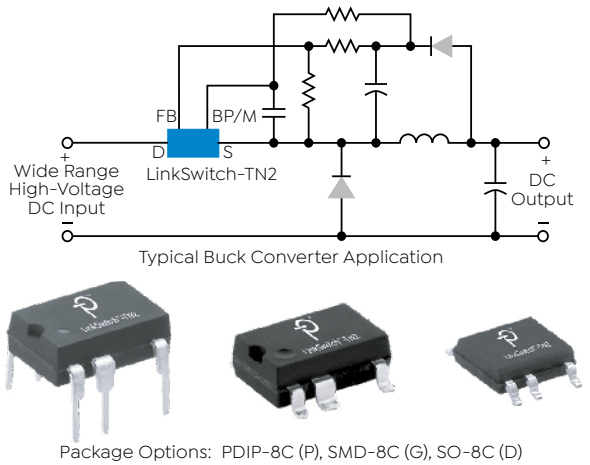
The NCD57080(A/B/C) is pin-to-pin compatible with many similar solutions from the competitors, representing a good and reliable alternative for high-current IGBT applications.

Product order code

- LNK3207D-TL
- LNK3207G-TL
- LNK3207P

LinkSwitch™-TN2 (LNK3207)

LinkSwitch-TN2 Switcher IC Increases Available Power by 60 % in Industrial and Smart Home and Building Applications



LinkSwitch™-TN2 – Typical Application Circuit and Package Options

The newest member of the LinkSwitch-TN2 AC-DC converter family facilitates higher power requirements in industrial designs, white goods, and building automation. The uprated, high-efficiency parts reduce BOM cost and offer flexible package options to simplify design.

The new LNK3207 devices increase the available current from 360 to 575 mA while delivering efficiency of over 80 %. No-load consumption is less than 30 mW. Because LinkSwitch-TN2 ICs offer very high levels of integration, a simple, high-current buck converter can be realized using a minimum number of components, eliminating at least one diode compared with competing solutions.

- **575 mA output current**
- **High efficiency, greater than 80 %**
- **Less than 30 mW no-load power consumption**
- **Reduces BOM cost and simplifies power supply design**

Features

- Supports buck, buck-boost, and flyback topologies
- Excellent load and line regulation
- Less than 100 µA standby current
- Selectable device current limit
- 66 kHz operation with accurate current limit reduces the size of the energy storage elements
- Frequency jittering optimizes EMI and reduces filter complexity
- Pin-to-pin compatibility with other family members allows easy upgrade to a higher power rating
- Enhanced safety and reliability:
  - Internal 725 V MOSFET
  - Line overvoltage protection (OVL)
  - Output overvoltage protection (OVP)
  - Overtemperature protection (OTP)
  - Auto-restart feature for short-circuit and open-loop faults
  - Extended drain pin creepage relative to other pins
- Three different package options:
  - PDIP-8C (LNK3207P)
  - SO-8C (LNK3207D)
  - SMD-8C (LNK3207G) optimized for high ambient temperatures (85 to 105 °C)
- Operating junction temperature:
  - From -40 to 150 °C

Key Applications

- Industrial:
  - Metering
  - Industrial controls
- Smart Home and Building:
  - Small and major appliances
  - Smart home devices
  - IoT devices
  - Home and building automation

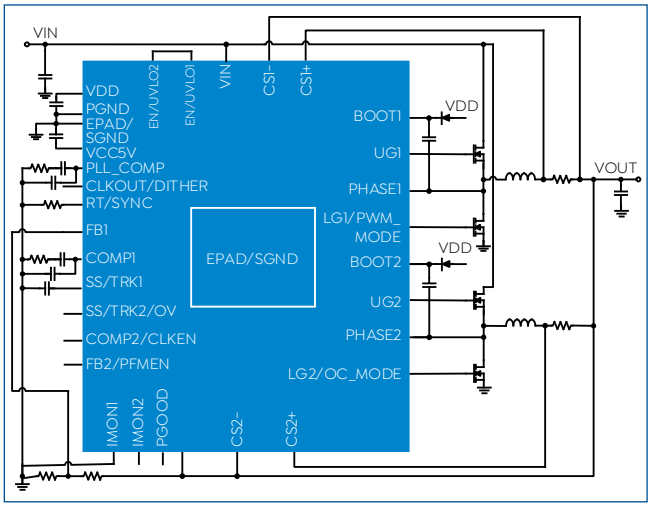
The compact, highly efficient, and flexible LNK3207 AC-DC converter IC keeps the number of external components to a minimum while providing numerous protection features native to the LinkSwitch-TN2 family. Built-in frequency jitter allows for a simplified EMI filter, reducing the component count even further. The integrated 725 V MOSFET is more than capable of withstanding any voltage peaks from the AC mains.

The LNK3207 IC was developed in response to increased current requirements in household and industrial applications, providing up to 575 mA while retaining all the benefits of the LinkSwitch-TN2 family.

Product order code
- ISL81806FRTZ-T
- ISL81806FRTZ-T7A

ISL81806

80 V Two-phase/Dual Output Synchronous Buck Controller Optimized for GaN FET



ISL81806 – Typical Application Diagram

The ISL81806 is an 80 V dual synchronous buck controller that generates two independent outputs or one output with two interleaved phases. Worldwide it is the first such controller optimized to drive E-mode GaN FETs. It is suitable for telecommunication, computing, and other industrial applications.

Each output has a voltage and current controller. The internal Phase-Locked Loop (PLL) assures an accurate frequency setting from 100 kHz to 2 MHz. The oscillator can be synchronized to an external clock signal for phase interleaving and is expandable to three, four, and six phases.

- **Wide input and output voltage range**
- **Dual or two-phase buck controller with interleaved outputs**
- **Optimized to drive E-mode GaN FETs**
- **Wide switching frequency**

Features

- Wide V_{IN} range: 4.5 V to 80 V
- Wide V_{OUT} range: 0.8 V to 76 V
- 5.3 V gate drive voltage for GaN FET
- Dual or two-phase Buck controller with interleaved outputs
- Integrated CC/CV controller + driver
- Selectable mode between PWM/DE/Burst
- Supports multi-chip paralleling and phase interleaving
- Optimized dead time for GaN FET
- Wide switching frequency: 100 kHz to 2 MHz
  - Supports external clock sync
- Light-load/forced PWM efficiency enhancement:
  - Low ripple diode emulation and burst mode operation
- Complete protection:
  - Shoot-through protection, OCP, OVP, OTP, UVP
- PGOOD indicator
- Output current monitor
- Independent EN and Soft Start for each output
- ISL81806EVAL1Z EVK for easy evaluation and prototyping
  - Full documentation included
- Compact size:
  - 5 x 5 mm 32-lead TQFN package

Key Applications

- Telecom 48 V to 12 V conversion
- Computing data center 48 V to 12 V conversion
- Power modules
- Robotics and home automation
- Battery and supercapacitor applications

The ISL81806 is a feature-rich GaN FET driver IC that simplifies application design and reduces associated costs. This highly integrated driver IC from Renesas reduces BOM costs by eliminating the need to use an MCU, current sense amplifiers, or housekeeping/auxiliary power circuit.

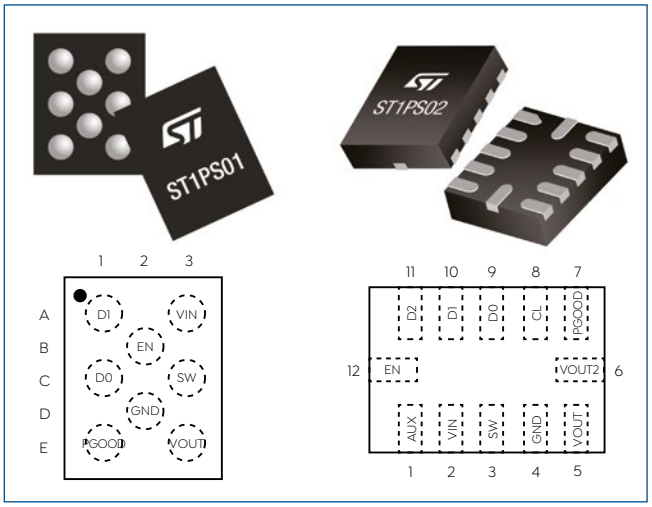
The ISL81806 provides highly efficient power conversion, achieving more than 96% for 48 to 12 V, 300 W DC-DC applications. Optimized to drive GaN FETs at high frequencies, the ISL81806 allows for a much smaller size of the final solution.

Product order code

- ST1PS01AJR
- ST1PS01BJR
- ST1PS01CJR
- ST1PS02AQTR
- ST1PS02BQTR
- ST1PS02CQTR

ST1PS01 / ST1PS02

400 mA Nano-Quiescent Synchronous Step-down Converter with Digital Voltage Selection



ST1PS01 (Left) and ST1PS02 (Right) with Package Pinouts, Top-through View

ST1PS01 converter is specifically designed for applications where high efficiency, PCB size, and thickness are the key factors. The output voltage can be set using two digital control inputs, a V_{OUT} from 0.625 V to 3.3 V can be dynamically selected. It reaches a very high-efficiency conversion using just a 2.2 µH inductor and two small capacitors.
ST1PS02 is a nano-quiescent miniaturized synchronous step-down converter, which is able to provide up to 400 mA output current with an input voltage ranging from 1.8 V to 5.5 V. ST1PS02 features an auxiliary output and settable inductor current limit, which are the main differentiators for this device.

- **500 nA input quiescent current at V_{IN} = 3.6 V (not switching)**
- **ST1PS01: 94 % typical efficiency at 1 mA load (V_{IN} = 3.6 V, V_{OUT} = 3.3 V)**
- **ST1PS02: 92 % typical efficiency at 10 mA load (V_{IN} = 3.6 V, V_{OUT} = 2.5 V)**
- **100 % duty cycle**

Features

- 1.8 V to 5.5 V input operating range
- Undervoltage lockout: 1.57 V (V_{IN} falling, typ.)
- Up to 400 mA output current capability
- Low power control operation for the best efficiency
- Embedded soft-start circuit
- Tiny external components: L = 2.2 µH (typ.)
- Selectable output voltage up to 3.3 V
- Power Good indication
- ±1.5 % output voltage accuracy (T_A = 25 °C)
- Dynamic output voltage selection:
  - ST1PS01: D0, D1
  - ST1PS02: D0, D1, D2
- ST1PS02 specific features:
  - Auxiliary load switch V_{OUT2} (AUX control input)
  - Settable inductor current limitation
- Available in compact packages:
  - ST1PS01: Flip-Chip (1.14 × 1.44 mm)
  - ST1PS02: TQFN (2.0 × 1.7 mm)

Key Applications

- Wearable applications
- Personal tracking monitors
- Smartwatches, sport bands
- Energy harvesting, wireless sensors
- Wearable and fitness accessories
- Industrial sensors, portable low power devices
- Single-cell Li-Ion battery applications
- Bluetooth® Low Energy (BLE)

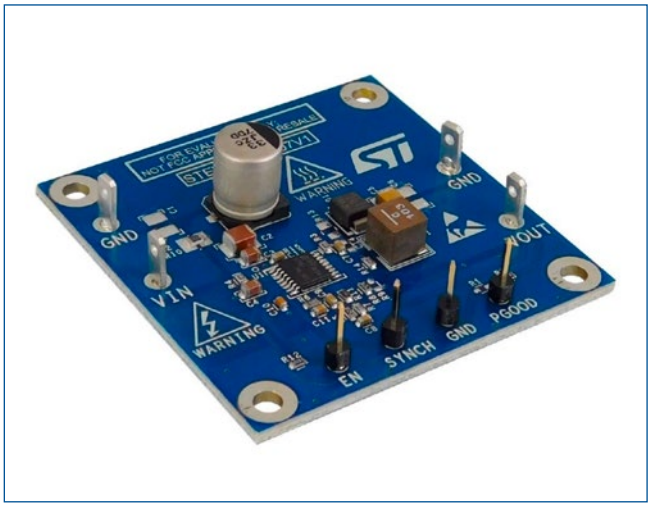
The ST1PS01 and ST1PS02 converters feature ultra-low quiescent current and high energy efficiency, enabling extended battery life in low-power applications.

These devices also deliver excellent performances, such as very low noise operation for noise-sensitive applications, extended input and output supply voltage range for design flexibility in a variety of different applications, and on-the-fly programmable output voltage selection via digital input pins. They are housed in tiny packages with low pin count, enabling compact design and reduced BOM costs.

Product order code
- A7987TR
- STEVAL-ISA207V1

A7987

61 V/3 A Asynchronous Step-Down Switching Regulator with Adjustable Current Limitation



A7987 on STEVAL-ISA207V1 Evalution Board

The A7987 is a step-down monolithic switching regulator that can deliver up to 3 A DC. The adjustable output voltage ranges from 0.8 V to V_{IN}. The wide input voltage range and the almost 100 % duty cycle capability meet the fail-safe specifications for automotive systems. The embedded switch-over feature on the V_{BIAS} pin maximizes efficiency at light load. The adjustable current limitation, designed to select the inductor RMS current in accordance with the nominal output current, and the high switching frequency capability make the size of the application compact.

- **3 A DC output current**
- **4.5 V to 61 V operating input voltage**
- **Adjustable switching frequency (250 kHz to 1.5 MHz)**
- **Output voltage adjustable from 0.8 V to V_{IN}**

Features

- 3 A DC output current
- 4.5 V to 61 V operating input voltage
- Adjustable switching frequency (250 kHz to 1.5 MHz)
- 100 % duty cycle capability
- High efficiency:
  - Up to 85 % efficiency at V_{IN} = 24 V, V_{OUT} = 3.3 V, I_{OUT} = 1 A
- Output voltage adjustable from 0.8 V to V_{IN}
- External synchronization
- Adjustable soft-start time
- Adjustable current limitation
- V_{BIAS} improves efficiency at light load
- PGOOD open collector output
- Digital frequency fold-back in short-circuit
- Auto-recovery thermal shutdown
- Qualified following AEC-Q100 requirements

Key Applications

- Automotive:
  - 24 V automotive battery systems
  - Industrial and commercial vehicles

The A7987 step-down switching regulator is a full-featured device, offering many functions, including a highly adjustable switching frequency, external synchronization, adjustable soft-start, plenty of integrated protection functions, and fault reporting via a dedicated PG pin. It can be operated over a wide supply voltage range while still delivering great output voltage flexibility that can be set anywhere from nearly 0 V up to V_{IN}.

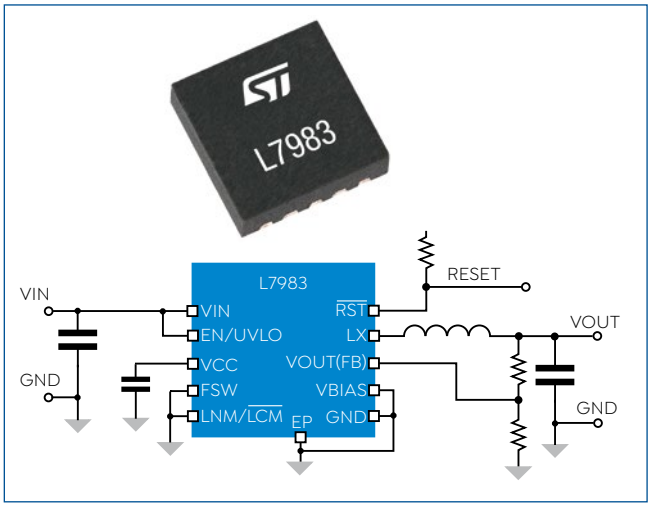
The A7897 also supports negative buck-boost configuration, which in combination with other features and the AEC-Q100 certification offers an extremely flexible solution for a wide range of automotive applications.

Product order code

- L7983PU33R
- L7983PU50R
- L7983PUR
- STEVAL-L7983ADJ
- STEVAL-L7983V33
- STEVAL-L7983V50

L7983

60 V/300 mA Synchronous Step-Down Switching Regulator with 10 µA Quiescent Current



L7983 and Typical Application Circuit

The L7983 device is a step-down monolithic switching regulator able to deliver up to 300 mA DC based on peak current mode architecture. The output voltage adjustability ranges from 0.85 V to VIN. The wide input voltage range and adjustable UVLO threshold meet the specification for the 12 V, 24 V, and 48 V industrial bus standards.

The "Low Consumption Mode" (LCM) is designed for applications active during idle mode, so it maximizes the efficiency at light load with a controlled output voltage ripple. The "Low Noise Mode" (LNM) makes the switching frequency constant, meeting the low noise application specification.

- **3.5 V to 60 V operating input voltage**
- **Fixed output voltage (3.3 V and 5 V) or adjustable from 0.85 V to V_{IN}**
- **300 mA DC output current**
- **Dynamic low consumption mode to low noise mode selection**

Features

- 3.5 V to 60 V operating input voltage
- Fixed output voltage (3.3 V and 5 V) or adjustable from 0.85 V to V_{IN}
- 300 mA DC output current
- Dynamic Low Consumption Mode (LCM) to Low Noise Mode (LNM) selection
- 10 µA operating quiescent current (L7983PU33R, VIN > 24 V, LCM)
- 2.3 µA shutdown current
- 200 kHz to 2.2 MHz programmable switching frequency
- Optional spread-spectrum (dithering)
- Internal soft-start
- Enable/adjustable UVLO threshold
- Synchronization to an external clock
- Internal compensation network
- Internal current limiting
- Overvoltage protection
- Output voltage sequencing
- Thermal shutdown

Key Applications

- Designed for 12 V, 24 V, and 48 V buses
- Battery-powered applications
- Decentralized intelligent nodes
- Fail-safe systems
- Sensors and low noise applications (LNM)

The L7983 is a highly flexible step-down regulator capable of operating over a wide supply voltage range, offering a highly adjustable switching frequency up to 2.2 MHz. It also offers programmable dithering for reduced EMI. One of its key features is extremely low power consumption with as low as 10 µA of quiescent current and high efficiency over the entire input voltage range, even with light loads.

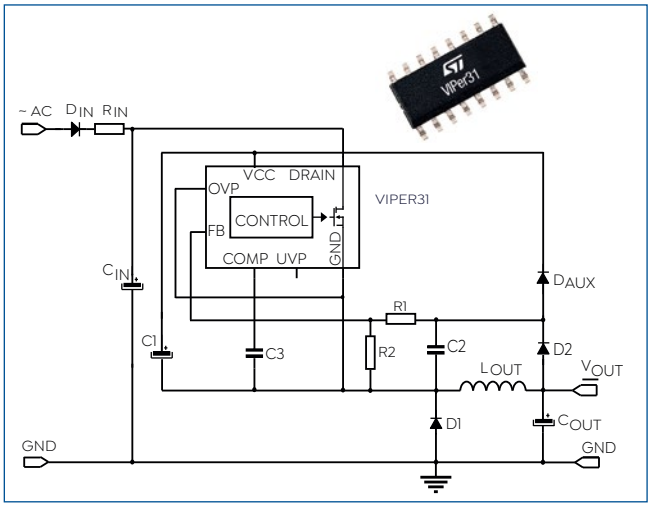
The L7983 offers two different operating modes, covering a wide range of applications and use cases. The LCM fits applications that typically drive low loads. The LNM can be used where minimizing switching noise is a must.

Product order code

- VIPER318HDTR
- STEVAL-VP12201F
- STEVAL-VP319X1B

VIPER318HDTR

Energy Saving Off-Line High Voltage Converter



Viper31 - Product Image and Typical Circuit Diagram

The VIPER318HDTR device is a high-voltage converter that smartly integrates an 800 V avalanche rugged power MOSFET with PWM current-mode control. The 800 V breakdown allows extended input voltage range to be applied, as well as to reduce the size of the drain snubber circuit. The IC can meet the most stringent energy-saving standards as it has very low consumption and operates in pulse frequency modulation at light load. Overvoltage and undervoltage protection with separate and settable intervention thresholds are available at OVP and UVP pins, respectively. UVP can also be used as a disabling input for the entire SMPS.

- **800 V avalanche-rugged power MOSFET to cover ultra-wide VAC input range**
- **Embedded HV startup and sense FET**
- **Current-mode PWM controller**
- **Drain current limit protection (OCP): 710-850-990 mA**

Features

- 800 V avalanche-rugged power MOSFET to cover ultra-wide VAC input range
- Embedded HV startup and sense FET
- Current-mode PWM controller
- Drain current limit protection (OCP):
  - 710 mA (VIPER317)
  - 850 mA (VIPER318)
  - 990 mA (VIPER319)
- Wide supply voltage range: 4.5 to 30 V
  - < 20 mW at 230 VAC with no load
  - < 430 mW at 230 VAC, 250 mW output load
- Jittered switching frequency reduces the EMI filter cost:
  - 30 kHz ± 7% (type X)
  - 60 kHz ± 7% (type L)
  - 132 kHz ±7% (type H)
- Embedded E/A with 1.2 V reference
- Built-in soft-start for improved system reliability
- Protections with automatic restart:
  - Overload/short-circuit protection (OLP)
  - Thermal shutdown
  - Overvoltage
- Protections without automatic restart:
  - Pulse-skip protection to avoid flux runaway
  - Undervoltage/disable
  - Max. duty cycle

Key Applications

- Low power SMPS for home appliances
- Home automation
- Industrial applications
- Consumer applications
- Lighting
- Low power adapters

The VIPER31 off-line HV converters offer many integrated features for increased ruggedness and efficiency, even under light loads. Viper31 incorporates a high-voltage avalanche-rugged MOSFET that can endure high input voltage peaks. Integrated HV startup reduces the components count and allows energy saving.

Viper31 family also incorporates a high-accuracy Error Amplifier (EA) that enables tight output voltage regulation, as well as a rich set of protection features that reduce design complexity and BOM costs even further.

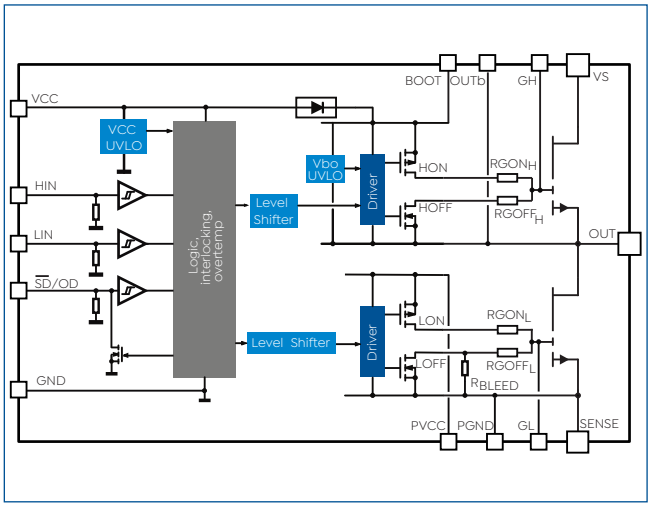
life.augmented

Product order code

- MASTERGAN2
- MASTERGAN2TR
- EVALMASTERGAN2

MASTERGAN2

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



MASTERGAN 2 Block Diagram

MASTERGAN2 is an advanced power system-in-package integrating a gate driver and two enhancement-mode GaN transistors in an asymmetrical half-bridge configuration. The integrated power GaNs have 650 V drain-source breakdown voltage and $R_{DS(ON)}$ of 150 mΩ and 225 mΩ for Low Side (LS) and High Side (HS) respectively, while the high side of the embedded gate driver can be easily supplied by the integrated bootstrap diode, while the high side of the embedded gate driver can be easily supplied by the integrated bootstrap diode.

- **Compact size: QFN 9 x 9 x 1 mm package**
- **Low $R_{DS(ON)}$: 150 mΩ (LS) + 225 mΩ (HS)**
- **I_{DS} (max) = 10 A (LS) + 6.5 A (HS)**
- **UVLO protection on low-side and high-side**

Features

- 600 V system-in-package integrating half-bridge gate driver and high-voltage power GaN transistors in the asymmetrical configuration:
  - QFN 9 x 9 x 1 mm package
  - $R_{DS(ON)}$ = 150 mΩ (LS) + 225 mΩ (HS)
  - I_{DS} (max) = 10 A (LS) + 6.5 A (HS)
- Reverse current capability
- Zero reverse recovery loss
- Undervoltage (UVLO) protection on both LS and HS
- 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 (OTP)
- Bill of material reduction
- Very compact and simplified layout
- Flexible, easy, and fast design
- Industrial temperature operating range:
  - From -40 °C to 125 °C

Key Applications

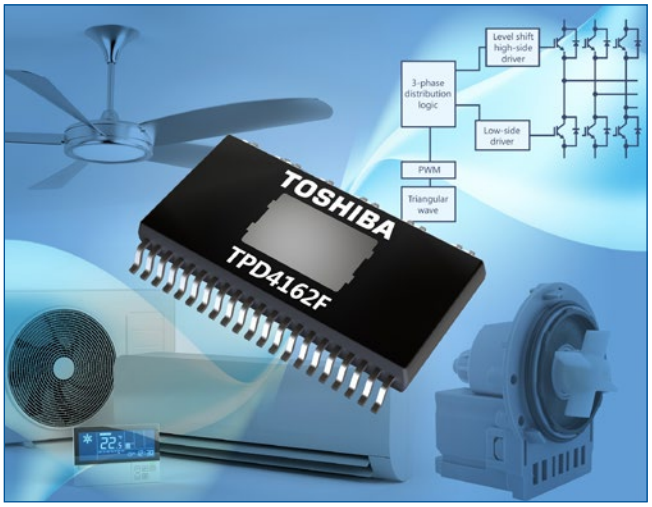
- Switch-mode power supplies
- Chargers and adapters
- High-voltage PFC
- DC-DC converters

The compact and highly efficient MASTERGAN2 devices deliver a high level of robustness and reliability in every application. Thanks to their high level of integration, they allow for simplified design, enabling a compact layout with a reduced number of external components. Besides the common protection features such as UVLO and OTP, MASTERGAN2 has also an interlocking function, preventing cross-conduction by turning both GaN FETs OFF.

The input pins extended range of the MASTERGAN2 devices allows easy interfacing with the broadest range of MCUs, Hall sensors, or DSPs, thus offering a lot of design flexibility.

TPD4162F

Compact Intelligent Power Device (IPD) with 600 V Rating



TPD4162F – Product Image

Toshiba's TPD4162F IPD is a DC brushless motor driver that contains a built-in PWM circuit, three-phase decoder, level shifting high-side driver, and a low side driver. It has embedded IGBTs and Fast Recovery Diodes (FRDs). The TPD4162F is suitable for any applications with input signals in the range of up to 220 V AC. Multiple protection features include current limiting, overcurrent protection (OCP), thermal shutdown, and undervoltage lockout (UVLO).

- **Rated power supply voltage (V_{BB}) up to 450 V**
- **HSSOP31 surface mount package 17.5 x 11.9 mm footprint, 2.2 mm height**
- **Overcurrent protection (OCP)**
- **Thermal shutdown and undervoltage lockout (UVLO)**

Features

- The high voltage power side and the low voltage signal side terminals are separated
- Simple bootstrap circuit provides high-side supply
- Built-in bootstrap diodes
- Built-in PWM and 3-phase decode circuit
  - 3-Hall element/IC sensor support
- Built-in IGBT output stage with FRDs:
  - 3-phase full-bridge configuration
- Pulses-per-revolution output:
  - FGC = High: 3 pulse/electrical angle: 360°
  - FGC = Low: 1 pulse/electrical angle: 360°
- Multiple protection features:
  - Current limiting
  - Overcurrent protection (OCP)
  - Undervoltage lockout (UVLO)
  - Thermal shutdown
- Output current:
  - I_{OUT} (DC): 0.7 A
  - I_{OUT} (Pulse): 1.2 A
- Operating junction temperature: -40 to 135 °C
- Compact HSSOP31 SMT package
- RoHS compliant

Key Applications

- Industrial
  - 220 VAC motor drives
  - Air conditioners
  - Air cleaners
  - Pumps

Toshiba TPD4162F intelligent Power Device (IPD) is a highly integrated device fabricated using a high-voltage SOI process. It requires a minimum number of supporting components, enabling more compact designs, offering the ability to install the control circuit to the motor directly. Compared to the previous generation of IPDs, it offers approximately 10% reduced power dissipation.

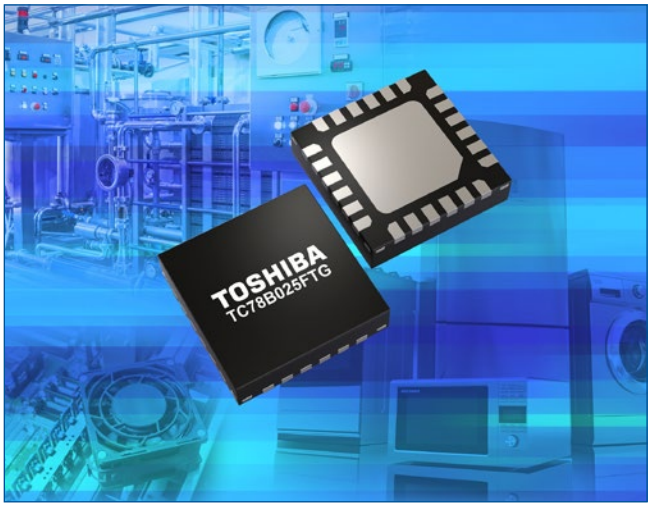
The TPD4162F allows simplified control of a DC brushless motor by applying a signal from a motor controller and a Hall element/IC.

TOSHIBA

Product order code | • TC78B025FTG(Z,EL,R

TC78B025FTG

Brushless Motor Driver IC with Very High Energy Efficiency and Closed-loop Speed Control



Toshiba TC78B025FTG – Product Image

Toshiba's TC78B025FTG, a three-phase brushless motor driver IC with a rotation speed control (closed-loop control) function, achieves flexible rotation speed control without the need for external microcomputers by incorporating a non-volatile memory (NVM).
This allows easy system configuration and supports motor speeds from hundreds to tens of thousands of rotations per minute (RPM), especially as Toshiba's Intelligent Phase Control (IPC) motor drive technology realizes energy-efficient driving across a wide rotation range without requiring lead angle adjustment.

- **Closed-loop speed control: uniform rotation speeds up to tens of thousands RPM**
- **Embedded non-volatile memory makes an external MCU unnecessary**
- **Intelligent Phase Control: automatic lead angle optimization across the entire speed range**
- **1-Hall drive system and current sense resistor elimination system for reduced BOM**

Features

- 1-Hall PWM drive system:
  - 1-Hall sine-wave commutation
  - 1-Hall 150° commutation
- Configurable speed curve
- Low ON-resistance:
  - Hi+Lo side = 0.2 Ω (typ.)
- Driving current (peak): 3.5 A max.
- Operating voltage: 4.5 to 16 V
- Serial interface
- Standby mode
- Soft start
- Built-in protection circuits:
  - Undervoltage lockout (UVLO)
  - Overvoltage protection (OVP)
  - Undervoltage protection for the charge pump
  - Output current limit protection (OCP)
  - Overcurrent protection (ISD)
  - Thermal shutdown (TSD)
  - Lock detection protection
- Compact P-VQFN24 package:
  - 4.0 x 4.0 x 0.9 mm
- Advantages
  - Uniform rotation speeds up to tens of thousands of RPM
  - No control software required
  - No external MCU required
  - Reduced current consumption by up to 20 % across the entire speed range
  - Only initial lead angle optimization necessary
  - Scalable power stage
- Benefits
  - Ideal for mission-critical applications that require constant cooling
  - Reduced development time and cost
  - Reduced Bill-of-Material (BOM)
  - Faster Time-to-Market

Key Applications

- 12 V fan applications
- Charging stations for EVs
- PCs and servers
- Home appliances
- Industrial equipment

The Intelligent Phase Control (IPC) system detects the motor current phase and feeds back the automatic lead angle control information. When the motor application has a sensor, the phase of the Hall signal is automatically adjusted to match that of the motor drive current. High efficiency is achieved regardless of RPM, load torque, and power supply voltage of a motor.

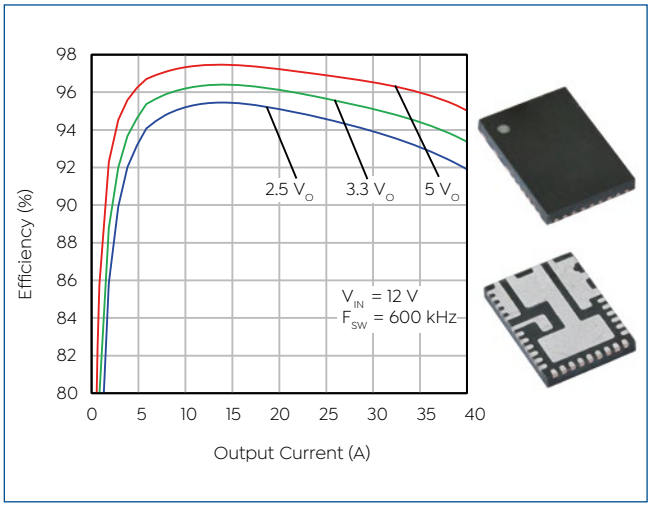
Besides IPC, the TC78B025FTG implements a resistorless current sensing system, saving PCB space and reducing BOM costs to a minimum.

Product order code

- SIC450ED-T1-GE3
- SIC451ED-T1-GE3
- SIC453ED-T1-GE3
- SIC451EVB-A

SIC450, SIC451, SIC453

4.5 V to 20 V Input, 15 A, 25 A, 40 A microBUCK®



SIC45x microBUCK® DC/DC Converter Family

Vishay broadens its offering of microBUCK® synchronous buck regulators with a new family of 15 A, 25 A, and 40 A devices featuring input voltages from 4.5 V to 20 V in the thermally enhanced 5 mm by 7 mm PowerPAK MLP34-57 package. Delivering increased power density and transient response compared to previous generation devices, Vishay Siliconix SiC45x family regulators offer PMBus 1.3 compliance for power system telemetry.

- **Output currents up to 40 A in the thermally enhanced 5 x 7 x 0.75 mm package**
- **Versatile, Scalable solution: 15 A (SiC453), 25 A (SiC451), 40 A (SiC450)**
- **Input voltages from 4.5 V to 20 V, Adjustable output voltage down to 0.3 V**
- **Highly configurable PMBus 1.3 compliance for power system telemetry**

Features

- Versatile:
  - Single supply operation from 4.5 V to 20 V input voltage
  - Scalable solution with a continuous output current of:
    - 40 A (SiC450)
    - 25 A (SiC451)
    - 15 A (SiC453)
  - Output voltage adjustable from 0.3 V to 12 V
  - Built-in 5 V regulator for internal circuits and driver supply
  - 1 % output voltage accuracy over temperature
  - Ultrafast transient response
- Highly efficient:
  - 98 % peak efficiency
  - Optional power save mode
- Highly configurable:
  - PMBus 1.3 compliant with 1 MHz bus speed
  - Internal NVM
  - V_{OUT} adjustability and reading resolution of 2 mV
  - Supports over 50 PMBus commands
  - Supports in phase or 180° out of phase synchronization
  - Output voltage source and sink capability
- Robust and reliable:
  - PV_{IN}, V_{OUT}, I_{IN}, I_{OUT}, and temperature reporting
  - Overcurrent protection in pulse-by-pulse mode (OCP)
  - Output over and undervoltage protection (OVP, UVLO)
  - Overtemperature protection with hysteresis (OTP)
  - Differential output remote sensing

Key Applications

- Communications & Infrastructure:
  - Server, cloud, and infrastructure
  - Networking, telecom, storage pplications
- Distributed Point of Load (POL) power architectures
- DDR memory

Vishay's new SIC45x family of microBUCK® synchronous buck regulators offers versatile operation from 4.5 V to 20 V input voltage, with adjustable output voltage down to 0.3 V. The new addition to the microBUCK® family represents a scalable solution, offering options from 15 A to 40 A in the same low profile MLP package.

SIC45x offers constant ON-time control for the superior transient response and PMBus 1.3 bus with telemetry and up to 1 MHz.

REDUCING THE COST OF OWNERSHIP

Sustainable green energy from clean, renewable sources is gaining significant momentum and market share: 176 GW of energy production capacity was installed in 2019 alone, and according to the International Renewable Energy Agency (IRENA), renewables account for three-quarters of the total installed capacity. The cost of green energy has also fallen rapidly over the last ten years, thanks to technological improvements, economies of scale, increasingly competitive supply chains, and the growing experience. For example, utility-scale photovoltaic energy has seen the biggest cost reduction (82%) since 2010, while the cost of wind energy production has fallen by approximately 35%. Therefore, it makes sense to explore the financial aspect of using these new technologies, as well.

The importance of WBG technologies in adopting sustainable green energy for commercial uses has already been highlighted in the previous articles. In fact, we cannot even talk about green energy without solutions based on WBG semiconductors. Unfortunately, the global economy depends on the price, not on environmental concerns. Si-based semiconductor manufacturing technologies are well-matured, and Si devices are still mass-produced. That makes them very inexpensive, which could be a deciding factor for many developers, at least from the financial perspective. However, even if WBG power semiconductors are currently a pricier option, the cost is balanced out at a system level: higher switching speeds and efficiencies enable using smaller passives and energy storage components, simpler cooling solutions, and compact enclosures, leading not only to reduced system costs but also to the emergence of some brand-new applications (e.g., 5G, high-power USB-PD, and much more).

In industrial applications, the Total Cost of Ownership (TCO) is a far more important financial aspect to consider than immediate costs. For example, the average lifespan of an industrial-class motor drive is about 20 years. In that period, 99% of total costs come from operation and maintenance, while only 1% comes from the initial purchase. On a busy factory floor with multiple motor drives, maintenance and operating costs must not be overlooked. For such applications, WBG solutions bring great financial benefits in terms of TCO due to their longer life cycle, lower maintenance requirements, and reduced operating costs.

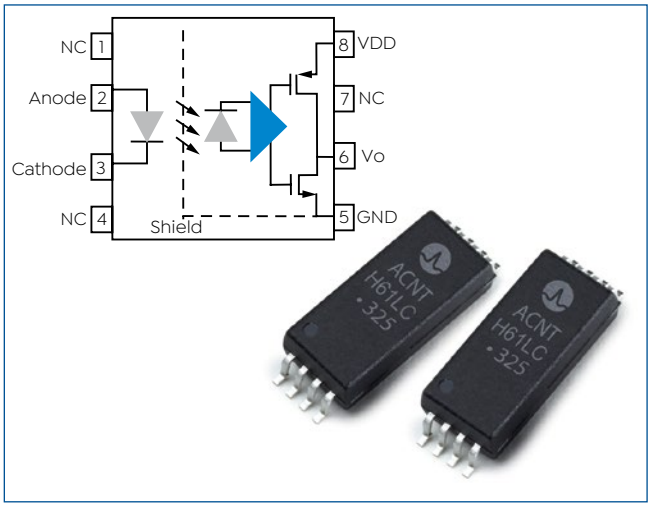
Another segment in which WBG technology can create a significant financial impact is the IT segment. Data centers are estimated to account for about 2% of global energy consumption. However, the IT segment is one of the fastest-growing segments, so it is expected that the energy consumption will reach 5% very soon, with a tendency for further growth. WBG semiconductors can bring multiple benefits to data center applications, where space is a luxury and heat management is one of the primary concerns. WBG semiconductors, especially GaN HEMT, can successfully cope with both of these challenges, bringing much-needed efficiency improvements and more compact power supply solutions that also generate less heat, ultimately leading to decreased operational and maintenance costs.

It is therefore not surprising that market forecasts for WBG technologies are quite optimistic: GaN devices expect up to +70% CAGR by 2026, dominating the consumer market and expanding into the telecom and automotive segments, while SiC devices expect CAGR growth up to +30%, taking over the xEV and xEV Supply Equipment (EVSE) market.

Product order code
- ACNT-H61LC-000E
- ACNT-H61LC-500E

ACNT-H61LC

High CTI, Low Power 10 MBd Digital CMOS Optocoupler



ACNT-H61LC – Product Image and Block Diagram

The ACNT-H61LC is a low-power digital optocoupler of comparative tracking index, CTI 600 V, Material Group I mold compound in 15 mm wide creepage and 14.2 mm clearance that combines a light-emitting diode (LED) and an integrated high gain photodetector designed to provide an optically isolated interface for system control and data communications interface. The device is extremely low power, consuming up to 2 mA of supply current across a wide temperature range. The LED forward current operates from 4.5 mA.

- **Comparative tracking index, CTI: 600 V (Material Group I)**
- **Low power supply current (IDD): 2 mA (max.)**
- **Low input current capability: 4.5 mA (min.)**
- **20 kV/µs min common mode rejection (CMR) at V_{CM} = 1000 V**

Features
- High-speed interface: 10 MBd (min.)
- Guaranteed AC and DC performance over a wide temperature range:
  - From -40 °C to +105 °C
- CMOS photodetector output
- 3.3 V or 5 V operation
- 15 mm Stretched SO8 package
- Internal clearance: 0.5 mm
- Safety and regulatory approvals:
  - UL 1577 recognized: 7,500 V_{RMS} for 1 minute
  - CSA approved
  - IEC/EN 60747-5-5 approved for reinforced insulation (V_{IORM} = 2,262 V_{PK}; V_{IOTM} = 12,000 V_{PK})

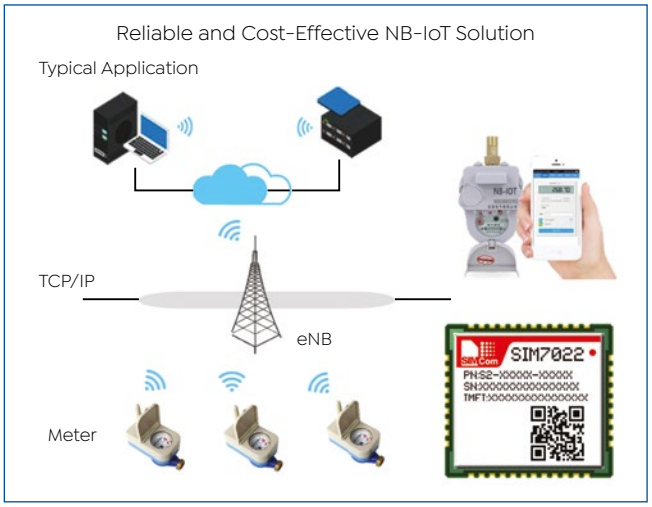
Key Applications
- Communication Interfaces: RS485, CAN Bus
- Digital isolation for A/D and D/A conversion
- High voltage power systems (690 VAC drives)
- Renewable energy inverters (1500 V PV)
- Medical imaging and patient monitoring
- Overvoltage CAT IV isolation (utility test equipment)

The ACNT-H61LC features high EMI due to the internal Faraday shield that provides a minimum of 20 kV/µs CMR, minimizing errors in a noisy environment and allowing reduction of regulatory standard's creepage requirements.

The ACNT-H61LC is well suited for isolated communication logic interface and control in high-voltage power systems such as 1500 V PV systems, 690 VAC drives, renewable inverters, and medical equipment, with guaranteed AC and DC performance over the entire operating temperature range.

SIM7022

Multi-Band NB-IoT Cellular Module



SIM7022 Multi-Band NB-IoT Cellular Module - Typical Application

The SIM7022 is a Multi-Band NB-IoT cellular module solution based on Qualcomm's latest NB-IoT chipset QCX212. It has strong extension capability with rich Interfaces including UART, GPIO, etc. Its package is compatible with the SIM800C/SIM7020 series, which maximizes the investments of customers and enables a short time to market.
Due to the unique combination of performance, security, and flexibility, this module is ideally suited for a broad range of low-power M2M applications, such as smart metering or a connected temperature controller.

- **Compact size of only 17.6 x 15.7 x 2.3 mm**
- **Low power consumption of up to about 0.8 µA**
- **Wide supply voltage range: from 2.1 to 4.3 V**
- **A rich set of integrated internet/cloud service protocols**

Features

- 3GPP Release 14 compliant
- Frequency bands:
  - CAT-NB: B1/B2/B3/B4/B5/B8/ B12/B13/B14/B17/B18/ B19/B20/ B25/B26/B28/B66/B70/B85
- Compatible with SIM800C/SIM7020, easy to upgrade
- Control via AT commands according to 3GPP TS27.005.27.007 and customized SIMCOM AT commands
- Supply voltage range: 2.1 V to 4.3 V
- Optimized for power consumption of up to about 0.8 µA in PSM mode
- Operating temperature: -40 to 85 °C
- LCC form factor
- Dimensions: 17.6 x 15.7 x 2.3 mm
- Weight: 1.3 g (±0.2 g)
- Interfaces:
  - High-speed UART interface
  - GPIO pins
  - ADC interface
  - UICC and U/SIM card 1.8 V
  - Netlight
  - RI
- Software Features:
  - Pv4/IPv6 stack with TCP/UDP Protocol
  - Secure Connection with TLS/DTLS
  - Internet Services: UDP/MQTT/ MQTTS/HTTP/HTTPS/COAP
  - OMA Lightweight M2M (LWM2M)
  - Firmware update via UART and OTA
  - EAT
- Certifications (pending):
  - RoHS/REACH
  - CE-RED
  - GCF
  - Deutsche Telekom/Vodafone/ Telefonica

Key Applications

- Smart metering
- Street lighting
- Connected temperature controller
- Smoke detector

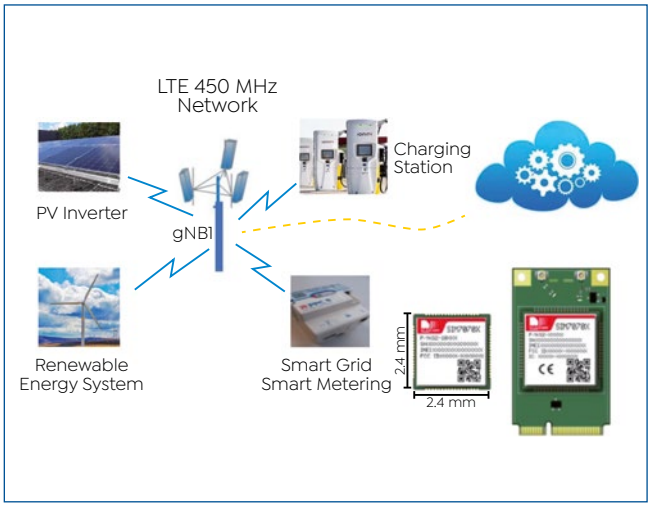
As a subset of the LTE standard, NB-IoT is designed to provide deeper coverage than traditional GSM solutions at a lower cost and with significantly increased battery life (up to 10 years), thanks to the extended Discontinuous Reception (eDRX) and Power Saving Mode (PSM) functionalities.

The SIM7022 NB-IoT cellular module is designed for applications that need low latency and low data throughput in a wide variety of radio propagation conditions.

Product order code
- S2-108HL
- S2-108HJ

SIM7070E

Dedicated LTE CAT M/NB2/EGPRS Module for LTE 450MHz Network Industry Market



SIM7070E – Typical Application

The SIM7070E is Multi-Band and Multi-Mode CAT-M/CAT-NB2/EGPRS cellular network module solution. It has strong extension capability with rich interfaces, including high-speed UART, GPIO, PCM, I²C, SPI, etc., which provide a lot of flexibility and ease of integration for the customer's application.

Due to the unique combination of performance, security, and flexibility, the SIM7070E is perfectly suited for low throughput data communication and low power consumption applications.

- **Combines all the key wireless technologies into one module**
- **Low power consumption up to about 3 µA in PSM mode**
- **LTE 450 MHz Network Support**
- **Good replacement solution for solving global 2G/CDMA 450 shutdown**

Features

- LCC form factor
- Dimensions: 24.0 x 24.0 x 2.3 mm
- Supply voltage range: 3.0 to 4.6 V
- Compatible with SIM7000/SIM800F/SIM900
- Operating temperature: from -40 °C to +85 °C
- Optional embedded GNSS (GPS/GLONASS/Beidou/Galileo)
- Optional 2 x 2 mm package eSIM
- Control via AT commands (3GPP TS27.005.27.007 and customized SIMCOM set)
- mini-PCIe interface module available (optional)
- Half-duplex FDD, single Rx, single antenna
- Power Class 2 TX for B31 & B72 and Class 5 for other LTE bands
- Frequency bands:
  - CAT-M: B1/B2/B3/B4/B5/B8/B12/B13/B14/B18/B19/B20/B25/B26/B27/B28/**B31**/B66/**B72**/B85
  - CAT-NB: B1/B2/B3/B4/B5/B8/B12/B13/B18/B19/B20/B25/B26/B28/**B31**/B66/B85
  - GPRS: 850/900/1800/1900 MHz
- Data rate (Kbps):
  - LTE Cat M1: DL 589/UL 1119
  - LTE Cat NB2: DL 127/UL 158.5
  - EGPRS: DL 296/UL 236.8
- Interfaces:
  - Pads for LTE and GNSS antenna
  - UART, SPI, I²C, GPIO, ADC
  - USB2.0 HS interface (480 Mbps)
  - UICC and U/SIM card (1.8 V)
  - Digital audio interface (PCM)
- Key software features
  - VoLTE support
  - IPv4/IPv6 stack with TCP/UDP
  - Secure connection with TLS/DTLS
  - Internet services: UDP/MQTT/FTP/FTPS/HTTP/HTTPS/COAP
  - OMA Lightweight M2M (LWM2M)
  - FW update via interface and OTA

Key Applications

- Smart metering
- Smart grid
- PV inverter
- Renewable energy system
- Circuit breaker
- PLC

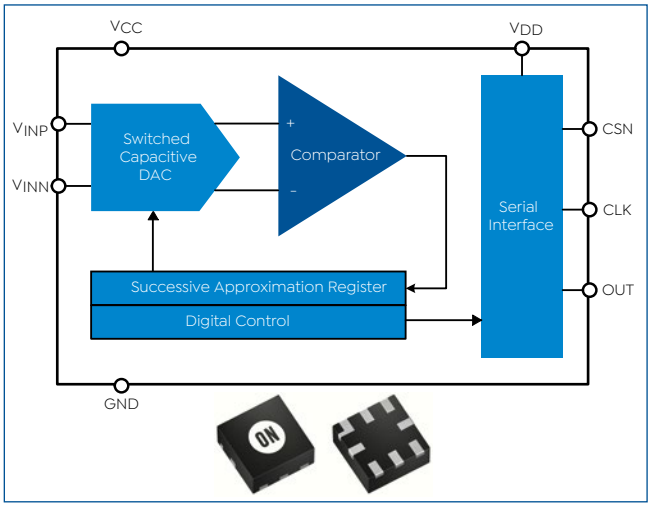
The SIM7070E is a multi-band CAT-M/CAT-NB2/EGPRS cellular network module, perfectly suited for LTE 450 MHz LPWA network applications and communication nodes in hard-to-reach places that require longer battery life.

With its Power Saving Mode (PSM) and Extended Discontinuous Reception (eDRX), the SIM7070E can extend battery life by up to 10 years.

Product order code
- NCD98010XMXTAG
- NCD98011XMXTAG

NCD9801x

12-Bit Low Power SAR ADC



NCD9801x – Block Diagram and Product Image

The NCD98010 (unsigned output) and NCD98011 (signed output) ADC products provide an extremely low power solution for analog to digital conversion applications using a capacitor-based successive approximation architecture. Optimized for low power consumption and high speed, they can achieve a sample rate of 2 MSPS while consuming less than 1 mW of power. The devices also feature a low input capacitance of 2 pF, an input voltage range of 1.65 to 3.3 V, and come in a space-saving 1.5 x 1.5 mm X2QFN8 package.

- **Ultra-low power 12-bit ADC, operation up to 2 MSPS**
- **Low input capacitance of 2 pF**
- **Small Package Size, 1.5 x 1.5 mm X2QFN8**
- **70 dB SNR at 2 MSPS**

Features

- Fully differential input
- 2 MSPS throughput
- Supply voltage range: 1.65 to 3.6 V
- Acquisition time: 62.5 ns
- Low gain error drift over temperature:
  - 0.0006% FS/°C
- Signal-to-Noise ratio (SNR at 1 kHz): 65 to 70 dB
- Total Harmonic Distortion (THD at 1 kHz): -80 dB
- Pre-calibrated
- SPI Interface
- Operating Ambient Temperature (TA): -40 to 120 °C
- Small 1.5 x 1.5 mm X2QFN8 package
- Pb-Free, Halogen-Free
- BFR Free and RoHS compliant

Key Applications

- Low-power data acquisition
- Battery-powered equipment
- Level sensors
- Ultrasonic flowmeters
- Motor controls
- Wearables
- Portable medical equipment
- Glucose meters

NCD9801x is the first in a family of SAR ADCs. It is best in class for low power consumption, offering a unique advantage to many potential applications. It provides low input capacitance and current consumption when compared to competing solutions.

The NCD9801x is supported by STR-NCD98010-GEVK, a Strata-enabled ADC evaluation board for simplified evaluation and testing.

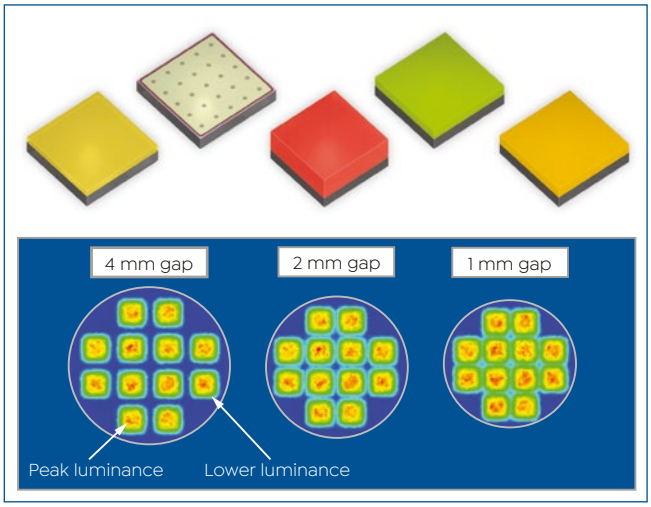
OSRAM

Product order code

- Q65113A0462
- Q65113A0463
- Q65113A0464
- Q65113A0468
- Q65113A0461

OSLON® Pure 1010 Colors

Highest Luminance at the Smallest Size



OSLON® Pure 1010 Series

The OSLON® Pure 1010 is designed to be used in spotlights for retail lighting, where exceptionally compact LEDs with high light output are needed. The scalability of the LEDs gives customers outstanding flexibility. With best-in-class Color Over Angle (COA), the OSLON® Pure 1010 enables customized high-density clustering, offering the best Center Beam Candela Power (CBCP) and Cd/W.
The OSLON® Pure Colors join the 1010 family, targeting professional indoor, retails, and special lighting segment, where high flux density is key. Customers can realize customized color spectra tailored to specific project requirements.

- **Real chip scale Package (1 × 1 mm) with top emitter**
- **Perfect lambertian emitters with real chip scale package for small luminaire designs**
- **White: best-in-class Color Over Angle**
- **Superior quality without bond wires or need for spacing**

Features

- Real Chip Scale Package (1 × 1 mm) with top emitter:
  - Perfect fit for highly dense clustering, tunable CCT, and miniature narrow viewing angle spotlights
- Best-in-class COA
- OSLON® Pure family can match various requirements for luminous flux and efficacy
- White:
  - Available with CRI 80, CRI 90
  - Wide range of CCT selection
- Colors:
  - Cyan, deep blue, true green (chip level conversion)
  - PC green, PC red (phosphor-converted)
  - Lambertian emitters (120 °)

Key Applications

- High-density cluster spots
- Architectural lighting
- Ambient & decorative lighting
- Entertainment and stage lighting
- Customized spectra
- Medical lighting (e.g., endoscopy)
- Vehicle lighting (e.g., bicycle)
- Indoor retail and shop lighting

OSRAM OS' OSLON® Pure LEDs are Lambertian emitters at real chip-scale size, delivering the highest luminance available on the market. Their superior quality without bond wires or the need for spacing makes them the perfect fit for dense clustering, tunable CCT, color mixing, and miniature narrow viewing angle spotlights. Seamless and flexible assembly on boards also enables customer-specific COB replacement.

OSLON® Pure LEDs provide Lambertian emission in the smallest form factor possible for a 1 x 1 mm die, simplifying luminaire designs.

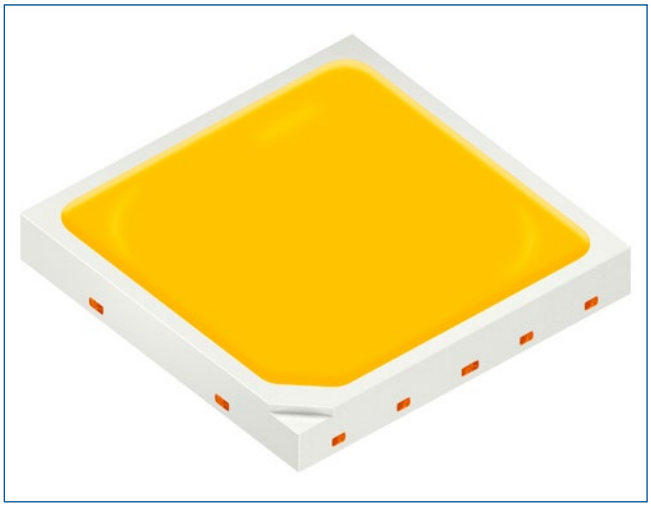
OSRAM

Product order code

- Q65113A1590
- Q65113A1591
- Q65113A1592
- Q65113A1593
- Q65113A1594
- Q65113A1595

OSCONIQ® S 5050

HP LEDs in 5050 QFN Package with Enhanced Corrosion Stability and Superior Lifetime



OSCONIQ® S 5050

The OSCONIQ® S 5050 high power LED offers optimum performance for high efficacy luminaires. The high lumen packages enable lighter and smaller fixture designs, provide excellent corrosion resistance, great lifetime, as well as best-in-class Color Over Angle (COA) and color stability in a 5050 package.
The enhanced corrosion stability, superior lifetime, and ESD protection up to 8 kV make it an ideal candidate for street lighting, high bays, and tunnel lighting applications. Due to the symmetric light output, it offers improved light uniformity, in combination with secondary optics.

- **Superior corrosion resistance per IEC standard**
- **Best-in-class Color Over Angle (COA) and color stability**
- **Optimal for high efficacy luminaires in 1 to 2 W conditions**
- **High lm/kg, enables lighter & smaller design**

Features

- Enhanced corrosion stability:
  - Meets L95 at 40 °C, 80 % RH, 15 ppm H_2S, 96 h
- Superior lifetime L70B50:
  - 100,000 h at Ts 85 °C, 150 mA/chip
- Package: white SMT, colored diffused silicone resin
- Radiation angle: 120° (typ.)
  - Lambertian emitter
- Color temperature: 3000 to 6500 K
- Color Rendering Index (CRI): 70 (min.)
- ESD up to 8 kV
- Luminous Flux: 217 lm (typ.) at 4000 K
- Luminous efficacy: 218 lm/W (typ.) at 4000 K
- Optimal illuminance, symmetric configuration:
  - Improved light uniformity with secondary optics
- Fine binning according to:
  - Brightness, forward voltage, color temperature
- Two voltage options available:
  - GW Q9LR32.PM: 6 V
  - GW Q9LR31.PM: 24 V
- 5050 EMC compatible footprint

Key Applications

- Industrial and lighting applications:
  - Industrial high bay lighting
  - Street and tunnel lighting
  - Smart outdoor lighting

The new OSCONIQ® S 5050 joins the line-up of products targeting the professional outdoor lighting segment where not only performance and lifetime but also reliability is key.

With superior corrosion protection, the OSCONIQ® lead frame package brings its robustness stability to another level, further enhancing its suitability for professional outdoor lighting applications.

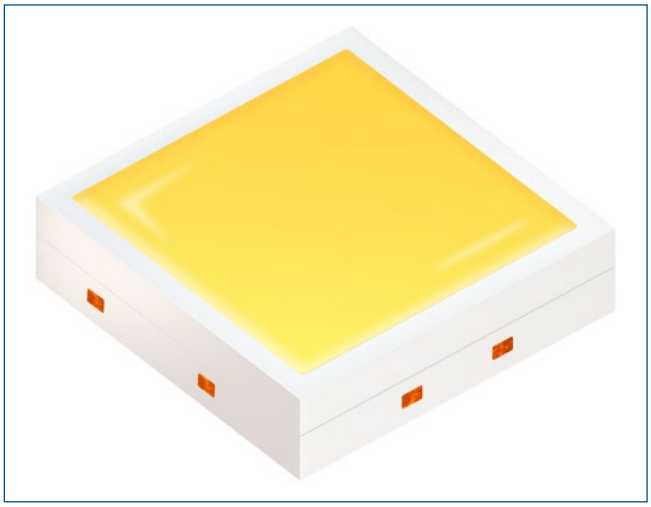
OSRAM

Product order code

- Q65113A2142
- Q65113A2180
- Q65113A2181
- Q65113A2182
- Q65113A2183
- Q65113A2184

OSCONIQ® C 2424

Highly Reliable CSP with Superior Performance and Lifetime



OSCONIQ® C 2424

Unlike conventional CSP solutions, OSCONIQ® C 2424 not only offers the highest performance levels but measures up to lensed high-power devices in terms of reliability and lifetime.
CSPs deliver high lumen density enabling compact fixture designs, but they lack reliability for outdoor applications. Conventional CSPs cannot provide the same lifetime and robustness as high-power LEDs, especially for outdoor applications. Based on our rich experience in the automotive segment where Epoxy Molding Compound (EMC) has been widely used, the technology is now available for general lighting applications to withstand the harshest conditions when needed.

- **CSP with small footprint of just 2424 – LES 2121**
- **Highly reliable and robust package design (based on OSCONIC® P platform)**
- **Wide current drive range up to 1.5 A**
- **Broad CCT range offerings of CRI 70, 80 and 90**

Features

- High efficacy and flux output
- Superior thermal dissipation
- Radiation angle (typ.): 120 ° (Lambertian emitter)
- ESD protection up to 8 kV:
  - ANSI/ESDA/JEDEC JS-001 (HBM, Class 3B)
- Fine binning according to:
  - Brightness, forward voltage, and color temperature
- Enables high efficacy luminaires with total system cost reduction
- Excellent LM 80 report available
- Broad CCT range offerings in:
  - CRI 70 (2200 K – 6500 K)
  - CRI 80 (2200 K – 5700 K)
  - CRI 90 (2700 K – 6500 K)

Key Applications

- Industrial and lighting applications:
  - Industrial high bay lighting
  - Portable LED Lighting
  - Spotlights
  - Street and tunnel lighting
  - Floodlight
  - Area lighting

OSCONIQ® C 2424 is a breakthrough CSP on the market. It ticks all the boxes - robustness, efficacy, lifetime, high lumen density, great price-performance ratio - making it the best CSP-like component available.

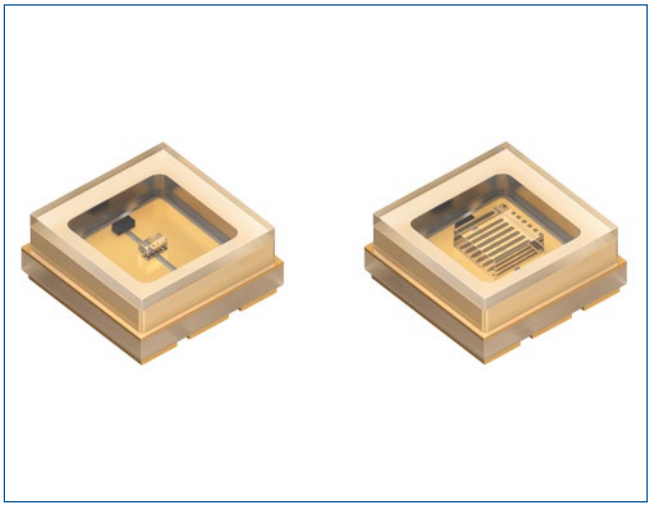
Being a top emitter, it allows for a very compact clustering in space-constrained applications. It has an outstanding thermal resistance, the lowest forward voltage, and great efficacy. Combined with its long lifetime and high robustness, it is an ideal CSP-like high power solution with all the benefits of a premium high power LED.

OSRAM

Product order code
- Q65113A2365
- Q65113A2366

OSLON® UV 3636

SU CULBN1.VC and SU CULDN1.VC: The First UV-C LEDs from OSRAM Opto Semiconductors



OSLON® UV 3636 – Low-Power (left) and Mid-Power (right) Variant

Imagine a world in which light makes your everyday life healthier, safer, and more pleasant. With UV-C solutions powered by OSRAM OS, this vision becomes a reality. 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, ranging from point-of-use water treatment, automotive interior disinfection to air purification in portal devices and HVAC systems.

- **Color: λ_{PEAK} = 275 nm (UV-C)**
- **Purification and disinfection without the use of chemicals**
- **Radiant Flux: typ. 4.7 mW (low-power), typ. 42 mW (mid-power)**
- **Radiant Efficiency: typ. 2.6 % (low-power), typ. 2.1 % (mid-power)**

Features

- Package: ceramic package with integrated glass cover
- Color: λ_{PEAK} = 275 nm (UV-C)
- Radiation angle: 120 ° (typ.)
  - Lambertian emitter
- Chip technology: AlGaN based Flip Chip technology
- SU CULBN1.VC (low-power):
  - Radiant flux: typ. 4.7 mW
  - Radiant efficiency: typ. 2.6 %
  - ESD: 2 kV acc. to ANSI/ESDA/JEDEC JS-001 (HBM)
- SU CULDN1.VC (mid-power):
  - Radiant flux: typ. 42 mW
  - Radiant efficiency: typ. 2.1 %
  - ESD: 5 kV acc. to ANSI/ESDA/JEDEC JS-001 (HBM)

Key Applications

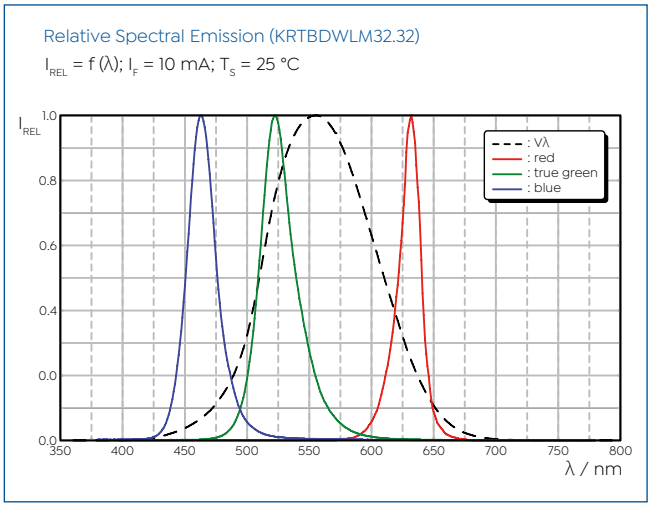
- Healthcare:
  - UV-C air disinfection
  - UV-C surface disinfection
  - UV-C water disinfection
  - Smoke/dust/particle sensing
- Industrial:
  - Curing applications
  - Treatment in the chemical industry

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 for the broadest range of different applications.

The OSLON® 3636 UV series LEDs combine low and mid-power range in a compact 3.6 x 3.6 mm package with a common footprint, high WPE (Wall Plug Efficiency), and a robust design for a longer lifetime.

OSIRE® E3323 – KRTBDWLM3x

First Automotive RGB LED Providing Measuring Data of Optical Parameters in a DMC



OSIRE® E3323

OSIRE® is OSRAM Opto Semiconductors (OSRAM OS) brand family, designed to meet the colored ambient lighting requirements in automotive applications. The OSIRE E3323 offers individually accessible red, true-green, and blue LED chips for maximum flexibility in terms of color point, driver selection, and interconnection. Customers can benefit from the imprinted Dot Matrix Code (DMC), which provides access to measurement data of luminous intensity, forward voltage, and color coordinates of every single LED at two setpoints (10 and 50 mA). This feature helps to reduce the optical measurement effort on the customer side.

- **Dot Matrix Code (DMC) providing access to measurement data of optical & electrical parameters**
- **Individually accesible LED chips for maximum flexibility**
- **Triangle and series chip configuration available**
- **White point calibration possible using measurement data**

Features

- Close LED chip arrangement:
  - Triangle arrangement: E3323 - KRTBDWLM31.32
  - Series arrangement: E3323 - KRTBDWLM32.32
- Package: white SMD package, colorless clear silicone resin
- Chip technology: Thinfilm/ThinGaN
- Common anode
- Maximum forward current (at 25 °C): 50 mA
- ESD: 2 kV acc. to ANSI/ESDA/JEDEC JS-001 (HBM, Class 2)
- Device ID linked to electro-optical test data
- Access to look-up file provided by OSRAM OS (.CSV format)
- White point calibration based on test data:
  - Test data is available at two setpoints (10 and 50 mA)
- DMC size: 1.6 x 0.4 mm
  - Pixel size: 50 µm
- Compact size: 3.3 x 2.3 x 0.7 mm
- Corrosion robustness class: 2B
- Operating temperature range (T_{OP}): -40 to 110 °C
- AEC-Q102 qualified

Key Applications

- Automotive:
  - Interior ambient lighting

The OSIRE E3323 utilizes an RGB package with an imprinted Data Matrix Code (DMC) carrying the unique Device ID. The Device ID is linked to electro-optical measurement data, including chromaticity coordinates, luminous intensity, and forward voltage for each color component at 10 mA and 50 mA. This feature helps to reduce calibration effort. DMC also enables improved traceability.

The OSIRE E3323 RGB LED is designed for automotive applications and complies with the AEC-Q102 specifications.

SMART ENERGY MANAGEMENT

According to studies, residential and commercial buildings are responsible for 36% (USA) and 25% (Europe) of total energy demand while contributing to up to 43% of CO2 emissions. It should be emphasized that CO2 legislation takes all the largest polluters and into account and is not limited to the automotive segment only. Therefore, CO2 regulation is the main reason for the emergence of new "green" trends and business models in the city and infrastructure segment.

Besides highly efficient power semiconductors, many other technologies are also required to enable the zero-emissions concept. Emerging new solutions in communications, edge computing, data processing, and cyber-security areas are also required to create a decentralized energy distribution system, in which residential and commercial consumers participate actively by sharing energy surplus from localized renewable green energy sources and storage elements (photovoltaic cells, wind turbines, battery storage). Energy flow can be managed and optimized by advanced AI algorithms, while transactions between the participants can be done very easily and at minimal cost using Blockchain technologies. Therefore, the digitalization of the energy sector is another key prerequisite for the holistic and efficient integration of clean, renewable energy sources into the city grid.

The energy landscape changes rapidly by introducing clean, renewable energy sources into the grid. However, incorporating green renewables is not an easy task: it requires careful planning, especially since their output is not constant and depends on many different factors. AI-enabled Non-Intrusive Load Management (NILM) algorithms can collect, filter, and process correlated energy production and consumption data in near real-time, providing accurate behavioral patterns and forecasts to the local Distribution System Operator (DSO). In turn, DSO manages energy resources accordingly via the bi-directional power grid. Energy gateways (eGTW) are edge computing platforms with embedded AI, capable of advanced data processing and behavioral pattern prediction on a household appliances level. Smart eGTWs can vastly disaggregate the energy consumption of a residential or commercial unit, enabling a highly optimized energy distribution.

An increasing number of Electric Vehicles (EVs) has an immense impact on the city grid infrastructure. However, there's still room for optimization: while not used, EVs can be utilized as additional energy storage units, participating in the energy distribution network. With the introduction of the Vehicle to Grid (V2G) bi-directional EV charging stations, EVs can establish exchange with the grid, creating a local "virtual pool" of energy that can be used to overcome high energy demand during peak hours. By utilizing the power distribution model described above, energy consumption can be largely optimized both locally (in a large commercial building) or on a city level (via bi-directional power exchange).

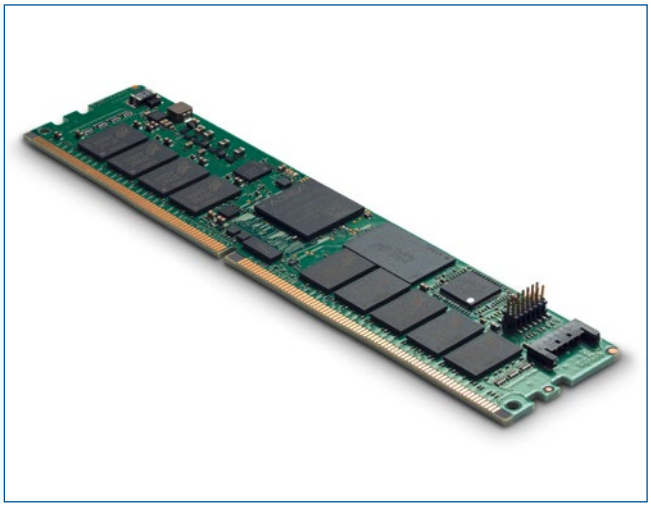
It is necessary to harmonize many different technologies to realize the concept of smart energy distribution. There are standards already in place to enable this concept. For example, we can find standardized communication protocols on the EV Supply Equipment (EVSE), such as the ISO/IEC15118-compliant HomePlug Green protocol, while the G.hn protocol, supported by the HomeGrid Forum, is more prevalent in the household applications. Although some standards are still under development, the stage is already set to fully integrate green energy production into the city's smart energy distribution system.

Product order code

- MTA4ATF51264HZ-3G2J1
- MTA4ATF1G64HZ-3G2E2
- MTA8ATF2G64HZ-3G2E2
- MTA9ASF1G72PZ-3G2E2
- MTA9ASF2G72PZ-3G2E1
- MTA18ASF4G72PZ-3G2E1

DRAM Memory Modules

Micron Technology DRAM Modules



Micron NVDIMM 32 GB

Accelerate your time-to-market with quality DRAM modules rigorously tested for reliability in a wide range of applications. From the cost-sensitive needs of consumer computing to the extreme temperature and performance needs of industrial applications to the exacting specifications of enterprise systems, we have the right solution for your design.

- **1.2 V and RoHS (Green)**
- **4 GB to 256 GB densities (varies by form factor), ECC and non-ECC**
- **2400 to 3200 MT/s and versions x64/x72**
- **RDIMM, SODIMM, UDIMM, ECC SODIMM, ECC UDIMM, VLP DIMMs**

Features

- DDR3, DDR4, DDR5 Modules
- RDIMM, SODIMM, UDIMM, ECC SODIMM, ECC UDIMM, VLP DIMMs form factors
- Densities from 4 GB to 256 GB
- Data rates: 2666 to 3200 MT/s for DDR4

Key Applications

- Consumer: printers
- Enterprise: servers
- Medical: medical imaging
- Networking: 5G
- Industrial: Industrial PCs
- Compute: datacenters and Clouds

As one of the world's largest memory and data storage manufacturers, Micron has all the necessary in-depth knowledge and capabilities to build memory modules from start to finish. The DRAM ICs are tested before assembling the modules, and then the modules themselves are re-subjected to a series of tests as final products.

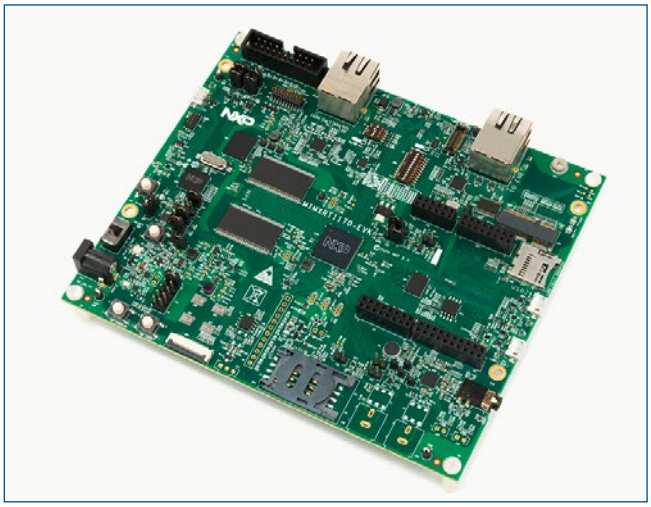
From high-performance SODIMM to high-density LRDIMM, Micron guarantees the quality and reliability of devices that customers can rely on.

Product order code

- MIMXRT1176DVMAA
- MIMXRT1176CVM8A
- MIMXRT11726VM8A

i.MX RT1170 Crossover MCUs

Ushering in the GHz MCU Era



i.MX RT1170 Evaluation Kit

The i.MX RT1170 MCU family features four target pillars that really set it apart, with its GHz performance, advanced security, rich feature set, and power efficiency. It is a dual-core device boasting a 1 GHz Arm® Cortex®-M7 and a 400 MHz Cortex®-M4. Both cores include a good amount of tightly coupled memory that further improves overall system performance. It has advanced security features along with up to 2 MB SRAM, and 2D HW GPU, 2 Gigabit Ethernet ports (and one 10/100), 2 HS USB OTG with PHY, and support for a MIPI display and camera. The i.MX RT1170 is manufactured in 28-nm FD-SOI technology, optimized for both active power and static power requirements.

- **Performance: 1 GHz Arm® Cortex®-M7 with 512 KB TCM/400 MHz Cortex®-M4 with 256 KB TCM**
- **Security: Secure boot, crypto engine, on-the-fly AES decryption, tamper detection**
- **Rich Integration: 2 MB SRAM, 2D GPU and 2D accelerator, MIPI CSI/DSI, 2 x 1 GbE**
- **Power Efficiency: 28 nm FD-SOI process, optimized for both active power and static power requirements**

Features

- Arm® Cortex®-M7 core:
  - Up to 1 GHz, 32 KB/ 32 KB L1 Cache, 512 KB TCM
- Arm® Cortex®-M4 core:
  - Up to 400 MHz, 16 KB/ 16 KB L1 Cache, 256 KB TCM
- 2 MB on-chip SRAM (including TCM for CPU core)
- Parallel LCD display up to WXGA (1280 x 800) at 60 FPS
- 8/16/24-bit parallel camera sensor interface
- 2-lane MIPI CSI and 2-lane MIPI DSI
- 2D GPU accelerator
- 8/16/32-bit SDRAM controller up to 200 MHz
- 8/16-bit parallel NOR Flash / NAND Flash / SRAM
- 2 x dual-channel FlexSPI interfaces with on-the-fly decryption:
  - Support for serial NOR, serial NAND, HyperBUS devices
- 2 x eMMC 5.0 / SD 3.0 / SDIO port
- 2 x USB 2.0 OTG, HS/FS, Device or Host role, PHY included
- Audio: 4 x I2S/SAI, 1 x SPDIF Tx/ Rx, ASRC, 8-ch digital microphone input
- 3 x Ethernet:
  - 1 Gbps Ethernet with AVB support
  - 10/100 Ethernet with IEEE 1588 support
  - 1 Gbps Ethernet with TSN support
- 2 x 12-bit ADC at 4.2 MSPS, up to 20 input channels total
- 4 x analog comparator, 1 x 12-bit DAC
- Full PMU integration, DC/DC, LDOs

Key Applications

- ML-based edge applications
- Industrial computing designs
- Motor control and power conversion
- Personal health and fitness
- Voice-enabled IoT devices

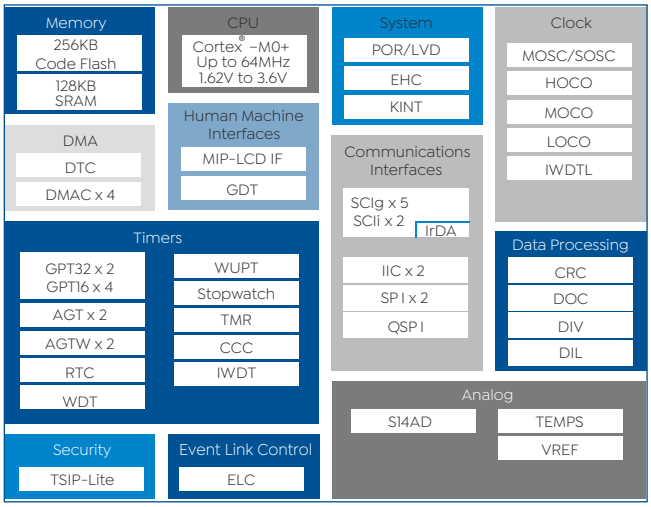
Smart home customers can take advantage of the MIPI interfaces and the integrated graphics accelerators, while consumer audio customers are able to use the i.MX RT1170 MCU as a DSP alternative, taking advantage of the USB audio class enablement offered in MCUXpresso Suite of Software and Tools. The i.MX RT1170 device even offers PCI pre-certification for the point-of-sale market.

Product order code

- R7F0E01182CFP#AA0
- R7F0E01082CFP#AA0
- R7F0E01182DBR#HA0
- R7F0E01082DBR#HA0
- R7F0E01182CFM#AA0
- R7F0E01082CFM#AA0

RE01-256K

Ultra-low Power Microcontroller with Leading EEMBC ULPmark™ Benchmark Score of 705



RE01 256KB – Block Diagram

The RE01-256K offers a unique combination of high performance, low voltage operation, and extremely low active and standby current, making the RE01-256K ideal for a wide range of IoT sensor applications. The RE01-256K has a high ratio of Flash/SRAM, featuring 256 Kbytes of ultra low power flash memory and 128 Kbytes of SRAM, offering execution from flash with current consumption as low as 12 uA/MHz. These features allow the RE01 to achieve market-leading levels of performance in the independently verified EEMBC ULP benchmarks.

- **High-speed operation at low voltage, 64 MHz at 1.62 V**
- **Ultra-low power operation, 12 uA/Mhz active mode, 100 nA standby mode**
- **Ultra-low power ADC operation, 4 uA operation with 1.6 kSPS**
- **Integrated energy harvesting controller with integrated battery charging support**

Features

- CPU: Arm®Cortex®-M0+
  - Up to 32 MHz, and up to 64 MHz in boost mode
- Memory: 256 KB flash, 128 KB SRAM
- Ultra-low current consumption
- Active mode:
  - From 12 to 25 µA/MHz
- Deep StandBy mode:
  - 100 nA (350 nA with full real-time clock and reset manager)
- SRAM data retention:
  - Less than 12 nA per 32 KB
- Unique low power peripherals
- On-chip high speed, medium speed, and low-speed oscillators:
  - High speed (HOCO): 24, 32, 48, 64 MHz
  - Medium speed (MOCO): 2 MHz
  - Low speed (LOCO): 32 kHz
- Frequency Lock Loop (FLL) enables 0.5% HOCO accuracy
- Clock Correction Circuit (CCC)
- Wakeup timer with 30 nA operation
- RTC with 100 nA operation
- 2 x 16-bit & 4 x 32 bit general-purpose timers (PWM)
- 2 x 8-bit timers
- 2 x 16-bit and 2 x 32-bit asynchronous independent timers
- Low-speed timer
- Watchdog timer with dedicated 32 kHz oscillator
- 7 x USART (2 with FIFO)
- 2 x I²C interface
- 2 x SPI, 1 x Quad SPI interface
- 1 MSPS 14-bit ADC, 1.6 kSPS at 32 kHz (4 µA consumption)
- Memory in Pixel Display Interface
- 2D graphics display circuit
- Energy Harvesting Controller (EHC)
- Trusted Secure IP (TSIP)
- Tiny 72-pin WLBGA package: 2.9 x 3.1 mm

Key Applications

- Sports watch, wearable devices
- Smart home (water leakage detection, smart lock)
- Healthcare (portable ECG)
- Smart agriculture & structure health monitoring
- Location tracker (GPS)

The RE01 is a unique family of MCUs with a high processor clock rate, low voltage operation, and extremely low power consumption. The EEMBC ULP-CP benchmark score is more than 50% better than the competition.

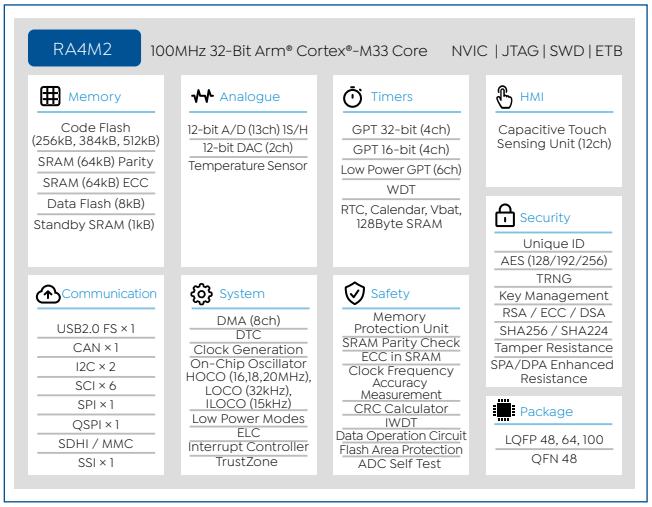
It offers high-speed operation under the limited power supply, such as in energy harvesting or coin cell battery applications. The RE01 enables compact size solutions using a smaller battery with the same level of performance.

Product order code

- RENR7FA4M2AD3CFP#AA0
- RENR7FA4M2AD3CFM#AA0
- RENR7FA4M2AD3CFL#AA0
- RENRTK7EKA4M2S00001BE

RA4M2

32-bit Arm® Cortex®-M33 100MHz MCU with Trust Zone and Secure Element Functionality



RA4M2 – Block Diagram

The Renesas RA4M2 group uses the high-performance Arm® Cortex®-M33 core with TrustZone®. In concert with the Secure Crypto Engine, it offers Secure Element functionality. It also offers rich connectivity options, such as USB 2.0 Full-Speed (Host/Device), SDHI, QSPI, and advanced analog.

The RA4M2 is supported by an open and flexible ecosystem concept – the Flexible Software Package (FSP) built on FreeRTOS – and is expandable to use other RTOSes and middleware. The RA4M2 is suitable for IoT applications requiring future-proof security, large embedded RAM, and low active power consumption down to 81 uA/MHz running CoreMark® from Flash.

- **RA4M2 Arm® Cortex®-M33 based MCUs boost performance up to 100 MHz for IoT Edge devices**
- **The latest Arm®v8-M core architecture with TrustZone + Secure Element functionality**
- **Lowest active power consumption down to 81 uA/MHz**
- **CTSU Capacitive Touch**

Features

- Arm® Cortex®-M33 up to 100 MHz
- Arm®v8-M architecture
- Arm® Memory Protection Unit (MPU)
  - Protected Memory System Architecture
  - Secure/Non-Secure MPU: 8 regions
- 512 KB code FLASH, 8 KB data FLASH
- 128 KB SRAM
- DMA 8 channels + DTC 5 channels
- CTSU Capacitive Touch
- Multiple on-chip clock sources:
  - Clock trim function for HOCO/MOCO/LOCO
  - PLL/PLL2, Clock Out support
- Independent watchdog timer with dedicated 15 kHz oscillator
- 12-bit A/D Converter
- 2 x 12-bit D/A Converter
- Temperature Sensor
- 6 x Serial Communications Interface:
  - Asynchronous and 8-bit clock synchronous interface
  - Smart card interface
  - Simple I²C, Simple SPI
  - Manchester coding
- 2 x I²C, 1 x SPI, Quad SPI
- Crystal-less USB 2.0 FS
- 2 x CAN
- SD/MMC host interface
- Serial Sound Interface Enhanced
- Security and Encryption:
  - Secure Crypto Engine 9
  - Arm TrustZone
  - Device lifecycle management
  - Tamper pins function

Key Applications

- Secure communication gateways
- Cloud gateways
- IoT communication platform & secure datalogger
- Metering control boards/ data concentrators
- HMIs with robust capacitive touch
- Central control unit for power conversion applications
- PLCs

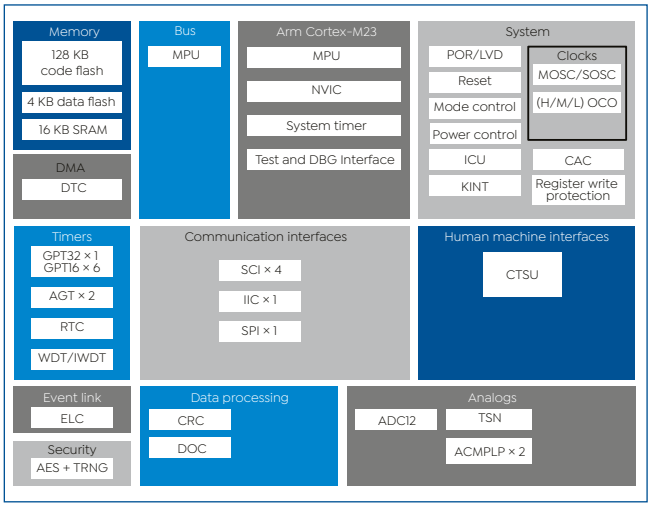
RA4M2 is a full-featured general-purpose MCU aimed at IoT and other applications that require an abundance of connectivity options, a high amount of RAM, low active power consumption, and state-of-the-art embedded security.

Featuring an integrated Secure Crypto Engine with cryptography accelerators, key management support, tamper detection, and power analysis resistance, in concert with Arm TrustZone, the RA4M2 delivers integrated Secure Element functionality for future-proof embedded security.

Product order code
- RENR7FA2E1A92DFM#AA0
- RENRTK7EKA2E1S00001BE

RA2E1

Entry-level Single-chip Microcontroller Based on the 48-MHz Arm® Cortex®-M23 Core



RA2E1 Block Diagram

The RA2E1 group is an entry-level single-chip microcontroller based on the 48-MHz Arm® Cortex®-M23 core and up to 128-KB code flash and 16-KB SRAM memory. The RA2E1 group supports a wide operating voltage range from 1.6 to 5.5 V and a large selection of packages such as LQFP, QFN, LGA, BGA, and WLCSP, with two temperature ratings (T_a): up to 85 °C and up to 105 °C. The RA2E1 provides pin and peripherals compatibility with the RA2L1. It is ideal for battery-operated applications and other systems that require high performance, low energy consumption, and compact size.

- **Optimized peripheral functions for cost-sensitive applications**
- **High versatility and low power consumption make it ideal for a wide range of applications**
- **The small size package sizes enable designers to use it in space-constrained applicaitons**
- **Upgrade path with hardware and software scalability**

Features

- 48 MHz Arm® Cortex®-M23
- Up to 128 KB Flash Memory and 16 KB SRAM
- 4-KB data flash memory (100,000 P/E cycles)
- 32-bit & 16-bit general-purpose timers
- Low power asynchronous general-purpose timer
- 12-bit A/D converter
- Low-power analog comparator
- Temperature sensor
- Enhanced capacitive touch sensing unit
- Serial communications interface (UART, Simple SPI, Simple I²C)
- SPI/I²C Multimaster interface
- HW AES/TRNG & Unique ID
- HW safety features for IEC/UL60730 certification
- High current drive & 5V tolerant IO ports
- ±1% highly accurate high-speed on-chip oscillator (HOCO)
- Wide voltage range: 1.6 to 5.5 V
- Flexible power architecture with Fast Wakeup
- Best-in-class HAL driver code
- Support for Arm® ecosystem and Renesas development tools
- Multiple package options:
  - LQFP, QFN, LGA, BGA, WLCSP
  - Supports T_a up to 105 °C

Key Applications

- System control for HA
- Power management for battery applications
- User interface for medical/health care devices
- Sensor management for detectors

The RA2E1 microcontrollers are intended for 16-bit applications where 32-bit performances are required, such as in consumer products, appliances, and industrial equipment. The RA2E1 covers a wide array of memory and pin count combinations, further enhancing the overall cost efficiency.

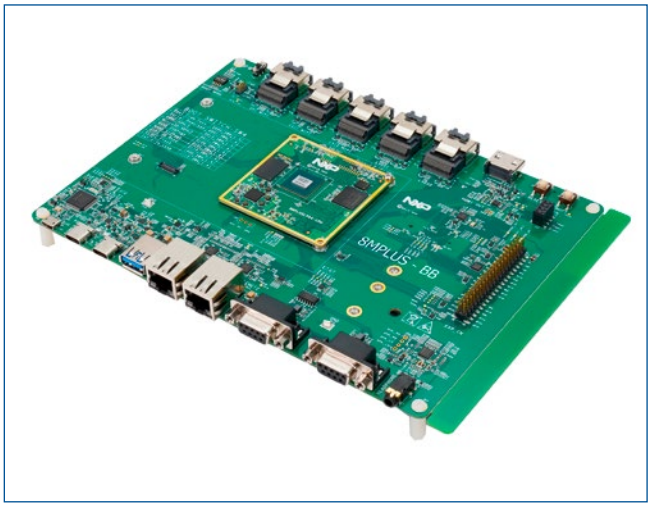
Designers starting with the RA2E1 can benefit from upgrading to any of the devices in the RA family portfolio at any time, with an extraordinary degree of reusability of development tools and software (RA Family Flexible Software Package - FSP).

Product order code

- MIMX8ML8DVNLZAB
- MIMX8ML8CVNKZAB
- MIMX8ML6DVNLZAB
- MIMX8ML6CVNKZAB
- MIMX8ML4DVNLZAB
- MIMX8ML4CVNKZAB

i.MX 8M Plus Applications Processor

High-performance, Power-efficient, Scalable and Secure Computing for Edge Devices



I.MX8 Plus Evaluation Kit

The i.MX 8M Plus is NXP's first device within the i.MX Family with an integrated Neural Processing Unit (NPU) - a machine learning accelerator running at up to 2.3 TOPS. The i.MX 8M Plus also has dual integrated Image Signal Processors (ISPs) for the advanced vision system.
The i.MX 8M Plus family focuses on machine learning and vision, advanced multimedia, and industrial automation with high reliability. It is built to meet the needs of smart home, building, city, and Industry 4.0 applications.

- **Quad/Dual Arm® Cortex®-A53 processor with a Neural Processing Unit (NPU) at up to 2.3 TOPS**
- **Dual Image Signal Processors (ISP) and two camera inputs for an effective vision system**
- **Video CODEC (Including H.265), 2D/3D GPU, and audio/voice functionalities**
- **Real-time control with Cortex®-M7**

Features

- Quad/Dual Cortex®-A53 cores running up to 1.8 GHz
- Cortex®-M7 running up to 800 MHz and HiFi 4 DSP also running up to 800 MHz
- Integrated Neural Processing Unit for ML acceleration with up to 2.3 TOPS
- HDMI with Enhanced Audio Return Channel (eARC)
- Multiple displays including MIPI-DSI, LVDS, and HDMI:
  - Support up to 2 x 1080p60 or 1 x 4kp30
- 1080p60 H.265 and H.264 video encode and decode
- PCIe Gen3, SDIO, and USB
- 2 x Gigabit Ethernet (1 with TSN), CAN FD, SD/eMMC
- High industrial reliability with DRAM inline ECC
- 14nm FinFET technology

Key Applications

- Machine vision and robot control
- Industrial computers, gateways, HMI
- Printers and scanners
- Factory automation
- Safety, security, and surveillance
- Traffic monitor and flow optimization
- Service drones
- Surround sound and soundbars
- Wireless or networked smart speakers
- Voice-assisted products

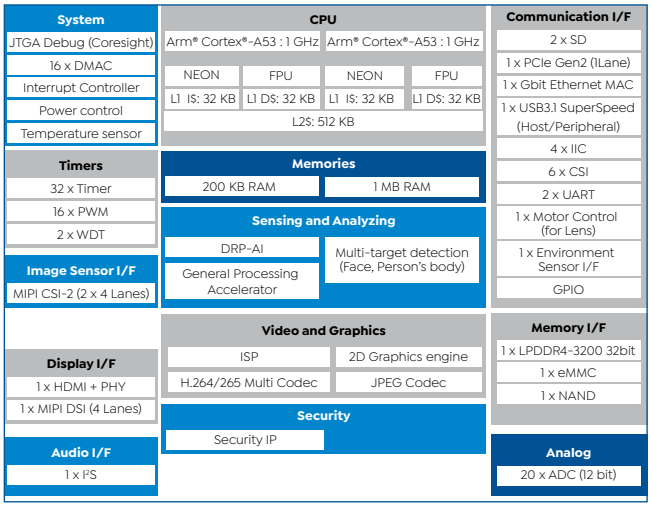
Built on 14 nm FinFET technology, the i.MX 8M Plus features powerful dual or quad Cortex-A53 cores at up to 1.8 GHz, a Cortex-M7 running up to 800 MHz for real-time tasks, and a 3D GPU that enables video and multimedia acceleration. The i.MX 8M Plus has a broad range of features that address different market needs.

The i.MX 8M Plus offers a rich and comprehensive set of high-speed interfaces and peripherals along with robust control networks supported by dual CAN-FD and Gigabit Ethernet with TSN capabilities, thereby expanding its application to the demanding Industry 4.0 market.

Product order code | • R9A09G011GBG#BCC

RZ/V2M

64-bit Dual ARM® Cortex®-A53 1 GHz MPU with Vision-Optimized AI Accelerator



RZ/V2M Functional Block Diagram

The RZ/V2M is an ASSP for a vision AI for real-time human and object recognition in embedded devices. It is equipped with Renesas' unique AI-only accelerator (DRP-AI) and a 4K-compatible Image Signal Processor (ISP). The RZ/V2M combines high-speed AI inference and low power consumption, achieving 1 TOPS/W class power performance.
In addition, the image signal processor is highly robust, producing a stable image that allows for a high AI recognition accuracy. As a result, the RZ/V2M is ideal for vision AI applications in a wide range of embedded markets, including surveillance security, ANPR, robotics, and healthcare.

- **DRP-AI: this flexible original IP realizes AI inference with higher power efficiency**
- **ISP Supports 4K at 30 FPS camera input with many kinds of correction functions**
- **High-speed interfaces such as MIPI-CSI2, PCIe, and USB3**
- **H.265/H.264 multi-CODEC**

Features

- CPU and DDR memory interfaces:
  - 2 x Cortex®-A53 up to 1.0 GHz
  - 32-bit LPDDR4-3200
- Vision and Artificial Intelligence:
  - AI accelerator: DRP-AI at 1.0 TOPS/W class
  - Image Signal Processor (ISP), multi-stream available
  - Camera interface: 2 x MIPI CSI-2
  - Face and human detection engine
- Video and graphics:
  - H.265/H.264 multi-CODEC
  - Encoding: H.265 up to 2160p30, H.264 up to 1080p120
  - Decoding: H.265 up to 2160p30, H.264 up to 1080p120
  - 2D graphics engine: 200 MPixels/s fill-rate
  - Display: MIPI-DSI (4-lane), HDMI 1.4a
- High-speed interfaces:
  - 1 x Gigabit Ethernet
  - 1 x USB3.1 Gen 1 Host/Peripheral
  - 1 x PCIe Gen 2 (1-lane)
  - 2 x SD 3.0
  - 1 x NAND Flash Interface ONFI1.0
  - 1 x eMMC 4.5.1
- Hardware Security Engine provided
- Package: FCBGA 15 x 15 mm, 0.5 mm pitch

Key Applications

- Object detection (surveillance & traffic monitoring cameras)
- Classification (product scanner, POS terminal)
- Face recognition (security door, door phone)
- Visual Inspection (Factory Line)
- Motion capture (sports analysis)
- Detection support (medical camera)
- Appliance with AI

The Dynamically Reconfigurable Processor (DRP) technology from Renesas is special-purpose hardware built into selected RZ Family MPUs that dramatically accelerates image processing algorithms by as much as 10 times or more. It combines the high performance of hardware solutions with the flexibility and expansion capability of a CPU.

The DRP can accelerate multiple algorithms in a single application and offload the main processor for specialized tasks. New configurations can be dynamically loaded into the DRP in as little as 1 ms.

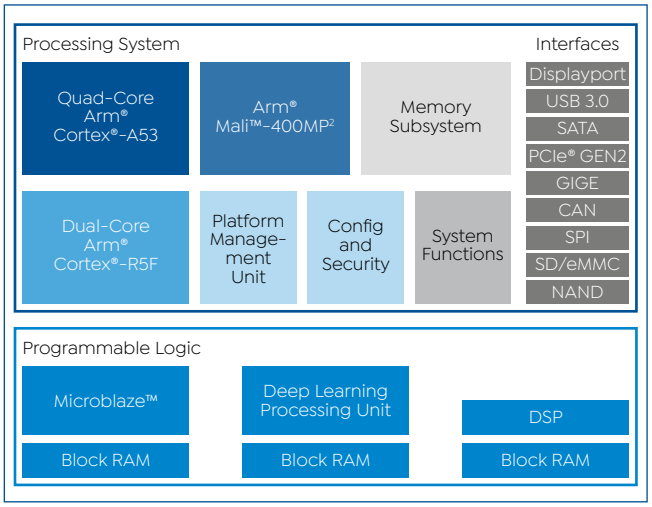
XILINX®

Product order code

- XLXXCAU10P-1SBVB484E
- XLXXCAU25P-2SFVB784I
- XLXXCZU1CG-1SBVA484E

16 nm UltraScale+™ Cost-optimized Portfolio

Artix® UltraScale+™ FPGAs and Zynq® UltraScale+™ MPSoCs



Zynq® Block Diagram

Introducing the next generation Cost-Optimized Portfolio for ultra-compact, high compute edge applications. The new UltraScale+ enhancements continue the scalability of Xilinx's established cost-optimized portfolio and inherit the industry-leading UltraScale+ FPGA and MPSoC technologies.

With new form factors that are 70 percent smaller than traditional Xilinx chip-scale packaging, the new Artix and Zynq UltraScale+ families can now address a wider range of applications within the industrial, vision, healthcare, broadcast, consumer, automotive, and networking markets.

- **Industry leading 16 nm perf/watt for cost-sensitive applications**
- **Highest compute density in new form factors, 60 % smaller, 70 % thinner**
- **Scalability across the UltraScale+ FPGA & SoC portfolio**
- **Multi-level safeguards for cybersecurity and IP protection**

Features

- The new ZU1 device delivers the most cost-optimized MPSoC, powered by the best-in-class Arm® multi-processing system, DSP compute, AI acceleration, and connectivity for cost-sensitive Edge & IoT systems
- New Artix UltraScale+ family enables the world's only 16 nm perf/watt cost-optimized FPGA on a proven architecture, featuring up to 16 Gb/s transceivers and the highest DSP performance in class
- Zynq UltraScale+ devices with InFO packaging deliver the highest Arm® processing, AI compute, signal processing, memory bandwidth, and I/O bandwidth per mm^2 vs. competing ASSPs
- Artix UltraScale+ delivers the highest DSP and serial bandwidth density in a cost-optimized device for high-performance applications in networking, vision, and video
- ZU1 delivers a new low-cost entry point to the production-proven ZU+ portfolio for edge application vendors, with the same processing system and scalable AI compute, vision processing, and system integration
- Artix UltraScale+ is the next generation from Spartan-7 and Artix-7 solutions for any-to-any connectivity over 2× higher serial bandwidth and DSP compute, and scalability to industry-leading Kintex® mid-range and Virtex UltraScale+ high-end FPGAs

Key Applications

- Machine vision, smart cameras, camera monitors
- Industrial networking, smart sensors, motor control
- Portable ultrasound, defibrillators, patient monitors
- Hand-held oscilloscopes, application test equipment
- Automotive - ADAS

As the world's only hardware adaptable cost-optimized portfolio based on proven 16 nanometer technology, Artix and Zynq UltraScale+ are available in TSMC's state-of-the-art InFO (Integrated Fan-Out) packaging technology.

Using InFO, the new cost-optimized members of the Artix and Zynq UltraScale+ family meet the need for intelligent edge applications by delivering high-compute density, performance-per-watt, and scalability in an ultra-compact package.

AFBR-S20N1N256

Qneo – Industry's First Compact NIR Spectrometer for Industrial Integration

AFBR-S20N1N256 Qneo Spectrometer – Product Image

The Qneo is targeting skilled analysis between 950 and 1700 nm. Based on a Czerny-Turner grating setup, this NIR sensor is designed for high-volume demands. Designed for industrial adaption the portable Qneo provides OEMs with more flexibility for integrating a spectral NIR sensor in any production environment (PAT) or handheld solution for POC. The Qneo spectrometer offers high optical performance, especially in terms of sensitivity. Equipped with an uncooled 256-pixel InGaAs array, the Qneo delivers performances matching cooled and more expensive devices.
Broadcom is setting new standards in compact and reliable NIR measurements.

- **High sensitivity**
- **Built-in electronics and software**
- **Miniature size: 60.0 x 40.0 x 19.0 mm**
- **Full system calibration**

Features

- Spectral range: 950 to 1700 nm
- Spectral resolution: 8 nm
- Detector type:
  - Uncooled 256-pixel InGaAs sensor
- Optical interface: SMA905
- External Interfaces:
  - USB2.0
  - SPI
  - UART
- Operating temperature range:
  - From -15 to 55 °C
- Dimensions (W x L x H):
  - 60 x 40 x 19 mm

Key Applications

- Industrial applications
- Agricultural measurements
- Biomedical applications
- Chemical research
- Counterfeit detection
- Environmental analysis
- Forensic analysis
- Light measurements
- Water quality analysis
- Quality control
- Process control and monitoring

Qneo compact spectrometer is built for simplified integration. Supported by an easy-to-use SDK consisting of a DLL library for the .NET framework, documentation, and sample code, the Qneo spectrometer allows capturing and analyzing spectra using programs written in C#, Visual BASIC.NET, C++, Delphi, LabVIEW, Mathematica, or Matlab.

Qneo is also supported by the Waves software, which features unique and sophisticated algorithms for data acquisition and evaluation, delivering these features through a clear and straightforward user interface designed to make things easy.

AS33-M42M Series

Full Magnetic Energy Harvesting Multi-Turn Absolute Encoder Module

AS33-M42M Series Energy Harvesting Absolute Encoder Module

The AS33-M42M series encoder is a 42-bit absolute magnetic encoder comprising 18-bit single-turn (ST), and 24-bit multi-turn (MT) counts by Broadcom Inc. This encoder's design features state-of-the-art energy harvesting multi-turn technology that converts the rotating magnetic field into electrical energy, which powers the revolution tracking circuit, regardless of the encoder rotation speed and direction. Therefore, there is no revolution count loss, even in the absence of an external power supply. The AS33-M42M series encoders do not require periodic maintenance of the battery backup components, preventing the associated downtime.

- **Single and multi-turn magnetic encoder family with compact size**
- **No battery backup required, maintenance-free**
- **High robustness and immunity againtst contaminants**
- **Wide operating temperature and RPM range**

Features

- High position accuracy single-turn magnetic counter
- Patented energy harvesting technology multi-turn counter
- Total 42-bit resolution with 18-bit single-turn and 24-bit multi-turn
- Compact size:
  - Overall encoder outer diameter: 33 mm
  - Maximum height: 20 mm
- Built-in communication protocol (optional):
  - Standard SSI (2 MHz)
  - BiSS-C (10 MHz)
  - RS-485 half-duplex (2.5/5/10 Mbps)
- Built-in temperature sensor
- Operating temperature range:
  - From -40 °C to 115 °C.
- Robust magnetic system:
  - Highly immune against contaminants
- RoHS compliant

Key Applications

- Industrial:
  - Servo motor
  - Robotic engineering and automation
  - Factory and automotive automation
  - Specialized equipment

The AS33-M42M series encoder has a built-in communication protocol supported by a full-duplex or half-duplex line transmission drive, offering good noise immunity for more robust transmission of data up to 10 Mbps in harsh industrial applications. Since it's based on magnetic technology, the encoder features high robustness and immunity against contamination such as dust and fingerprints. As a result, it requires less stringent control in harsh industrial environments.

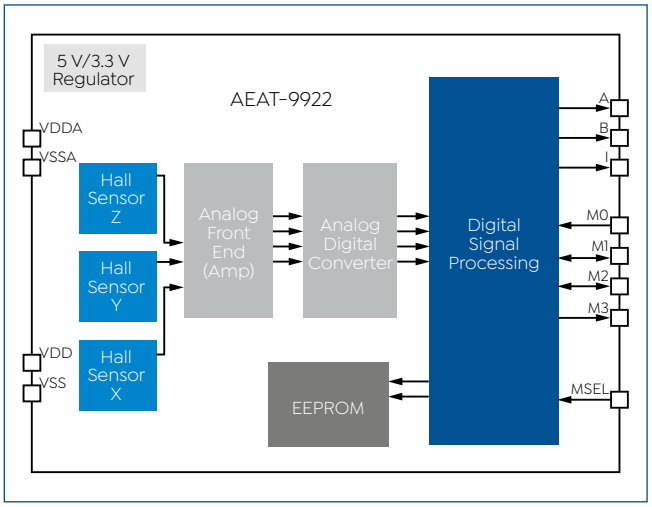
In addition, Broadcom provides the full set of calibration tools required to achieve the specified accuracy.

Product order code

- AEAT-9922-100
- AEAT-9922-102
- AEAT-9922-Q24

AEAT-9922

10-Bit to 18-Bit Programmable Angular Magnetic Encoder



AEAT-9922 - Block Diagram

The AEAT-9922 is an angular magnetic rotary sensor that provides accurate angular measurement over a full 360° of rotation. It is a sophisticated system that uses integrated Hall sensor elements with complex analog and digital signal processing within a single device. A simple two-pole magnet generates the necessary magnetic field by rotating it perpendicularly. Wide magnetic field sensor configurations allow on-axis (end of shaft) or off-axis (side of the shaft) modes. The AEAT-9922 is a versatile solution that supports a broad range of applications with its robust architecture to measure and deliver both absolute and incremental signals.

- **5 V and 3.3 V operation**
- **Selectable 10 bits up to 18 bits of absolute resolution**
- **Flexible Incremental ABI resolution ranging from 1 to 10,000 CPR**
- **Commutation angle output UVW 1 to 32 pole-pair**

Features

- Supports On-Axis (end shaft) and Off-Axis (side shaft) mounting
- User programmable Incremental A, B, I and UVW
- Programmable hysteresis
- Absolute output over 2-wire SSI, 3-wire SSI, and 4-wire SPI
  - Each output available in a different mode
- PWM mode with Initialization and Error Bits option
- INL angle correction for high accuracy with Auto Calibration feature
- Compact QFN-24 leads 4 x 4 mm package
- Wide operating temperature range:
  - From -40 °C to 125 °C
- RoHS compliant

Key Applications

- Industrial:
  - Brushless DC motor and stepper motor
  - Resolver and potentiometer replacement
  - Industrial automation and robotics
  - Industrial sewing machine and textiles equipment

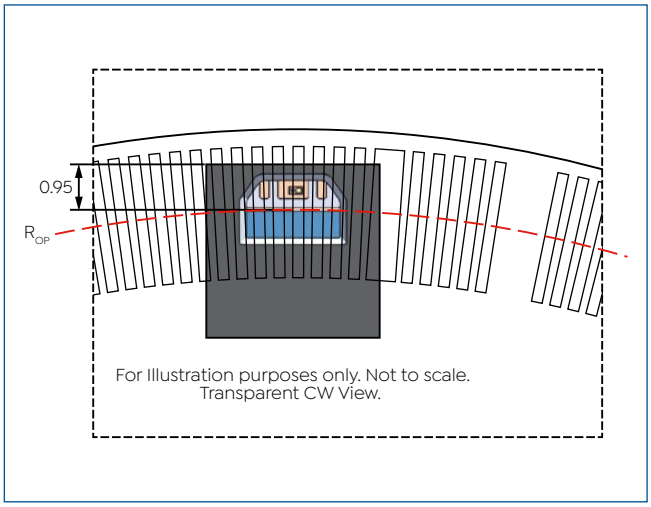
For an easy evaluation of the AEAT-9922 programmable on/off-axis magnetic encoder, the HEDS-9922PRGEVB evaluation kit set including the SPI programming kit, the pre-assembled AEAT-9922 evaluation boards, and the on-axis magnets, is available for orders through normal Broadcom sales channels:

- HEDS-9922PRGEVB: AEAT-9922 Programming Kit & Evaluation Set
- HEDS-9922EVB: AEAT-9922 Evaluation Board

Product order code
- AEDR-9920-100
- AEDR-9920-102

AEDR-9920

Three-Channel Reflective Incremental Encoder



AEDR-9920 Encoder Placement Illustration

The AEDR-9920 miniature reflective incremental encoder offers three-channel (ABI) differential digital outputs for linear and rotary applications starting at 4.6 mm optical radius with larger spatial (misalignment) tolerance up to 500 µm. A smaller optical radius can be achieved with a lower spatial and support the lower resolution with a spiral code wheel. The differential or TTL-compatible output signals can be directly interfaced to most signal processors. The compact size and programmable resolution provide easy integration into small motors, actuators, linear stages, and medical equipment.

- **Miniature size: 4 x 4 mm**
- **For miniature, small motor, and high temperature applications**
- **Built in pin selectable and user SPI reprogrammable interpolations**
- **Suitable for linear and rotary applications**

Features

- Next-generation miniature reflective incremental encoder:
  - High operating temperature, resolution, and frequency
- Operating Voltage 3.3 V and 5 V
- Encoding line density: 225 LPI (8.86 LPmm)
  - Example: Rotary RoP 4.6 mm, to achieve 256 CPR
- Higher resolutions with pin selectable interpolation up to 256x
  - 65,536 CPR or 262, 144 PPR after quad
- User SPI reprogrammable interpolation from 1x up to 512x
- Base frequency 200 Khz and up to 2 Mhz at 16x interpolation and above
- Infrared (IR) light source:
  - More robust to contamination
- Surface-mount leadless package (W x L x H):
  - 4.0 × 4.0 × 1.05 mm
- Operating temperature range:
  - From -40 to 115 °C (extended industrial)
- Optional automotive part AEDR-9920A:
  - AEC-Q100 option
  - Automotive Grade 1: from -40 to 125 °C

Key Applications

- Industrial:
  - Closed-loop stepper motors
  - Small motors, actuators
  - Industrial printers
  - Robotics
- Healthcare & Wearables:
  - Card readers
  - Pan-tilt-zoom camera
  - Portable medical equipment
  - Optometric equipment
  - Linear stages

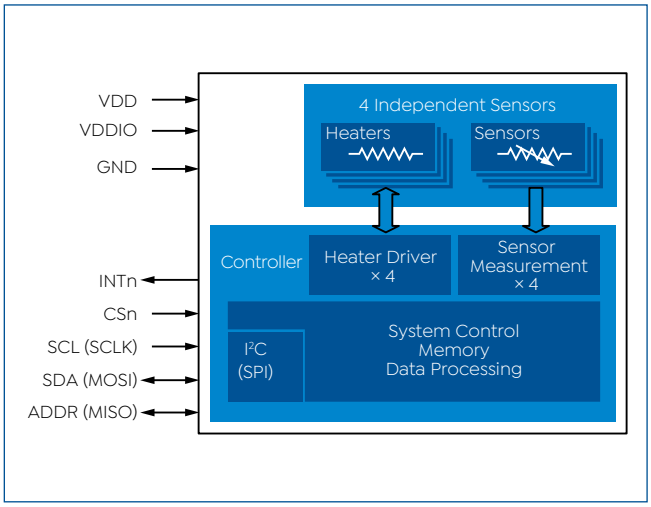
The AEDR-9920 is the next-generation miniature reflective high-resolution incremental encoder, capable of operating over extended temperature range and at a high frequency, making it suitable for commercial, industrial, and automotive end applications. The encoder houses an LED light source and photo-detecting circuitry in a single package.

Its compact size of 4.00 × 4.00 × 1.05 mm (W x L x H) allows it to be used in a wide range of miniature commercial applications, where size and space are primary concerns.

Product order code
- 507870028
- 507870026

ENS160 Air Quality Sensor

Digital Metal Oxide Multi-Gas Sensor



ENS160 Block Diagram

ENS160 is a digital multi-gas sensor specifically designed for indoor air quality monitoring, offering optimum detection of a wide range of gases and volatile organic compounds (VOCs), including toluene, hydrogen, ethanol, NO_2, and ozone. Based on ScioSense innovative TrueVOC™ technology, ENS160 combines the flexibility of four independently controlled sensor elements, based on metal oxide (MOX) technology, with intelligent on-chip algorithms to estimate equivalent CO_2 and TVOC concentrations, and calculate various air quality indices (AQI).
The LGA packaged device offers an SPI or I²C slave interface with a separate supply for host communication.

- **Detection of reducing (VOCs) and oxidizing gases (e.g., NO_2)**
- **Multiple IAQ outputs (TVOC, eCO_2, AQI)**
- **On-chip data processing**
- **High immunity to siloxanes and humidity**

Features

- Warm-up time: less than 1 minute
- Initial start-up time: less than 1 hour
- Supports up to 4 independent MOX gas sensors
- Integrated pre-calibrated sensor fusion and automatic baseline correction algorithms
- Integrated sensor measurement and heater drive control
- Wide operating ranges:
  - Temperature (T): -40 to +85 °C
  - Relative humidity (RH): 5 to 95 %
- High-speed I²C and SPI interfaces
- Separate digital I/O supply pin:
- V_{DDIO}: from 1.71 to 3.6 V
- Configurable interrupt engine:
  - Polarity, pin configuration, events
- Raw sensor data also available
- Low peripheral BOM required
- Compact size: 3.0 x 3.0 x 0.9 mm LGA package
- Tape & reel, reflow solderable

Key Applications

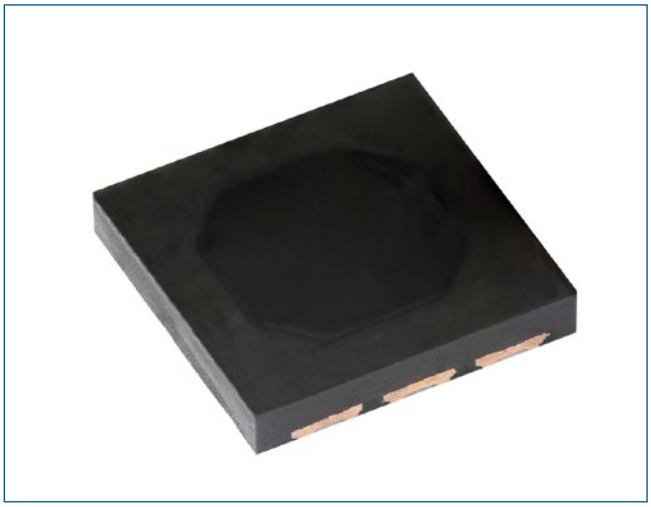
- Smart buildings:
  - HVAC systems
  - Smart thermostats
  - Demand-controlled ventilation
- Home automation:
  - Indoor air quality monitoring
  - Air cleaners/purifiers
  - Home appliances
  - Cooker hoods
- Smart consumer:
  - Wearables
  - IoT devices

ScioSense has implemented a new multi-element sensor architecture for its next generation of air quality sensors using four highly integrated MEMS microplates, supported by their new innovative TrueVOC™ sensor fusion technology that synthesizes signals from each sensor element while compensating for the influence of humidity and ozone.

Intelligent TrueVOC™ sensor fusion technology is also key to obtaining an enhanced equivalent CO_2 (eCO_2) score, taking into account a range of pollutants and odorous gases generated by human activity, along with exhaled CO_2.

K857PE

Industry's First Automotive 4-Quadrant Silicon PIN Photodiode in Surface-Mount Package



Vishay Semiconductors K857PE Si PIN Photodiode is a 4-quadrant photodetector with a 1.6 mm² per quadrant active area, available in a surface-mount package. This photodiode functions in epitaxial technology and offers high photosensitivity. The K857PE pin photodiode operates at -40 °C to 110 °C temperature range, 20 V reverse voltage, and 1 nA dark current. This photodiode offers 1.3 V maximum forward voltage, 840 nm peak sensitivity wavelength, and 30 ns rise time and fall time. For small signal detection, AEC-Q101 qualified device in opaque package delivers excellent Signal-to-Noise Ratio and virtually no tolerance between segments.

- **1.6 mm² per quadrant active area available in a surface-mount package**
- **Functions in epitaxial technology and offers high photosensitivity**
- **Operates at -40 to 110 °C temperature range**
- **1.3 V maximum forward voltage, 840 nm peak sensitivity wavelength**

Features

- 4 quadrant Photo Pin Diode
  - Complete active area of 6.4 mm²
  - Single Photo Pin Diode with 1.6 mm²
- Epitactical PD with high linearity
- FAM package technology with 8.5 µA reverse light current per segment
- 20 V reverse voltage
- 1 nA dark current
- 1.3 V maximum forward voltage
- Angle of half sensitivity (φ): ±60°
- Wavelength of peak sensitivity (λp): 840 nm
- Spectral bandwidth: 690 to 1050 nm
- Rise and fall time (V_R = 10 V, R_L= 50 Ω, λ = 830 nm): 30 ns
- Compact size (L x W x H): 4.72 x 4.72 x 0.8 mm
- Supports reflow soldering profile up to 260 °C (max.)
- Operating and storage temperature range: from -40 °C to 110 °C
- AEC-Q101 qualified
- Pb-Free, Halogen-Free, and RoHS compliant

Key Applications

- Automotive, industrial, and smart building applications
- Rain,light, and tunnel sensing - sun tracking
- Laser beam alignment - docking system
- Virtual reality

The K857PE is the industry's first 4-quadrant silicon PIN photodiode in the surface-mount package. Qualified for automotive applications, the K857PE combines high photosensitivity with low crosstalk of only 0.1 % and virtually no tolerance between its segments and enables various sensor and control applications for the automotive, consumer, and industrial markets.

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 June 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

30938 Burgwedel
Burgdorfer Straße 2
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