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MARKETING INNOVATIVE PRODUCTS

2020

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INDUSTRIAL AUTOMATION AND TRENDS IN MODERN INDUSTRY

The advancement of the industry has always revolved around finding ways to automate production more efficiently. In a relatively short time, the industry has come a long way: just a few decades ago, Industrial Automation and Control (IACS) systems relied on bulky, unreliable, and complex relay logic. From the racks full of relays, miles of cables stretched across the factory floor, connecting them to the equipment on the production line. Once hardwired, reconfiguration of the production line for another task was very difficult in most cases, if not impossible.

Later on, with the advent of microcontrollers, bulky and rigid relay logic was replaced by much smaller, faster, and far more flexible Programmable Logic Controllers (PLCs). Frequent failures and low productivity rates have quickly become a thing of the past. Today, powerful and cheap microprocessors are bringing edge computing to the factory floor, redefining the concept of industrial automation from the ground up and introducing novel business models based on data availability and online services.

On the other hand, production is driven by demand. People are no longer satisfied with having the same product for years: the market of today is dynamic, and the production has to keep up with the demand. The future of the industry is no longer a massive industrial complex somewhere in the Far East, producing large batches of the same product for years, with long delivery times, and unable to meet the demands of a highly dynamic market. The future is a flexible, modular, and highly autonomous production facility that can deliver a highly customized product in small batches, very quickly.

The modern industrial automation concept in Industry 4.0 envisions highly autonomous and efficient manufacturing modules that can be quickly configured and recombined according to requirements. While the networking challenges are being addressed by a dedicated IEEE 802.1 TSN standardization group, the operating efficiency is improved through the use of new semiconductor technologies based on Silicon Carbide (SiC) and Gallium Nitride (GaN).

TSN and Industrial IoT: One of the essential prerequisites for advanced automation in Industry 4.0 is a converged network that enables intelligent and flexible networked production, as well as the ability to use cloud-based technologies and services such as Industrial IoT (IIoT), at all production levels. In this regard, a dedicated IEEE 802.1 TSN task group is already working to extend the traditional Ethernet standard with mechanisms that allow the convergence of different classes of data traffic within the same network. In essence, TSN-enabled Ethernet allows the IT-level data traffic within the time-critical OT-level network, without affecting the real-time performance.

WBG Semiconductor Technologies in Industrial Applications: New Wide-Bandgap (WBG) semiconductor technologies based on SiC and GaN solutions are used to produce MOSFETs that can operate at very high voltages and at significantly elevated operating temperatures. WBG MOSFETs can reduce switching losses by up to about 50% compared to conventional Si-based devices such as IGBT. Smarter driver ICs allow for better control and more efficient switching while reducing drive losses even further, thus extending their life cycle significantly. This has a positive impact on the Total Cost of Ownership (TCO).

Industrial Security and IEC 62443: With the Internet as an integral part of everyday life, online availability is a crucial factor. However, exposing the industrial network to public services inevitably brings up some security concerns. In this sense, a well-designed holistic safety concept such as the one proposed in the IEC 62443 standard series, can help protect the integrity of an automated production facility with great success, allowing it to safely interact with the broadest range of services via the Internet.

Based on the facts above, it is not difficult to conclude that modern industrial automation is a multidisciplinary concept and requires experts from several fields of expertise. As one of the main supporters of Industry 4.0, EBV Elektronik is ready to help you meet the demands of the modern market. A team of experts from all relevant fields of application is always at your disposal. The distribution is today. Tomorrow is EBV!

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TSN AND INDUSTRIAL IOT

Time-Sensitive Networking (TSN) is an Industry 4.0-driven trend for reliable, deterministic, and converged networking. By blurring the boundaries between the Information and Operational Technologies, TSN lays the foundations for the implementation of modern industrial technologies such as the Industrial Internet of Things (IIoT), thus representing the backbone of the latest industrial revolution 4.0.

Industry 4.0 introduces a concept of intelligent and flexible networked production, combined with the ability to use network services and cloud-based technologies such as Industrial IoT (IIoT) at all production levels. With continuous real-time data exchange between the factory floor and the enterprise level, Industry 4.0 introduces some new opportunities for industrial automation, such as downtime prevention through predictive maintenance and productivity optimization through automatic forecasting and inventory management. However, network requirements are not the same throughout different levels of the production facility. In a conventional factory, production-level networks are used for data exchange between the field equipment through the closed, vendor-specific implementation of the Ethernet standard (such as EtherNet/IP, PROFINET, EtherCAT…), using specialized gateways to interface with the enterprise-level network. This increases the complexity of the network infrastructure and the associated costs while reducing flexibility and interoperability.

To address real-time network requirements of various applications, the IEEE association has formed a dedicated TSN Task Group (TG), focused primarily on determinism and real-time capabilities over Ethernet (i.e., guaranteed packet transport with bounded latency, low jitter, and no congestion losses). So far, many different mechanisms have already been published by the TSN TG, while some are still in development. One of the most important to mention is the IEEE 802.1AS time synchronization mechanism, which brings time-awareness to Ethernet. Time synchronization enables other mechanisms such as the IEEE 802.1Qbv Time-Aware Scheduler (TAS) to achieve bounded low latency by using timed traffic gates (one per QoS level), and 802.1Qbu Frame Preemption to ensure link availability for higher priority frames.

However, TSN does not specify which mechanisms must be used for a particular application. In this regard, another standardization group (IEC/IEEE 60802) is working on a TSN profile for industrial automation (TSN-IA profile). The IEC/IEEE 60802 profile will include the most appropriate tools from the TSN toolkit required to implement a highly interoperable TSN in the segment of industrial automation. Although IEC/IEEE 60802 is not expected to be officially published before 2022, there's already a draft version of this standard available. Furthermore, many demonstrators, application examples, and case studies already prove multiple benefits of using TSN as a basis for a unified and converged industrial network, and as an enabler for modern industrial automation concepts.

Product order code

- PEX88096B0-DB
- PEX88096B0-2-DB
- PEX88080B0-DB
- PEX88080B0-2-DB
- PEX88064B0-DB
- PEX88064B0-2-DB

PEX88000

PCIe Gen4 Switch Family

Part Number	Description
SS02-00B00-00	PEX88096 Switch
SS03-00B00-00	PEX88080 Switch
SS04-00B00-00	PEX88064 Switch
SS05-00B00-00	PEX88048 Switch
SS06-00B00-00	PEX88032 Switch
SS07-00B00-00	PEX88024 Switch
SS08-00B00-00	PEX88T32 Retimer

PEX8800 PCIe Gen4 Switches

The new PEX88000 PCIe Gen 4.0 switch family builds on the longevity of the PEX series of switches, now spanning 12 families. The PEX88024 switch allows Data Center and Cloud Providers to build flexible, scalable rack infrastructures. PCIe Gen 4.0 and Gen 3.0 switches substantially reduce the inherent latency and power usage caused by components required to convert host PCIe data to other protocols. The result is a rack of devices that have converged into a single high-performance, scalable, and high-availability compute solution.

- **Maximum Performance**
- **Low Latency**
- **Low Power**
- **Multi-Purpose**

Features

- Highly flexible and configurable
- Up to 48 DMA channels/functions
- Embedded ARM® Cortex®-R4 CPU
- Eliminate the topology restrictions of PCIe
- Fan-out CPU PCIe ports to connect to a large number of I/Os or other subsystems in Servers and Storage systems. No software will be required in this application.
- Purpose-built to support NVMe All-Flash Array (AFA) systems
- Create cost-efficient, high-availability hypers-scale systems by enabling communication between in-rack hosts and endpoints using PCIe
- Simplify connectivity while providing the highest PCIe switching performance available for data center servers, storage, and networks
- Reduce latency, system complexity, and power consumption in data-intensive environments
- Take advantage of industry-first features for most demanding hyper-converged, Artificial Intelligence, Machine Learning, NVMe JBOFs, and rack-scale systems

Key Applications

- Machine learning
- Artificial Intelligence
- Converged Servers
- Storage Systems
- I/O systems Using PCIe

Market Segment

- Communication & Infrastructure
- Industrial

Sub Market

- Telecom and Networking
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Human Machine Interface

Technology Segment

- High End Processing

Broadcom PCIe Switch Technology enables high-speed connectivity for Artificial Intelligence (AI), Machine Learning (ML), and high-performance memory and data storage.

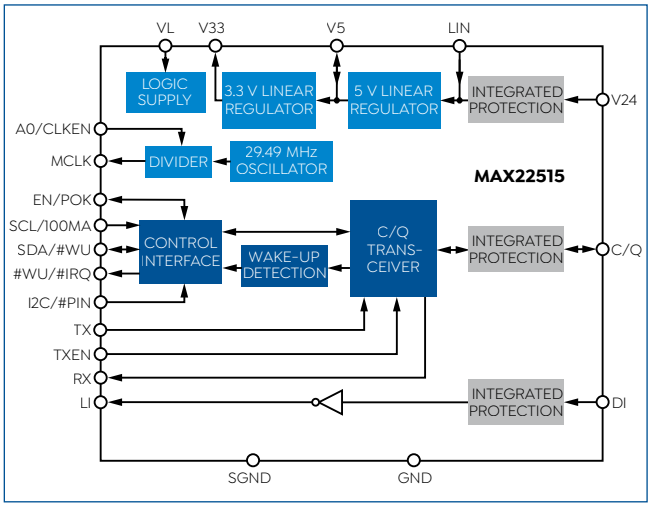
The new PEX88000 PCIe Gen 4.0 switches family can dramatically increase performance and flexibility.

Product order code

- MAX22515ATG+
- MAX22515ATG+T
- MAX22515AWP+T
- MAX22515EVKIT#

MAX22515

IO-Link Transceiver with Integrated Protection



AX22515 Block Diagram

The MAX22515 low power industrial transceiver can operate as either an IO-Link device or a non-IO-Link sensor transceiver in industrial applications. The MAX22515 features a selectable control interface (pin mode or I²C), two integrated linear regulators, and integrated surge protection for robust communication. The transceiver includes one C/Q input-output channel and one digital input (DI) channel.
The device features a flexible control interface. Pin-control logic inputs allow for operation with switching sensors that do not use a microcontroller.

- **High Configurability and Integration Reduces SKU**
- **Integrated Protection Enables Robust Systems**
- **Optimized for Small Designs**
- **Flexible control interface**

Features

- Operates from 8 to 36 V
- Auxiliary digital input (DI)
- I²C or pin mode control
- Selectable C/Q driver current: 50 to 250 mA
- Selectable C/Q driver slew rate (I²C mode)
- Integrated oscillator for IO-Link communication
- IO-Link Wake-up detection and Wake-up generation
- Integrated linear regulators: 3.3 V, and 5 V
- Register set compatible with the MAX22513
- ±1.2 kV/500 Ω surge protection on V24, C/Q, DI, and GND
- Reverse polarity protection on V24, C/Q, DI, and GND
- Hot-plug protection on supply input (V24)
- Glitch filters for improved burst resilience
- Selectable driver overcurrent configuration
- -40 to +125 °C operating temperature range
- Fast demagnetization of inductive loads
- 2 Ω (typ.) C/Q driver ON-resistance
- 1.3 mA (typ.) supply current
- Available in two tiny packages:
  - 20-Bump WLP (2.5 x 2.0 mm)
  - 24-Pin TQFN-EP (4 x 4 mm)

Key Applications

- IO-Link Masters
- Industrial Sensors
- IO-Link Sensor and Actuator Devices

Market Segment

- Industrial

Sub Market

- Human Machine Interface
- Robotics
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Elevators, Escalators, Moving Walkways

Technology Segment

- Smart Sensing & Connectivity

Maxim provides the most complete portfolio of IO-Link and binary sensors in the industry.

The MAX22515 reduces the footprint by the factor of 2, integrating the IO-Link transceiver, digital input option, and protection, all in one chip.

This IC has very low ON-resistance, reduced total heat dissipation by 4x, and lower power consumption.

TOSHIBA

TC9562BXBG

Ethernet-AVB/TSN Connectivity IC for Automotive and Industrial Applications

Toshiba TC9562BXBG

The latest member of Toshiba's Ethernet connectivity IC lineup provides advanced Ethernet capability for automotive and industrial applications.
It enables deterministic real-time performance up to 1 Gbps Ethernet transfer rates and supports Time-Sensitive Networking (TSN) protocol. The optimized hardware is complemented by a programmable ARM® Cortex®-M3 core which can be used to implement additional features, offloading the host CPU or enabling stand-alone operation for customized audio endpoints.

- **High-Speed PCIe (5.0GT/s) to Ethernet AVB/TSN Bridging**
- **Time-Sensitive Networking (TSN) Protocol Support**
- **Realization of New Ethernet AVB based Car Audio Solutions**
- **Programmable On-chip ARM® Cortex®-M3 MCU (187MHz)**

Features
- PCIe® Gen 2 (5 GT/s)
- Ethernet (AVB/TSN support) 10/100 Mbps/1 Gbps
- Supports IEEE 802.1AS, IEEE802.1Qav, IEEE 802.1Qbv, IEEE802.1Qbu and IEEE 802.3br
- Dedicated HW for traffic shaping
- SGMII, RGMII, RMII or MII interface
- Hardware support for IEEE1722-2016 audio format including media clock recovery
- I²S/TDM, Quad SPI, I²C, SPI & UART
- Automotive AEC-Q100 / IATF 16949
- Stand-alone operation
- Flexible PHY interface
- Low jitter time synchronization
- High-quality multichannel audio
- Superior QoS performance including frame pre-emption
- Multiple traffic types sharing on the same wire (network convergence)
- Deterministic and bounded low-latency communication
- Complete flexibility in choosing Ethernet PHY types and switches
- Stand-alone audio endpoint applications without an additional MCU/MPU
- Realization of new Ethernet AVB-based car audio solutions
- Reduced cable harness

Key Applications
- Factory automation
- Professional AV
- Automotive Applications (Telematics, IVI, ADAS)
- Car Audio Systems

Market Segment
- Automotive
- Industrial

Sub Market
- ADAS, Automotive Infotainment & Cluster
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Embedded Computing & Storage

Technology Segment
- Smart Sensing & Connectivity

It's not just a "PCIe to Ethernet bridge."

Unique "retrofit" solution for existing industrial factory automation systems

Cost-effective solution without large overhead vs. currently available FPGA and SoC solutions

Standalone capability thanks to the built-in Arm® core (e.g., for audio-related automotive applications)

TOSHIBA

Product order code

- TLP2363(E(O
- TLP2363(TPL,E(O
- TLP2363(V4-TPL,E(O
- TLP2363(TPR,E(O
- TLP2363(V4-TPR,E(O

TLP2363

High-speed 10 Mbps Logic Output Photocoupler for PLCs

Toshiba TLP2363

TLP2363 is a new high-speed 10 Mbps logic output photocoupler for 24 V digital input PLC, and other measurement and control equipment. It delivers a clear HIGH or LOW signal level on the output by suppressing noise, even with a slow-moving input signal of 60 s or less, with a slow rising/falling edge. As a result, there is no need for a waveform shaping circuit, which reduces the number of components and saves the PCB area and cost. The common footprint allows designers to replace products from other manufacturers, allowing them to take advantage of the TLP2363's improved specifications.

- **Inverter Logic Type (Open Collector Output)**
- **Package: 5-pin SO-6**
- **Operating Temperature Range: from -40 to +105 °C**
- **Supply Voltage: from 2.7 to 5.5 V**

Features

- Data transfer rate: 10 Mbps (typ.)
- Threshold input current: 5.0 mA (max.)
- Threshold input current: 0.3 to 2.4 mA (V_{CC} = 3.3 V, RL = 1 kΩ)
- Supply current: 4 mA (max.)
- Common-mode transient immunity: ±20 kV/μs (min.)
- Isolation voltage: 3750 V(RMS) (min.)
- Easy to design PLC with few additional components
- A good match for the digital interface of a PLC

Key Applications

- Programmable Logic Controllers (PLCs) (IEC 61131-2)
- Factory Automation
- Measuring Instruments

Market Segment

- Industrial

Sub Market

- Instrumentation, Test and Measurement
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Robotics

Technology Segment

- Analog & Power

The TLP2363, combined with appropriate external components, enables a 24 V digital input module to adhere to the IEC 61131-2 Type 1 specification.

It makes the design quick and easy, featuring a small package for compact designs.

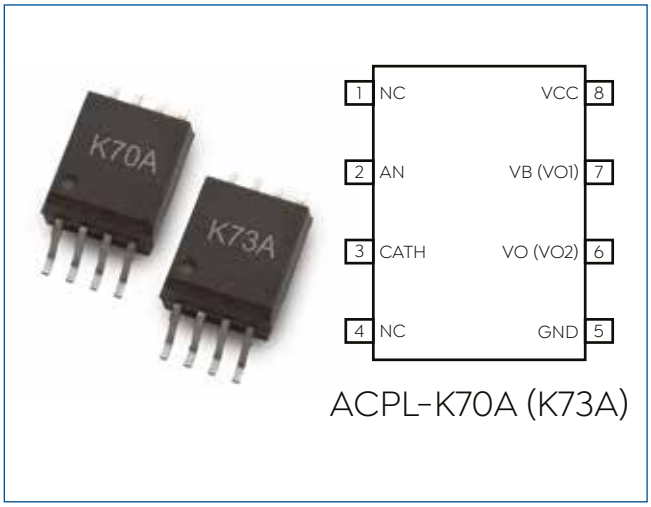
BROADCOM
connecting everything

Product order code

- ACPL-K70A-000E
- ACPL-K70A-060E
- ACPL-K70A-500E
- ACPL-K70A-560E
- ACPL-K73A-000E
- ACPL-K73A-060E

ACPL-K70A

Low Power Consumption High Gain Optocouplers



ACPL-K70A and ACPL-K73A

The ACPL-K70A is a low power consumption high gain single channel optocoupler. It is the equivalent single channel product of the dual-channel ACPL-K73A in a stretched SO-8 footprint. Each channel can be driven with an input current as low as 40 µA and has a typical current transfer ratio of 3500%. This high gain coupler uses an AlGaAs LED and an integrated high gain photodetector to provide an extremely high current transfer ratio between input and output. This device is designed for use in CMOS, LSTTL, and other low power applications.

- **High Current Transfer Ratio - 3500% at IF = 40 µA**
- **Specified AC and DC Performance over Temperature: -40 °C to 105 °C**
- **Ultra Low Input Current Capability 40 µA**
- **Stretched SO-8 package**

Features

- Stretched SO-8 package with 8 mm creepage/clearance
- Higher working voltage, 1140 V_{PEAK} and isolation voltage, 5000 V_{RMS}
- Specified for 3.3 V and 5 V Operation
- TTL and CMOS Compatible Output
- tPHL and tPLH at 2 µs and 40 µs respectively, at IF = 12 mA
- Worldwide Safety Approval: UL 1577 recognized
- CSA Approval
- IEC/EN/DIN EN 60747-5-5 Approval for Reinforced Insulation
- VCC and VO terminals can be tied together to achieve conventional Darlington operation
- An external resistor at the transistor base (VB terminal) can be added to make a gain-bandwidth or input current threshold adjustment
- Separate pins for the photodiode and output stage resulting in TTL compatible saturation voltages and high-speed operation

Key Applications

- RS232 line receivers
- PLC I/Os
- Control Signal Isolation
- Microprocessor bus isolation
- Digital Logic Ground Isolation

Market Segment

- Industrial
- Smart Consumer & Building
- Smart Grid

Sub Market

- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Power Supplies (AC/DC, DC/DC)
- Power Supplies (UPS, Chargers)
- Smart Grid Protection and Control

Technology Segment

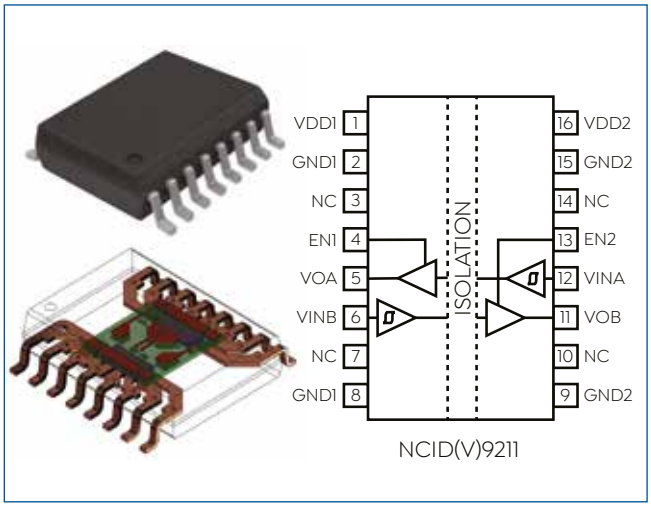
- Analog & Power

The ACPL-K70A/K73A is a family of low-power consumption and high-gain optocouplers, which fits perfectly into a wide range of applications.

The Application Note 951-1 describes applications for low input current, high gain optocouplers.

NCID9211

High Speed Dual-Channel, Bi-Directional Ceramic Digital Isolator



NCID(V)9211 Digital Isolator

The NCID9211 is part of a family of galvanically digital isolators that use ON Semiconductor's patented off-chip capacitor isolation technology. These isolators support digital communication between systems without conducting ground loops or hazardous voltages. Their capactive ceramic substrate construction offers ~25 times the thickness of thin film on-chip capacitors and coreless transformers, resulting in electrical performance benefits traditionally offered by optocouplers but exceeding optocouplers in speed, common mode transient immunity as well as temperature and lifetime performance.

- **Digital Isolator Matching Insulation Reliability of Optocouplers (DTI ≥ 0.5 mm)**
- **High Speed, No Insulation Material Wear Over Time and No Degradation**
- **8 mm Clearance and Creepage, SO16 Wide Body Package**
- **Safety and Regulatory Approvals, AEC−Q100 Qualified**

Features

- Full Duplex, Bi-directional communication
- DTI (Distance Through Insulation): ≥ 0.5 mm
- Maximum working insulation voltage: 2000 V peak
- Minimum common-mode rejection: 100 kV/μs
- High Speed:
  - Data rate (NRZ): 50 Mbps
  - Propagation delay: 25 ns max.
  - Pulse width distortion: 10 ns max.
- Specifications guaranteed over 2.5 to 5.5 V supply voltage and −40 to +125 °C extended temperature range
- No insulation material wear out over time, no degradation, consistent device-to-device performance
- Overtemperature detection
- Output Enable function

Key Applications

- Power Supplies
- Isolated PWM Control
- Industrial Fieldbus Communications
- MPU Interfaces (SPI, I2C, etc.)
- Programmable Logic Controller
- Isolated Data Acquisition Systems
- Voltage Level Translators

Market Segment

- Industrial
- Smart Grid

Sub Market

- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Instrumentation, Test and Measurement
- Motion Control, Servo Drives
- Power Conversion (Inverters, Welding, Converters)
- Power Supplies (UPS, Chargers)
- Railway (Traction, Control, etc...)
- Renewable Energy Generation

Technology Segment

- Analog & Power

The ability to transfer high-speed data across a high-voltage barrier without compromising security or reliability is very useful for industrial applications.

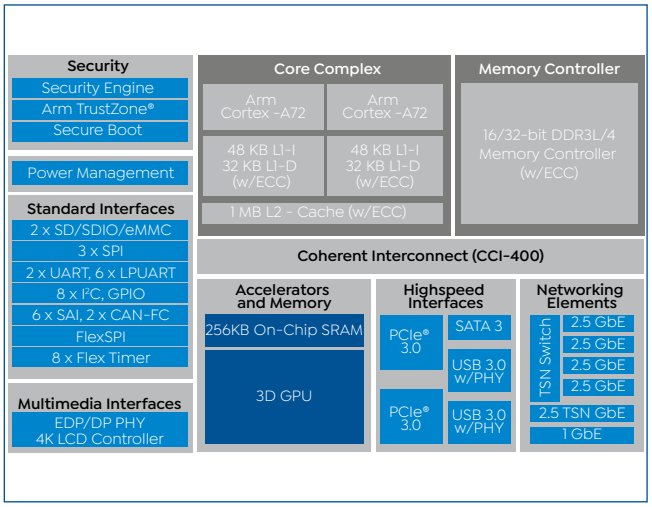
ON Semiconductor digital isolators meet UL and VDE safety standards and are also AEC-Q100 qualified.

Product order code

- LS1028AXE7PQA
- LS1028AXN7PQA
- LS1028ARDB-PA

LS1028A

Highly Integrated SoC for Converged Networking in Industrial IoT



LS1028A Block Diagram

The LS1028A has functionality for Industry 4.0 including Time-Sensitive Networking (for deterministic Ethernet), high-performance Cortex®-A72 cores, 3D graphics for HMI and integrated security capabilities using NXP's Trust Architecture. The LS1028A is an SoC of the Layerscape family with integrated 3D GPU for HMI, and support for TSN in the integrated Ethernet switch and independent Ethernet controllers. The family consists of 4 parts: LS1028A, LS1027A, LS1028A, and the LS1017A, with either 1 or 2 Cortex®-A72 and the option to include HMI capabilities with DP/eDP, LCD Controller, and 3D GPU.

- **2x Arm® Cortex®-A72 with NEON™ SIMD and FPU delivering more than 16,000 CoreMarks®**
- **Open Industrial Linux**
- **Purpose-Built for Fanless, Small Form Factor Industrial Infrastructure**
- **Hardware Virtualized Environments**

Features

- 48 KB L1-I Cache/32 KB L1-D Cache with ECC
- 1 MB L2 Cache with ECC
- Flexible power/performance with 1300, 1000, 800 MHz core speeds
- High level of integration
- 4 port Ethernet Switch with support for TSN, up to 2.5 Gbps per port:
  - Up to 4 SGMII (1 Gbps)
  - QSGMII (1 Gbps)/QXGMII (2.5 Gbps)
- Two independent Ethernet controllers
  - SGMII/USXGMII port supports TSN, up to 2.5 Gbps
  - RGMII to 1 Gbps
- 1588 1-step and 2-step hardware timestamping on all ports
- High-speed serial I/O including 2x PCIe Gen 3 controllers, 1x SATA 3.0, and 2x USB 3.0 with PHY:
  - PCIe root complex and endpoint
  - USB Device and Host mode
- 3D GPU with integrated eDP/DP PHY:
  - Up to 4K resolution
  - Support for OpenGL, OpenCL
- 2 x SD/SDIO/eMMC, 2 x CAN FD, 8 x UART, 8 x Flex Timer, 8 x I²C, 6 x SAI

Key Applications

- CNC
- Access Communication
- Industrial PC/HMI
- Networking Gateway
- Industrial Switch/IoT Gateway
- Relay Protection Controller
- Smart Grid Gateway
- Railway Controllers/Network Gateways
- Avionics Control and Communications

Market Segment

- Communication & Infrastructure
- Industrial
- Smart Grid

Sub Market

- Telecom and Networking
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Robotics
- Embedded Computing & Storage

Technology Segment

- High End Processing

The i.MX RT1170 crossover MCU family endpoints, in combination with the LS1028 switches, form the complete NXP TSN. The main features are:

- IEEE 802.1AS (gPTP) network time sync, 802.1Qbv time aware
- Real-time processing in sync with network cycle time on i.MX endpoints

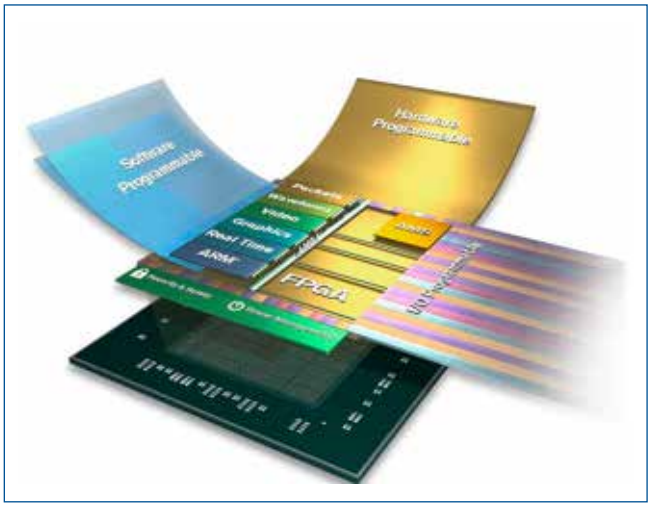
XILINX®

Product order code

- XCZU4EV-2SFVC784I
- XCZU4EV-3SFVC784E
- XCZU2EG-1SFVC784I
- XCZU19EG-2FFVD1760I
- XCZU2CG-2SFVA625E
- XCZU9CG-2FFVB1156I

Zynq UltraScale+ MPSoC

SoCs with heterogeneous multi-processing engines for smarter systems



Zynq MPSoC Architecture Block Diagram

Zynq® UltraScale+™ MPSoC devices provide 64-bit processor scalability while combining real-time control with soft and hard engines for graphics, video, waveform, and packet processing. Built on a common real-time processor and programmable logic equipped platform, three distinct variants include dual application processor (CG) devices, quad application processor and GPU (EG) devices, and video codec (EV) devices, creating unlimited possibilities for Industrial Internet of Things (IIoT).

- **Quad-core ARM® Cortex®-A53**
- **Dual-core ARM® Cortex®-R5**
- **ARM® Mali-400 GPU**
- **Programmable Logic**

Features

- ARM® Cortex®-A53
  - Up to 4 x CPU frequency up to 1.5 GHz, NEON engine, 32 KB L1 Cache per CPU, 1MB L2 Cache (shared, 16-way associative)
- ARM® Cortex®-R5
  - Up to 2 x CPU frequency up to 600 MHz, lockstep-capable, 32 KB L1 Cache per CPU, 128 kB TCM with ECC per CPU
- 256 kB On-Chip Memory
- Multi-protocol memory controller, ECC, 8-Channel DMA Controller
- Tri-speed Ethernet, PCI Express® Gen2, SATA 3.1, USB3.0, and DisplayPort
- 2 x CAN, 2 x SD/SDIO 2.0/eMMC4.51, 2 x SPI
- Two master and slave I^2C interfaces
- ARM® AMBA® AXI4-based
- RSA, AES, SHA
- 47 to 502 LUTs
- Block RAM, UltraRAM, DSP
- 1.0 to 3.3 V I/Os, LVCMOS, LVDS, SSTL
- PCI Express® Gen3
- Video Encoder/Decoder, H.264, and H.265
- 10-bit 200 kSPS ADC, up to 17 external inputs

Key Applications

- Human Machine Interface

Market Segment

- Industrial
- Smart Consumer & Building
- Smart Grid

Sub Market

- Embedded Computing & Storage
- Embedded Vision
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Human Machine Interface
- Motion Control, Servo Drives
- Robotics
- Heating, Ventilation and Air Conditioning
- Home & Building Control and Automation
- Railway (Traction, Control, etc...)
- Renewable Energy Generation
- Smart Grid Protection and Control

Technology Segment

- High End Processing

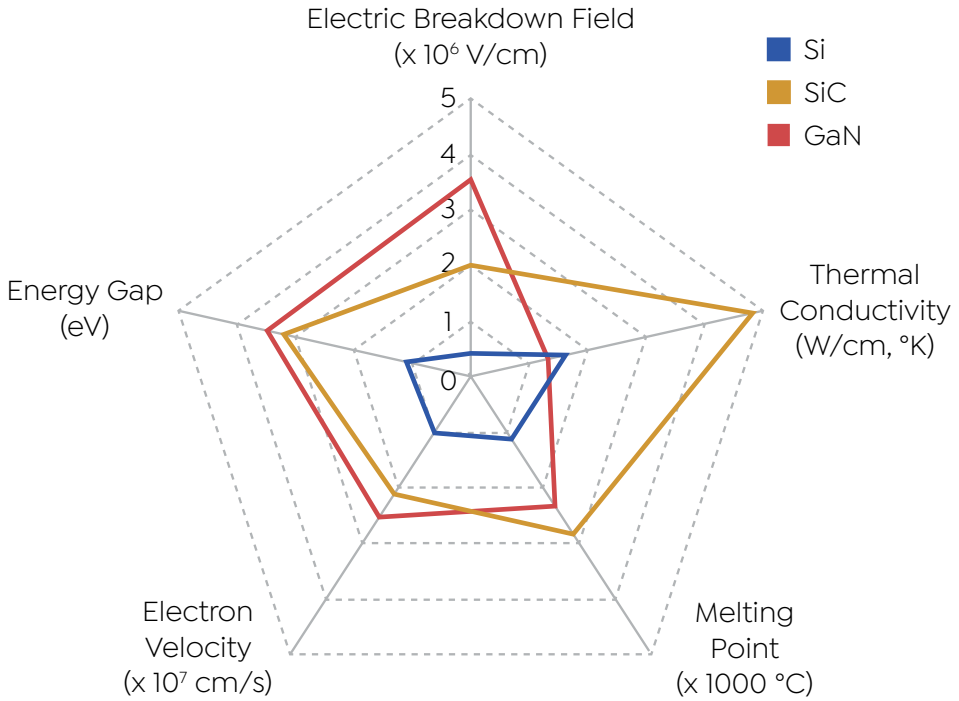
Xilinx Zynq® UltraScale+™ MPSoC devices enable true heterogeneous multi-processing with the right engines for the right tasks, for smarter systems. Perfectly suited for the broadest range of intelligent IIoT solutions

WIDE-BANDGAP SEMICONDUCTOR TECHNOLOGIES IN INDUSTRIAL APPLICATIONS

Power efficiency is an important topic when considering industrial applications. A typical production facility can be a huge consumer of electricity. With numerous electric machines and tools, every watt of energy lost is a significant contribution to total losses and production costs, not to mention the negative impact on the environment and CO2 emissions. As silicon-based semiconductor solutions have reached a plateau in their performance, some alternative solutions are desperately needed for the industry to continue its evolution.

Semiconductors using Wide-Bandgap (WBG) technologies were in a development phase for quite some time. Finally, after their behavior and failure mechanisms have been thoroughly analyzed and well understood, WBG semiconductors are now emerging in the global market, bringing some significant advantages over Si-based solutions. With considerably higher operating temperatures (up to 300 °C vs. around 150 °C) and highly efficient switching performance at much higher frequencies, WBG semiconductors allow for smaller, faster, and more reliable equipment, paving the way for the next industrial revolution.

When discussing WBG technologies, it is essential to differentiate between silicon-carbide (SiC) and gallium-nitride (GaN) technologies. Both of these technologies have their advantages and some drawbacks. For example, SiC technology allows for a very high breakdown voltage of up to 1.7 kV (in development, up to 3.3 kV). GaN-based devices (usually configured as a High Electron Mobility Transistor or HEMT) can easily reach extremely high switching frequencies at relatively high voltages (up to 650 V), due to their high electron mobility. However, WBGs can be complicated for driving and may require specialized gate driver ICs.



Due to excellent thermal properties offered by the SiC technology, SiC-based MOSFETs are often used in applications operating at very high voltages and temperatures. With a thermal conductivity more than three times higher than traditional Si-based devices, SiC technology allows the use of much smaller die for the same temperature rise and more compact cooling solutions. Also, in power conversion applications, higher switching frequency allows for the reduced size of energy tanks (inductors, transformers, capacitors…), which can be beneficial for space-constrained applications.

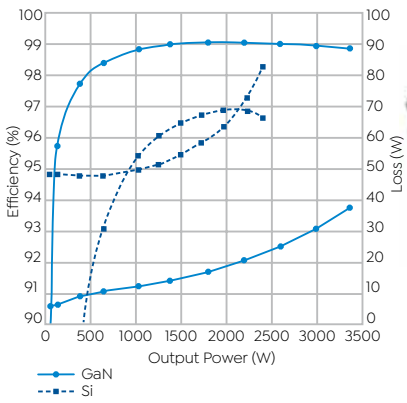
For power inverters applications, on the other hand, the switching frequency is limited by the design of the electrical machine being driven. Therefore, some other system-level benefits for these applications need to be considered. Although the frequency and switching times must be kept in the same range as with IGBTs, SiC-based converters can reduce losses by up to 50% compared to those using IGBTs. Additionally, reduced switching losses and better thermal conductivity allow for very compact cooling solutions, resulting in the ability to mount the inverter directly on the motor. An integrated inverter doesn't have to use cables to supply the motor with highly dynamic PWM modulated AC power, which is very beneficial for reduced EMI radiation. These benefits make SiC technology an ideal solution for servo drives and traction inverters. Besides allowing compact design and providing significantly extended life-cycle for motor drives through optimized switching losses, WBG technologies also have a positive effect on the industrial environment in general, lowering both initial installation costs, and the Total Cost of Ownership (TCO).

Another critical factor for consideration when discussing WBG-based devices is how to drive them efficiently. As mentioned above, there are certain complications due to their internal structure. For example, SiC gates must be driven to 20 V for full enhancement, which is close to the typical absolute maximum of 25 V. Both SiC and GaN devices can suffer from 'phantom' switching due to sensitivity to high-speed transients, so several volts of a negative voltage has to be applied to turn them OFF completely.

WBG technologies are still relatively new. As the manufacturing processes improve and mature, some of the drawbacks are reduced or even eliminated. New types of WBG semiconductors are already in development, aiming to eliminate the need for a negative turn-off voltage and reduce the full enhancement voltage, simplifying the complexity of driving circuits. However, a wide range of specialized drivers is already available on the market that successfully addresses these issues, enabling flawless operation and control via digital signals. With all the benefits they offer, there is hardly a reason not to embrace WBG technologies as the future of power electronics.

GAN063-650WSA

Nexperia Power Gallium Nitride (GaN) FETs: Performance, Efficiency, Reliability



Si vs GaN
Half Bridge Boost Converter: V_{IN} = 240 V, V_{OUT} = 400 V, F_{SW} = 100 kHz

GaN vs Si in Half-Bridge Topology

Nexperia GaN FETs in TO-247

GAN063-650WSA is a 650 V, 50 mΩ Gallium Nitride (GaN) FET in the industry recognizable TO-247 package. Whether designing onboard charging systems and inverter drive for the next generation of battery-electric vehicles or a power supply for the latest 5G telecommunication network, Nexperia's GaN FETs will be key to your solution. Nexperia's GaN technology offers superior reliability, high efficiency and simplified driver requirements with industry-standard gate drive voltages.

- **V_{DS}: 650 V**
- **Threshold voltage: +4 V**
- **Transient over-voltage capability V_{DS}: 800 V**
- **V_{GS} range: ±20 V**

Features
- RDS_{ON} Max: 60 mΩ
- Easy to drive
- Gate driving voltages: 0 V to +10 or +12 V, with +4 V threshold
- Inherently safe against parasitic turn-on
- Reduced losses in reverse conduction mode (very low source-drain voltage in reverse conduction mode)
- Ultra-low Qrr for fast switching
- High transient over-voltage capability
- Package: TO-247 (SOT429)

Key Applications
- On-Board-Chargers (OBC)
- DC/DC Power Conversion
- Battery Storage & UPS
- Industrial Automation
- Server & Telecom Power Supplies
- Traction Inverter
- Totem Pole PFC
- ZVS DC-DC
- Multiphase inverters

Market Segment
- Industrial
- Smart Grid
- Communication & Infrastructure

Sub Market
- Railway (Traction, Control, etc...)
- Power Supplies (UPS, Chargers)
- Power Conversion (Inverters, Welding, Converters)
- Elevators, Escalators, Moving Walkways
- Robotics
- Motion Control, Servo Drives
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Telecom and Networking
- Wireless Infrastructure
- Renewable Energy Generation

Technology Segment
- Analog & Power

The GAN063-650WSA is the beginning of the GaN-on-Si FET family from Nexperia.

There are additional resources available for this device, including a Spice model, thermal model, technical notes, application notes, and blog articles.

ON Semiconductor®

Product order code

- NXH25C120L2C2SG
- NXH35C120L2C2ESG
- NXH35C120L2C2S1G
- NXH35C120L2C2SG
- NXH50C120L2C2ES1G
- NXH50C120L2C2ESG

NXHxxC120L2C2x

Transfer-Molded IGBT Power Modules, CIB, 1200 V, 25, 35 and 50 A Current Rating

TMPIM26, a DIP-26 Transfer-Molded Power Integrated Module

The NXHxxC120L2C2x is a series of transfer-molded power modules, containing a converter and inverter circuit (without and with brake) of rectifiers, IGBT, and NTC thermistor. Its transfer-molded power package construction has several advantages over traditional gel-filled power modules, allowing for better efficiency, more compact and higher density constructions, and improved overall system reliability.
The modules are rated 1200 V and are available in 25 A, 35 A, and 50 A versions.

- **1200 V, 25 A , 35 A or 50 A Rated Converter and Inverter Circuit Power Module**
- **Transfer-Molded Power Package, Enabling Efficient, Compact, and Reliable Systems**
- **Converter-Inverter Circuit: With and Without Brake, Including an NTC Thermistor**
- **Space-Saving and Compact DIP Package**

Features

- High-performance transfer-molded package with improved temperature and power cycle performance
- Advantages over the traditional gel-filled module design such as:
  - Low thermal resistance
  - Better efficiency
  - Compact and thin design
  - Improved reliability
- 1200 V-rated, high-performance IGBT and diodes
- Integrated CIB (Converter, Inverter, Brake)
- Lower parasitic for better efficiency
- Integrated NTC and current sense resistor (optional)
- Solderable pins
- Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Key Applications

- Industrial Motor Drives
- Pumps
- Fans

Market Segment

- Industrial

Sub Market

- Motion Control, Servo Drives

Technology Segment

- Analog & Power

High-reliability contacts in corrosive atmosphere and environments.

Improved power handling capability, including a simple heatsink construction.

The compact, thin package minimizes parasitics for better electrical efficiency while enduring more thermal and power cycles for improved overall system reliability.

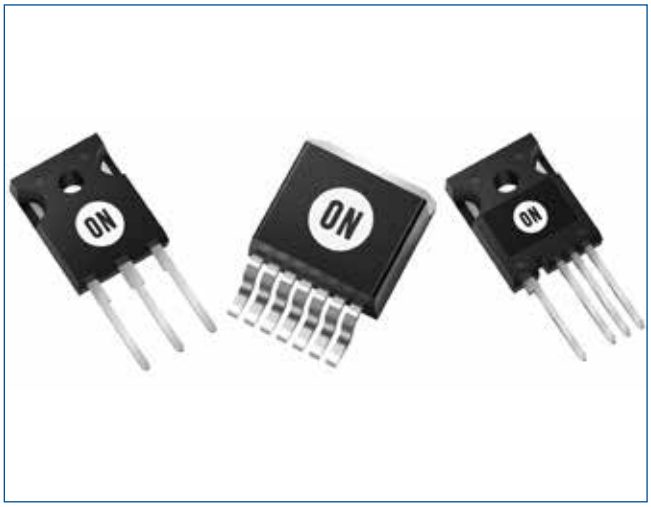
ON Semiconductor®

Product order code

- NTBG020N090SC1
- NTBG020N120SC1
- NTBG060N090SC1
- NTH4L080N120SC1
- NTHL020N090SC1
- More products available

Silicon Carbide MOSFET

Series of 1200 V and 900 V rated SiC MOSFETS in TO247 and D2PAK



TO-247-3, D2PACK-7, TO247-4

Silicon Carbide Technology has a better thermal conductivity (3x) and a higher breakdown field strength (10x) over traditional Silicon technology. This enables higher current density, lower capacitance hence faster-switching frequency and low ON-resistance at a device level. Benefits for systems employing Silicon Carbide devices are consequently reduced losses, higher temperature operation, optimized system size and weight, and higher overall performance

- **1200 V and 900 V Rated**
- **Typicall RDS_{ON} from 20 mΩ to 160 mΩ**
- **D2PAK and TO247 Packages**
- **Industrial and Automotive Grade (AEC-Q101 Qualified, and PPAB Capable)**

Features

- Superior characteristics over conventional Si technology
- D2PAK 7-lead package
- TO247 package with 3 or 4 leads
- 100% UIL Tested
- Pb-Free and RoHS Compliant

Key Applications

- DC/DC Converter
- PFC Boost Inverter
- Power Supply
- PV Photovoltaic Inverter and Charging

Market Segment

- Automotive
- Industrial
- Smart Grid

Sub Market

- Automotive Power Train and Chassis
- Commercial, Construction and Agricultural Vehicles
- Motion Control, Servo Drives
- Power Conversion (Inverters, Welding, Converters)
- Power Supplies (UPS, Chargers)
- Renewable Energy Generation

Technology Segment

- Analog & Power

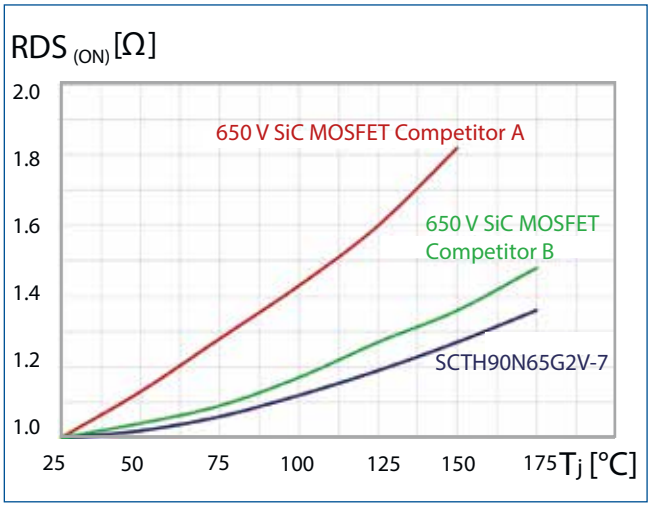
Higher voltage ratings & current density, and lower capacitance & ON-resistance, compared to traditional silicon technology.

Industrial and automotive-grade devices available in various packages.

ON Semiconductor also offers SiC MOSFET drivers, SiC diodes, and SiC-based power modules, providing a complete portfolio of wide bandgap SiC technology.

SCTH90N65G2V-7

Silicon Carbide Power MOSFET 650 V, 116 A, 18 mΩ in an H2PAK-7 package



Normalized ON-State Resistance vs. Temperature

This Silicon Carbide (SiC) Power MOSFET device has been developed using ST's advanced and innovative 2nd generation SiC MOSFET technology. The device features remarkably low ON-resistance per unit area and very good switching performance. The variation of switching loss is almost independent of junction temperature.

- **Very High Operating Junction Temperature Capability (TJ = 175 °C)**
- **Very Fast and Robust Intrinsic Body Diode**
- **Extremely Low Gate Charge and Input Capacitances**
- **Automotive Grade Version Available**

Features
- Low ON-state resistance:
  - 18 mΩ typ. @ 25 °C
- High current capability:
  - Continuous drain current (I_D) 116 A max. @ 25 °C
- Simple to drive
- A broad portfolio of 650 V and 1200 V SiC MOSFETs in thru-hole and SMD technology

Key Applications
- Switching Applications
- Power Supply for Renewable Energy Systems
- High Frequency DC-DC Converters

Market Segment
- Automotive
- Industrial

Sub Market
- Automotive Power Train and Chassis
- Commercial, Construction and Agricultural Vehicles
- Connected Car, Body Electronics and Automotive Lighting
- Elevators, Escalators, Moving Walkways
- Embedded Computing & Storage
- Motion Control, Servo Drives
- Robotics

Technology Segment
- Analog & Power

STMicroelectronics has a wide SiC MOSFET devices portfolio in the 650 V & 1200 V range, in TO247, HIP247, H2PAK, and D2PAK-7L packages.

Both automotive and Industrial-grade devices are available.

SiR626DP

60 V 1.7 mΩ TrenchFET® MOSFET increases efficiency with best in class FOM

SiR626DP

The new SiR626DP 60 V TrenchFET® MOSFET in PowerPAK® SO-8 combines low $RDS_{(ON)}$ down to 1.7 mΩ with best-in-class gate charge of 52 nC and output charge of 68 nC, reducing power losses and increasing efficiency.

- **TrenchFET® Gen IV Power MOSFET**
- **Very Low RDS - Qg Figure-of-Merit (FOM)**
- **Tuned for the Lowest RDS - Qoss FOM**
- **100% Rg and UIS tested**

Features

- Low maximum ON-resistance down to 1.7 mΩ at 10 V
- Ultra-low gate charge of 68 nC at V_{GS} of 10 V and output charge of 68 nC
- Low COSS of 992 pF
- Decreased power loss from gate driving, charging, and discharging output capacitance
- Improved efficiency in synchronous rectification and switching applications
- SPICE and Thermal models are available
- Offered in 6.15 x 5.15 mm thermally enhanced PowerPAK® SO-8 package
- 100% RG and UIS-tested
- RoHS-compliant and halogen-free

Key Applications

- Synchronous Rectification
- Primary Side Switches
- DC/DC Converters
- Solar Micro-Inverters
- Motor Drive Switches
- Battery and Load Switches
- Industrial

Market Segment

- Industrial
- Smart Grid
- Healthcare & Wearables
- Communication & Infrastructure
- Smart Consumer & Building

Sub Market

- Medical Instruments
- Power Conversion (Inverters, Welding, Converters)
- Home Appliances
- Power Supplies (AC/DC, DC/DC)
- Heating, Ventilation and Air Conditioning
- Robotics
- Motion Control, Servo Drives
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Elevators, Escalators, Moving Walkways
- Power Supplies (UPS, Chargers)

Technology Segment

- Analog & Power

Vishay is one of the world's foremost manufacturers of power MOSFETs.

The Vishay Siliconix MOSFET product line includes a diverse range of advanced technologies in more than 30 package types.

Product order code

- PSMN1R5-25MLHX
- PSMN1R8-30MLHX
- PSMNR51-25YLHX
- PSMNR60-25YLHX

NextPowerS3 MOSFETs

Ideal For Battery-powered Motor Control Applications (25/30 V Portfolio)

Device	Package	$RDS_{(ON)}$ 10V [mΩ]	ID (max) [A]	$Rth_{(j-mb)}$ [K/W]
PSMNR51-25YLH	LFPAK56	0.57	380	0.33
PSMNR60-25YLH	LFPAK56	0.7	300	0.48
PSMN1R5-25MLH	LFPAK33	1.81	150	1.12
PSMN1R8-30MLH	LFPAK33	2.1	150	1.12

Nexperia NextPowerS3 Power MOSFETS

Nexperia presents new 25/30 V NextPowerS3 Power MOSFET devices, ranging down to super-low $RDS_{(ON)}$ of 0.57 mΩ, in LFPAK56/E and LFPAK33. It features low Qg for minimized switching losses, which is especially important at peak efficiency and in high-frequency designs. Such market-leading performance is offered by utilizing Nexperia's unique NextPowerS3 technology, without compromising other important parameters such as maximum current (IDS), Safe Operating Area (SOA). These devices are ideal for applications such as motor control, battery protection, power OR-ing, and synchronous rectification.

- **Optimized for Low $RDS_{(ON)}$**
- **Max Current up to 380 A**
- **Best-in-class Safe Operating Area (SOA)**
- **Copper-clip for Excellent Thermal Performance**

Features

- Balanced $RDS_{(ON)}$ and Qg for class-leading efficiency
- Available in 25 V and 30 V
- 4 new types: PSMNR51-25YLH, PSMNR60-25YLH, PSMN1R5-25MLH, PSMN1R8-30MLH
- Low spiking and ringing for low EMI designs
- Fast switching - reduced switching losses
- Low leakage < 1 µA at 25 °C
- Three package variants: LFPAK33 (SOT1210), LFPAK56 (SOT669) and LFPAK56E (SOT1023)
- High-reliability LFPAK package qualified to 175 °C
- Wave solderable: exposed leads for optimal solder coverage and visual solder inspection

Key Applications

- Brushed and Brushless Motor Control
- Power OR-ing
- Battery Protection
- Hot-Swap
- E-Fuse
- DC Switch / Load Switch
- Synchronous Rectification in AC-DC and DC-DC Applications

Market Segment

- Industrial
- Communication & Infrastructure
- Smart Consumer & Building
- Smart Grid

Sub Market

- Robotics
- Home & Building Security (Alarms, Access Control)
- Audio and Video
- Renewable Energy Generation
- Power Supplies (UPS, Chargers)
- Power Conversion (Inverters, Welding, Converters)
- Wireless Infrastructure
- Telecom and Networking
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Home Appliances

Technology Segment

- Analog & Power

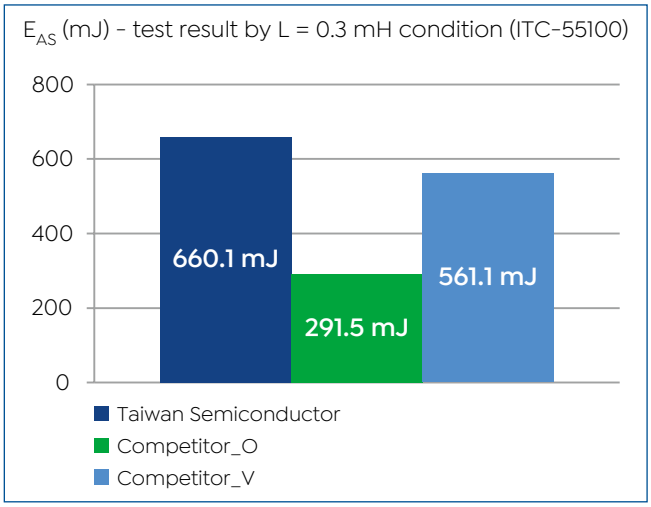
High-performance 25 V, 30 V, and 40 V MOSFET platform incorporates Nexperia's unique superjunction technology combined with the copper-clip LFPAK package to deliver the lowest RDS(on), as well as continuous current capability up to 380 A.

Product order code

- TSM025NB04CR RLG
- TSM025NB04LCR RLG
- TSM033NB04CR RLG
- TSM033NB04LCR RLG
- TSM036N03PQ56 RLG
- More products available

Motor Control MOSFETs

30-60 V N-Channel MOSFETs in PDFN33 and PDFN56 for Motor Control



Motor Control MOSFETs - UIS Capability Test

Taiwan Semiconductor N-channel power MOSFETs are developed to increase efficiency, power density, and cost-effectiveness. Designers benefit from a robust E_{AS} capability and a high power density package with MSL1 selection. Perfectly suitable for high-temperature environment applications. More than 40 products are available in the PDFN-56 single and dual packages, as well as in the PDFN-33 package.

- **175 °C Operation Junction Temperature**
- **100% UIS and Rg Tested**
- **Both Standard, and Logic Level Options**
- **Robust E_{AS} Capability**

Features

- High power density package with MSL1 selection
- 175 °C operating junction temperature
- High thermal design margin
- Higher surge current capabilities
- Well-suited for applications in high-temperature environments

Key Applications

- Motor Drive
- DC/DC Converter
- Battery Management/Load switch

Market Segment

- Industrial

Sub Market

- Motion Control, Servo Drives
- Robotics
- Factory Automation (PLCs, I/O, Sensors & Actuators)

Technology Segment

- Analog & Power

Taiwan Semiconductor delivers high quality and highly reliable power semiconductors to the market for more than 40 years.

UIS-tested: robust EAS capability of these devices allows for highly reliable switching operation in motor-driving applications.

NCP51705

SiC MOSFET Driver, Low-Side, Single 6 A, High-Speed

NCP51705

The NCP51705 driver is designed to primarily drive SiC MOSFET transistors. To achieve the lowest possible conduction losses, the driver is capable to deliver the maximum allowable gate voltage to the SiC MOSFET. By providing high peak current during turn-on and turn-off, switching losses are minimized. For improved reliability, dV/dt immunity and fast turn-off, the NCP51705 can utilize its onboard charge pump to generate a selectable negative voltage rail. For isolated applications, the NCP51705 provides a 5 V rail to power the secondary side of digital or high-speed optoisolators.

- **High Peak Output Current with Split Output Stages**
- **Extended Positive Voltage Rating up to 28 V Max**
- **User−adjustable Built−in Negative Charge Pump (−3.3 V to −8 V)**
- **Adjustable Under−Voltage Lockout**

Features

- High peak output current with split output stages
- Extended positive voltage rating up to 28 V max.
- User-adjustable built-in negative charge pump (-3.3 to -8 V)
- Accessible 5 V reference / bias rail
- Adjustable under-voltage lockout
- Fast desaturation function
- Allows independent turn-on and turn-off adjustment
- Efficient SiC MOSFET operation during the conduction period
- Fast turn−off and robust dV/dt immunity
- Minimizes the complexity of bias supply in isolated gate drive applications
- Sufficient VGS amplitude to match best SiC performance
- Self-protection of the design
- QFN24 package 4 x 4 mm
- Package featuring small & low parasitic inductance

Key Applications

- High Perfomance Inverters
- High Power Motor Drivers
- Totem Pole PFC
- Industrial & Motor Drives
- UPS & Solar Inverters
- High Power DC Chargers

Market Segment

- Industrial
- Smart Grid

Sub Market

- Motion Control, Servo Drives
- Power Conversion (Inverters, Welding, Converters)
- Power Supplies (UPS, Chargers)
- Renewable Energy Generation

Technology Segment

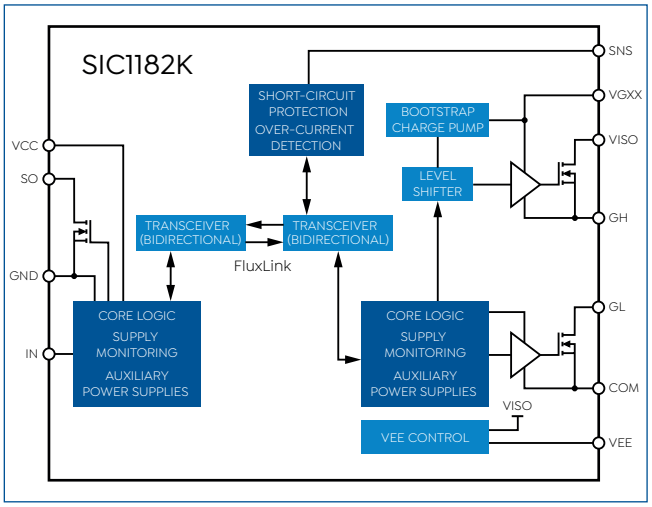
- Analog & Power

The NCP51705SMDGEVB is an evaluation daughter-board (EVB) for the NCP51705 SiC MOSFET driver. The EVB is designed on a four-layer PCB and includes the NCP51705 driver with all the necessary drive circuitry.

The EVB also includes an onboard digital isolator and the ability to solder any SiC MOSFET in a TO-247 high voltage package.

SIC1182K

Power Integrations SCALE-iDriver™ SIC1182K Single Channel SiC MOSFET Gate Driver IC



SIC1182K Block Diagram

The SIC1182K is a single-channel gate driver with up to 8 A output current in an eSOP-R16B package for SiC MOSFETs. It comes along with a new feature, combining short-circuit protection (at and during turn-on phase) as well as overvoltage limitation by SiC advanced active clamping (at turn-off phase) through a single sensing pin. In cases where the driven semiconductor component provides a current-sense terminal, an adjustable over-current detection can be realized. Reinforced galvanic isolation is provided by Power Integrations' revolutionary solid insulator FluxLink™ technology.

- **Overvoltage limitation (SiC Advanced Active Clamping)**
- **Short-circuit current fault detection and turn-off in typically 2µs**
- **±8 A peak gate output current**
- **eSOP-R16B package with FluxLink™ technology provides reinforced isolation for up to 1200 V**

Features

- Ultrafast short-circuit monitoring
- Over-current detection for SiC MOSFETs with current-sense terminal
- UVLO primary and secondary side
- Rail-to-rail stabilized output voltage
- Unipolar supply voltage for secondary-side
- Suitable for 600/650/1200 V SiC MOSFET switches
- Up to 150 kHz switching frequency
- Propagation delay jitter ±5 ns
- -40 °C to +125 °C operating ambient temperature
- High common-mode transient immunity
- eSOP package with 9.5 mm creepage and clearance
- Undervoltage lock-out protection for primary and secondary-side including fault feedback
- 100% production partial discharge test
- 100% production HIPOT compliance testing
- Reinforced insulation pending VDE V 0884-10 certification
- UL 1577 recognition pending
- Halogen-free and RoHS compliant

Key Applications

- General purpose and servo drives
- Photovoltaic converters
- Uninterruptible power supplies
- Welding inverters
- Off-Board Charging
- Power Quality (Statcom < 100 kVA, APF, AFE)

Market Segment

- Industrial

Sub Market

- Motion Control, Servo Drives
- Commercial, Construction and Agricultural Vehicles

Technology Segment

- Analog & Power

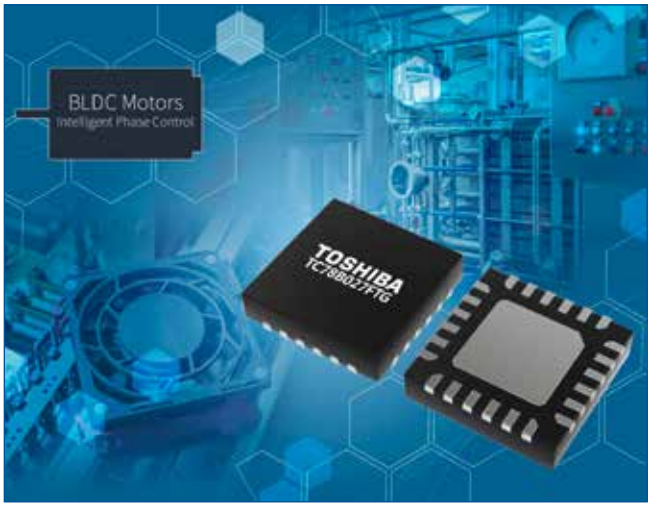
The SIC1182K single-channel gate driver is suitable for 600/650/1200 V SiC MOSFET Switches.

There is a complete family in place to drive both IGBTs and MOSFETs.

A Reference Design RDHP-1901 is available for driving half-bridge SiC MOSFET power modules, such as the Infineon FF6MR12KM1 or Cree's CAS300M12BM2.

TC78B027FTG

Three-phase Brushless Motor Control Pre-driver IC



Toshiba TC78B027FTG

TC78B027FTG is a three-phase brushless motor control pre-driver IC for applications such as high-velocity fans, blowers, and pumps. Intelligent Phase Control technology developed by Toshiba, realizes an automatically optimized high-energy efficient drive in a wide range of rotational speeds. The adjustment burden is also reduced. Closed-Loop Speed control function regulates motor rotational speed fluctuations caused by changes in power supply voltage and load. An external MCU is not required. Various FETs can be used so that solutions based on TC78B027FTG cover a wide range of low to medium-power applications.

- **Intelligent Phase Control***
- **Closed-Loop Speed Control****
- **Flexible in Various Power Applications with Appropriate External FETs**
- **Embedded NVM to Control Motor Speed, Hence No MCU Required**

Features

- Automatic BLDC current and voltage phase adjustment, by comparing them
- Elimination of the current consumption resulting from the phase difference
- Minimal rotation speed fluctuation, controlled by closed-loop speed control (no MCU required)
- Stable rotation speed under various disturbances (changes in voltage or load)
- Additional Benefits:
  - Faster Time-To-Market
  - Reduced energy consumption
  - Uniform rotation speeds up to tens of thousands RPM without MCU (Closed-loop)
  - Optimized motor cost (1-Hall PWM drive)

Key Applications

- High-velocity Fans
- EV Charging Station Cooling
- Vacuum Cleaner
- Blowers
- Pumps
- Power Tools

Market Segment

- Industrial
- Smart Consumer & Building
- Healthcare & Wearables

Sub Market

- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Medical Diagnostic and Therapy
- Heating, Ventilation and Air Conditioning
- Home Appliances

Technology Segment

- Analog & Power

* Intelligent Phase Control technology developed by Toshiba Corporation realizes an automatically optimized high-efficiency drive in a wide range of rotational speeds.

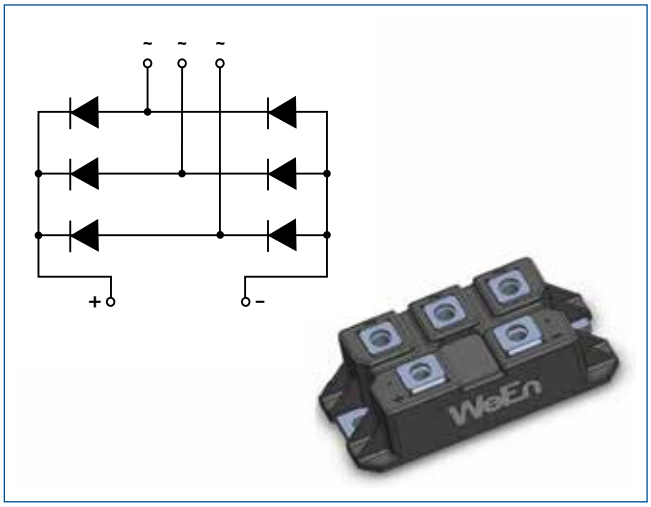
** The closed-loop speed control function regulates the motor rotation speed fluctuations, caused by the changes in supply voltage and load. An external MCU is not required since the TC78B027FTG features an internal NVM for speed profile settings.

The TC78B027FTG can be operated by 1-Hall sine-wave commutation and 1-Hall 150° commutation. The closed-loop speed control function is implemented without the use of an external MCU.

Motor rotation speed can be controlled by either using a PWM signal or applying an analog voltage to the SPD pin.

WDMF75M16

Three-phase Rectifier Bridge, Power Diode Module



WDMF75M16, a Power Diode Module in WMM01 Package

WDMF75M16 is WeEn's first Power Module. This three-phase rectifier bridge comes in the industry standard WMM01 package. This package features heat transfer through an aluminum oxide DBC, ceramic isolated metal baseplate. It has a high voltage capability of 1600 V and a high inrush current capability. The six silicon diodes are made in a planar process. The diodes have a high operating temperature capability, Tj (max) = 150 °C.

- **WMM01 Package**
- **High Operating Temperature Capability, Tj (max.) = 150 °C**
- **Diodes Made in Planar Process**
- **High Voltage Capability of 1600 V and a High Inrush Current Capability**

Features
- Three-phase rectifiers
- Heat transfer through aluminum oxide DBC, ceramic isolated metal baseplate
- High voltage capability
- High inrush current capability
- Planar process
- High operating temperature capability:
  - Tj (max.) = 150 °C

Key Applications
- Three phase rectification for power supplies
- Rectification for DC motor field supplies
- Battery charger rectifiers
- Input rectification for variable frequency drives

Market Segment
- Industrial
- Smart Consumer & Building
- Smart Grid

Sub Market
- Motion Control, Servo Drives
- Elevators, Escalators, Moving Walkways
- Robotics
- Heating, Ventilation and Air Conditioning
- Power Supplies (AC/DC, DC/DC)
- Power Supplies (UPS, Chargers)
- Power Conversion (Inverters, Welding, Converters)

Technology Segment
- Analog & Power

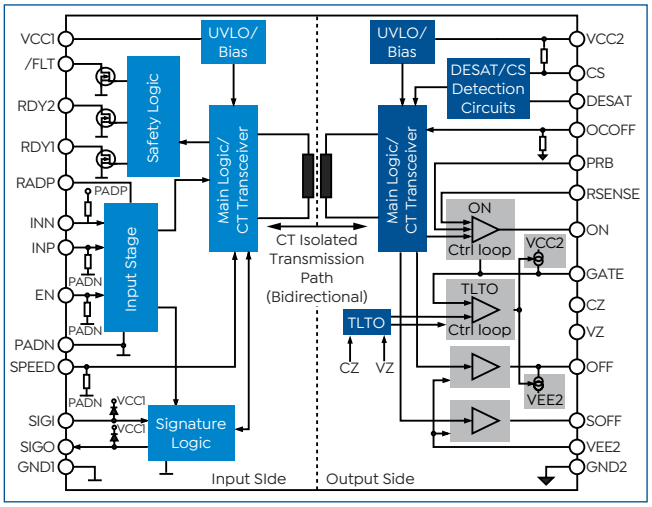
With a heritage of more than 50 years (formerly NXP), WeEn is a key player in the semiconductor industry which has focused on developing a broad portfolio of industry-leading bipolar power products, including silicon carbide diodes, thyristors (containing silicon-controlled rectifiers and triacs), high voltage transistors, and more.

Product order code

- SP001585168
- SP001039292
- SP001689604
- SP001357942

EiceDRIVER™ 1EDS-SRC Family

The New SRC EiceDRIVER™ Family: 1EDS20I12SV, 1EDU20I12SV, and 1EDI20I12SV



EiceDRIVER™ 1EDS-SRC Block Diagram

The new SRC EiceDRIVER™ family, which includes 1EDS20I12SV, 1EDU20I12SV, and 1EDI20I12SV, represents the latest generation of highly efficient low-EMI electric drive systems with lower EMI and improved efficiency. Based on the Infineon coreless transformer technology, it is the first high-voltage isolated gate driver on the market with dynamic Slew Rate Control (SRC), which allows on-the-fly dV/dt control of electric drives through precise gate current control, providing the best trade-off between minimum power dissipation and minimum EMI, depending on operating conditions. 1EDS20I12SV is UL 1577 (V_{ISO} = 5 kV(RMS)) and VDE 0884-10 certified, while 1EDU20I12SV is only UL 1577 certified. Evaluation board is available: EVAL-1EDS20I12SV.

- **Slew Rate Control**
- **Single-Channel Isolated IGBT Driver**
- **Supports IGBT up to 1200 V and 900 A**
- **IGBT OFF-State: 2 A Pull Down to Rail**

Features

- Overcurrent protection for Sense IGBTs and Conventional IGBTs
- Desaturation detection
- Soft turn-off shut down: 1 A pull-down to rail
- Two-level turn-off
- Reduction or elimination of dV/dt filter
- Low EMI during low load conditions and high efficiency during high load conditions
- Real-time adjustable gate current control
- SRC controlled gate current in 11 levels

Key Applications

- Motor Control and Drives
- Solar Inverters
- UPS Systems

Market Segment

- Industrial

Sub Market

- Elevators, Escalators
- Home & Building Control and Automation
- Robotics
- Motion Control, Servo Drives
- Factory Automation
- Heating, Ventilation and Air Conditioning

Technology Segment

- Analog & Power

The new EiceDRIVER™ SRC family is tailored to fit high-voltage industrial applications, such as those using EconoDUAL™ 3 power modules, with voltages up to 1200 V and currents up to 900 A.

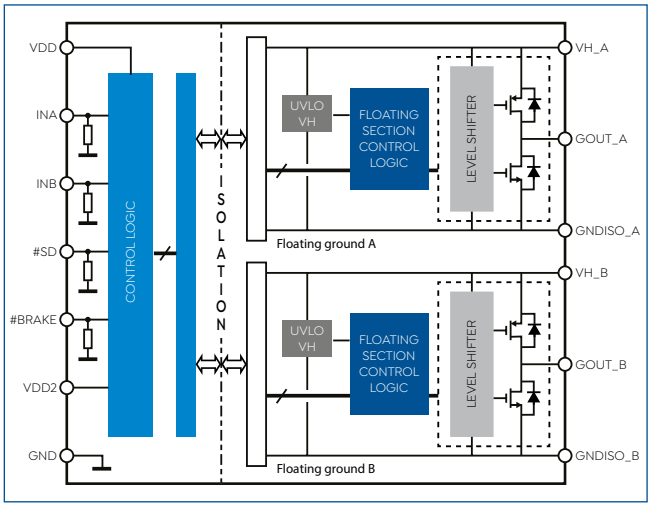
These drivers meet modern requirements for long-term stability in industrial applications. They are available in the 300 mil wide body DSO-36 package.

Product order code

- STGAP2DM
- STGAP2DMTR
- STGAP2SCM
- STGAP2SCMTR
- STGAP2SM
- STGAP2SMTR

Products STGAP2S and STGAP2D

Galvanically Isolated 4 A Single and Half-Bridge Dual Channel Gate Drivers



STGAP2D Block Diagram

The gate driver is characterized by 4 A capability and rail-to-rail outputs, suitable also for high power inverter applications (motor drivers in industrial applications). STGAP2S is proposed in two different configurations. The configuration with separated output pins allows optimizing turn-on and turn-off switching periods independently, by using dedicated gate resistors. The configuration featuring single output pin and a Miller Clamp function prevents gate spikes during fast commutations in half-bridge topologies. STGAP2D integrates several protection functions: dedicated SD and BRAKE pins, UVLO and thermal shutdown, and the interlocking function that prevents outputs from being high at the same time.

- **1700 V Single-/Dual-Channel Gate Driver**
- **Driver Current Capability: 4 A Sink/Source at 25 °C**
- **Overall Input-Output Propagation Delay: 80 ns**
- **UVLO function**

Features

- dV/dt transient immunity ± 100 V/ns
- Gate driving voltage up to 26 V
- 3.3 V, 5 V TTL/CMOS inputs with hysteresis
- Temperature shutdown protection
- Standby function
- Specific to STGAP2S:
  - Separate sink and source for easy gate driving configuration
  - 4 A Miller clamp dedicated pin
- Specific to STGAP2D:
  - Interlocking function
  - Dedicated SD and BRAKE pins

Key Applications

- Motor Driver for Home Appl., FA, Industry
- 600/1200 V Inverters
- Battery Chargers
- Induction Heating
- Welding
- UPS and Power Supplies
- Fans

Market Segment

- Industrial
- Smart Grid

Sub Market

- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Motion Control, Servo Drives
- Power Supplies (UPS, Chargers)
- Power Conversion (Inverters, Welding, Converters)
- Elevators, Escalators, Moving Walkways
- Robotics
- Railway (Traction, Control, etc...)
- Renewable Energy Generation
- Smart Grid Protection and Control

Technology Segment

- Analog & Power

The STGAP series allow the implementation of negative gate driving, and the onboard isolated DC-DC converters allow working with optimized driving voltages for MOSFET/IGBT or SiC. The following eval boards are available:

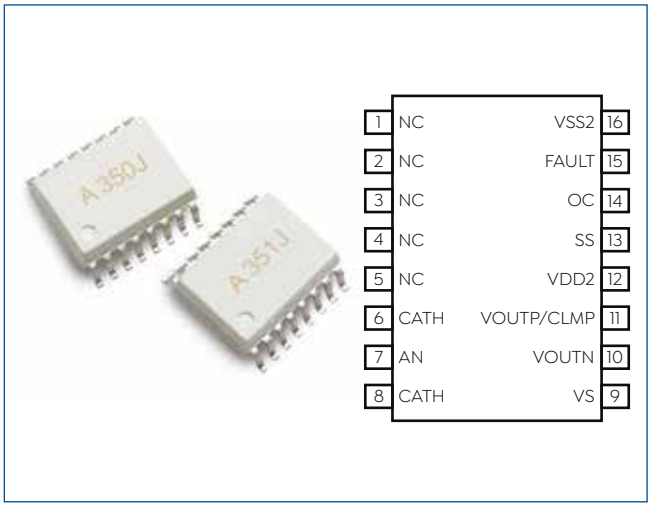
- 15 kW, 3-phase Vienna rectifier
- 15 kW, 3-phase, 3-level Active Front End
- 3.6 kW PFC totem pole reference design

Product order code

- ACPL-350J-000E
- ACPL-350J-500E
- ACPL-351J-000E
- ACPL-351J-500E

ACPL-350J

Gate Drive Optocoupler with Overcurrent Protection and Fault Signal



ACPL-350J and ACPL-351J

The ACPL-350J is a 3 A gate drive optocoupler device with an integrated IGBT and MOSFET diagnostics, protection and FAULT signal for external isolated feedback. The device features common-mode transient immunity (CMTI) greater than 100 kV/µs and provides minimal propagation delay with excellent timing skew. ACPL-351J is the 5 A version of this gate drive device. The high peak output current and wide operating voltage range eliminate the need for an output buffer circuit, enabling designers to implement cost-effective gate driver solutions for motor drives and power inverters.

- **FAULT signal for External Isolated Feedback**
- **150 ns max. Propagation Delay**
- **Integrated Miller Clamping**
- **CMR 100 kV/µs at V_{CM}=1.5 kV**

Features

- Adjustable soft-shutdown
- Rail-to-Rail Output Voltage
- Industrial Temperature Range: -40 to 105 °C
- Eliminates the need for an output buffer circuit
- Worldwide Safety Approval:
  - IEC/EN/DIN EN 60747-5-5, V_{IORM} = 1414 V_{PEAK}
  - UL 1577: 5000 V_{RMS}/1 min.
  - CSA notice #5

Key Applications

- IGBT/MOSFET Gate Drive
- Renewable Energy Inverter
- AC/Brushless DC Motor Drives
- Industrial Inverters
- Switching Power Supplies

Market Segment

- Industrial
- Smart Consumer & Building

Sub Market

- Elevators, Escalators, Moving Walkways
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Human Machine Interface
- Motion Control, Servo Drives
- Robotics
- Home & Building Control and Automation
- Power Supplies (AC/DC, DC/DC)

Technology Segment

- Analog & Power

The ACPL-350J/351J is a family of gate driver optocouplers that can be also used in SiC/GaN applications, while the IGBT/MOSFET driving performances can be evaluated using the ACPL-351J Evaluation Board.

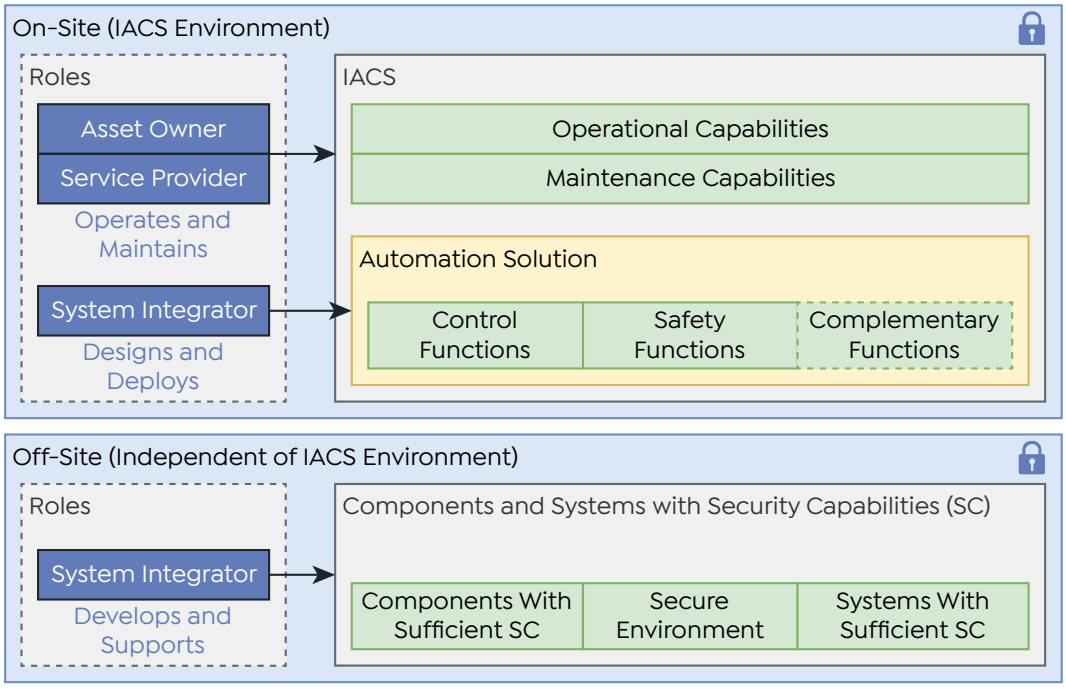
Please request the ACPL-351J Evaluation Board and schematic from your EBV or Broadcom sales representative.

INDUSTRIAL SECURITY AND IEC62443

In a highly interconnected Industrial Automation and System Control (IACS) concept introduced by Industry 4.0, the overall system security is of utmost importance. Exposing the industrial network to the Internet can bring many security concerns. Robust, yet flexible and well-thought security solutions, such as those proposed in the IEC 62443 standard series (IEC 62443), provide a robust framework for developing and deploying a holistic security solution for industrial automation of any scale.

Unlike the office environment where time is not a critical parameter, and the main focus is on confidentiality, industrial cyber-security must provide continuous operation of the production line, protecting the integrity of essential automation and control functions. The IEC 62443 standard series developed by the ISA99 committee provides a robust and flexible security standard framework, covering various aspects of a typical Industrial Automation Control System (IACS), offering a cohesive, holistic protection concept.

An efficient industrial security solution includes technical and organizational security measures. It cannot be implemented by neglecting the importance of the roles that the stakeholders must perform, starting with the Product Supplier, over the System Integrator, and ultimately - the Asset Owner. The IEC 62443 standard series recognizes these roles and describes a set of actions in various cases for each of them, as illustrated in the picture below:



The IEC 62443 standard series also recognizes the need for layered, partitioned implementation of technical security solutions, preventing over-protection of less critical parts of the system and increasing the overall effectiveness of the implemented security solution. Based on the risk assessment process, the entire IACS is partitioned into “zones” and “conduits,” with assigned Security Level Targets (SL-T). To achieve a specific SL-T, System Integrator must use components with sufficient SL Capabilities (SL-C). Once deployed, the achieved Security Level (SL-Achieved or SL-A) of the partition is measured and evaluated. This process is repeated until the SL-A reaches the SL-T.

In general, Security Levels are sorted from SL 0 to SL 4, according to the immunity they provide against third-party attackers with different amounts of motivation, expertise, and with different amounts of resources invested. IEC 62443 does not prescribe any strict rules for achieving a specific SL. It allows implemented security measures to evolve dynamically in relation to the severity of the attacks. The standard does, however, provide a mechanism for continuous evaluation of the SL ratings, based on the well-accepted “Plan-Do-Check-Act” or PDCA evaluation model.

A holistic protection concept such as IEC 62443, relies on implementing appropriate security solutions at every level, including technology, processes, and people. Technology alone is not sufficient to achieve the desired level of protection, regardless of its capabilities. Therefore, the overall protection level directly depends on all three factors mentioned above: technology, processes, and people. The Protection Level rating is used to qualitatively describe how well protected the production plant is during the operation, taking into account the SL ratings along with relevant technical and organizational safety procedures and processes (Maturity Level, ML ratings).

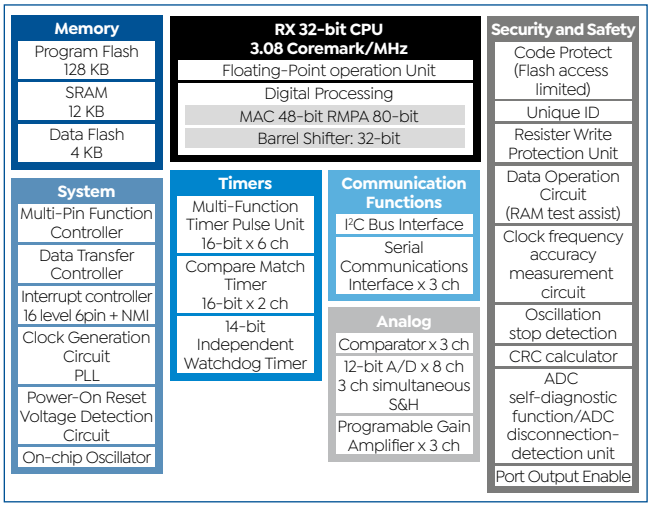
The IEC 62443 standard series does not prescribe strict methods for dealing with security threats. Instead, the standard offers a robust framework for developing the complete security solution for an industrial environment. The standard reaches far beyond what is presented in this short article, outlining various methods for maintaining a consistent level of protection throughout the entire lifecycle of an IACS.

Product order code

- R5F513T5ADFL#30
- R5F513T3AGFJ#30
- RTK0EMXA10C00000BJ

RX13T

32-bit RX Microcontroller with Enhanced Analog Features Optimized for Single Motor Control



RX13T Block Diagram

The new Renesas RX13T microcontroller Series is specialized for single-motor control. It offers optimized analog features such as 3 channel dedicated Programmable Gain Amplifiers (PGA) and Sample and Holds (S/H) which are bypassable. The 32 MHz 32-bit RXv1 CPU Core with a single-precision Floating Point Unit enables field-oriented motor control on a state-of-the-art level. Integrated DataFlash and oscillator further reduce the BOM size and cost, while simplifying the solution. By supporting 5 V operation and T_{AMB} up to 105 °C, the RX13T MCU is a perfect solution for demanding applications.

- **Optimized Functions for Single Motor Control from Timer to ADC incl. PGA and S&H**
- **Built-in Data Flash and Oscillator for BOM and System Cost Reduction at 5 V Supply**
- **Field Oriented Control Support Through CPU with Single-precision FPU**
- **Low Pin Count Package and Reasonable Flash Size Lineup**

Features

- 32-bit RX CPU core:
  - Max. operating frequency: 32 MHz (50 DMIPS)
  - Multiplication and division unit handles 32-bit × 32-bit operations
  - Accumulator can handle 64-bit results
  - Built-in 32-bit FPU (compliant to IEEE754)
  - Fast interrupt
- Low power design and architecture:
  - Operation from a single 2.7 V to 5.5 V supply
  - Three low power modes
- On-chip memory:
  - 128 / 64 KB capacities, no wait states
  - 12 KB of SRAM
  - On-chip DataFlash memory: 4 KB
- DMA: 5 channel DTC
- Independent watchdog timer
- Useful functions for IEC60730 compliance
- Up to 4 communication channels
- Up to 8 extended-function timers
- 12-bit A/D converter: 8 ch

Key Applications

- General industrial and consumer equipment

Market Segment

- Healthcare & Wearables
- Industrial
- Smart Consumer & Building
- Smart Grid

Sub Market

- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Motion Control, Servo Drives
- Robotics
- Home Appliances
- Power Supplies (AC/DC, DC/DC)
- Medical Instruments
- Home & Building Control and Automation

Technology Segment

- High End Processing

Start your motor control development easily, with the Motor Renesas Solution Starter Kit (RSSK), the RX13T CPU card, and the Renesas Motor Workbench 2.0.

This Workbench can display the waveform of internal MCU variables in real-time, and it can automatically extract vector control parameters.

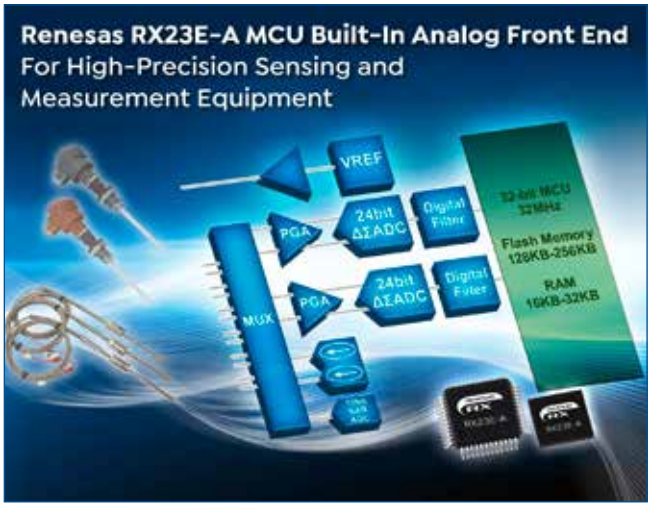
An RX13T On-Demand training course is available.

Product order code

- R5F523E6ADFL#30
- R5F523E6ADNF#U0
- R5F523E5ADFL#30
- R5F523E5ADNF#U0
- RTK0ESXB10C00001BJ

Renesas RX23E-A

MCU with High-precision On-chip Analog Front End



RX23E-A MCU with High-Precision AFE

The RX23E-A group microcontrollers are equipped with a high-end analog front end that can be used for temperature, pressure, flow or weight measurement with more than 0.1% precision without calibration, making it ideal for high-precision sensing, test, and measurement equipment. The RXv2 core microcontroller with DSP / FPU operations, enables high-accuracy measurement, control, and communication with a single chip. The Analog front-end also includes highly precise voltage references, matched and programmable excitation current sources and rail-to-rail PGAs.

- **Highly Integrated Dual 24-bit Delta-Sigma ADC as One-chip Microcontroller Solution**
- **32-bit RXv2 MCU at 32 MHz with FPU, up to 256 KB Flash, Various Communication Interfaces**
- **Simultaneous Measurement Trigger for Multiple Analog Signals by Using Dual ADC and ELC**
- **Three Low Power Consumption Modes**

Features

- Enhanced DSP: 16-bit and 32-bit instructions supported
- 32-bit FPU (IEEE754 compliant)
- Memory protection unit (MPU)
- Operation from a single supply (1.8 to 5.5 V)
- Three low power modes
- 128 KB to 256 KB code flash
- On-chip data flash: 8 KB
- On-chip SRAM, 16 to 32 KB
- DMAC: four channels
- DTC: four transfer modes
- Event Link Controller
- Up to 8 communication functions:
  - CAN, SCI, I2C, RSPI...
- Up to 12 extended-function timers:
  - 6 x 16-bit MTU
  - 4 x 8-bit TMR
  - 2 x 16-bit compare-match timers
- Advanced analog functions:
  - 2 x 24-bit delta-sigma ADC
  - High-precision, ultra-low noise instrumentation PGA: 30 nV(RMS)
  - Rail-to-rail instrumentation PGA
  - Offset drift: 10 nV/°C (gain = 128)
  - Gain drift: 1 ppm/°C
  - 6 x 12-bit A/D converter
- Operating temperature range:
  - –40 °C to +105 °C

Key Applications

- Scale
- Force Sensor

Market Segment

- Industrial
- Healthcare & Wearables
- Smart Grid
- Smart Consumer & Building

Sub Market

- Medical Diagnostic and Therapy
- Medical Instruments
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Instrumentation, Test and Measurement
- Robotics
- Heating, Ventilation and Air Conditioning
- Metering (Electricity, Flow, Heat)

Technology Segment

- High End Processing

The RX23E-A Renesas Solution Starter Kit (RSSK) includes the RX23E-A evaluation board with sensor measurement peripheral circuits.

Combined with the software available on the official website, this kit allows users to start evaluating analog features right after unboxing.

The RSSK helps users shorten development cycles and reduce time to market.

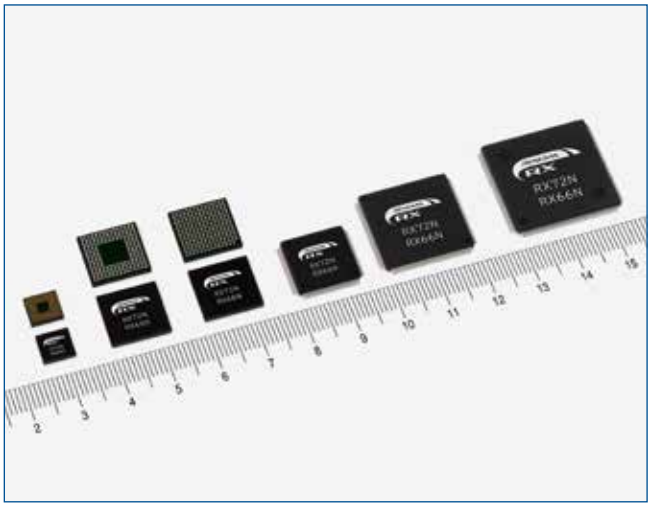
RENESAS

Product order code

- R5F572NNDDFC#30
- R5F572NNDDFB#30
- R5F572NNDDFP#30
- RTK5RX72N0C00000BJ
- R5F566NNDDBD#20
- R5F566NNDDFB#30

RX66N and RX72N

The new RX66N and RX72N MCU Families Offer Highest CPU Performance and Flash Integration



RN72N, RN66N Package Size Comparison

The new Renesas RX66N and RX72N high-performance MCU families offer the highest integration of fast 120 MHz-Flash and SRAM memory and peripheral functions. Up to 4 MB of Flash and 1 MB of SRAM save external memory extensions and enable feature-rich applications like AC Servo Drives and Motion Controllers of HMI Control Panels with TFT LCD. The super high-performance CPU with 120 or 240 MHz delivering up to 1396 CoreMark paired with dual IEEE1588 compliant Ethernet, strongest Crypto features and various HW accelerators matches with demanding needs for future proof and cutting edge designs.

- **Ultra Performance: 32-bit RX MCU at 240 MHz, On-chip Double-precision FPU, 1396 CoreMark**
- **Flash Integration: Up to 4-MB Dual-bank Flash, 1 MB SRAM, QSPI**
- **Rich Connectivity:Dual IEEE1588 Ethernet, SD Host Interface, QSPI and Triple CAN**
- **Best Preipherals: Trigonometric Functions Unit, LCD Controller, 2D Engine, CMOS Camera I/F**

Features

- Arithmetic unit for trigonometric and SQRT functions
- Up to 4 MB of flash memory
- 1 MB of SRAM
- Data transfer:
  - DMACAa, DTCb, EXDMAC, DMAC
- Real-time clock with advanced functions
- Independent watchdog timer
- Useful functions for IEC60730 compliance
- Communications interfaces:
  - Ethernet MAC compliant with IEEE 1588
  - USB PHY layer
  - CAN, SCIj, SCIh, SCIi, I²C, QSPI...
  - SD host interface, MMCIF
  - Parallel data capture unit (PDC) for the CMOS camera interface
  - Graphic-LCD controller (GLCDC)
  - 2D drawing engine (DRW2D)
- Up to 29 extended-function timers
- 2 x 12-bit A/D converter
- 2 x 12-bit D/A converter
- Temperature sensor
- Encryption functions

Key Applications

- Industrial Robotics

Market Segment

- Communication & Infrastructure
- Healthcare & Wearables
- Hi-Rel
- Industrial
- Smart Consumer & Building

Sub Market

- Telecom and Networking
- Robotics
- Home & Building Control and Automation
- Motion Control, Servo Drives
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Human Machine Interface
- Information Kiosk & Advertising Panels
- Elevators, Escalators, Moving Walkways
- Surveillance, Parking & Traffic Control

Technology Segment

- High End Processing

Jump-start evaluation on networking, HMI, and security with the RX72N Envision Kit: you can develop HMI features such as voice input and output, and develop IoT devices using Wi-Fi/ BLE and Ethernet, all with one kit!

The RSK RX72N Starter Kit is also available. It is the perfect kit for developers who are new to the RX72N.

CoolSiC™ MOSFET

CoolSiC™ MOSFET Evaluation Board for 7.5 kW Motor Drive Applications

CoolSiC™ MOSFET Evaluation Board for 7.5 kW Motor Drive Applications

The EVAL-M5-E1B1245N-SiC is a complete evaluation board including a 3-phase CoolSiC™ MOSFET power module for motor drive applications. In combination with one of the available MADK control board options with the M5 32-pin connector, it demonstrates Infineon's silicon carbide power module technology.
It features EasyPACK™ 1B 1200 V CoolSiC™ MOSFET power module FS45MR12W1M1_B11 in a six-pack configuration which is optimized for motor drive applications with very high-frequency switching operation such as General Purpose Drives and the fast-growing servo drive and robotics market.
The board also uses the EiceDriver™ 1200 V high speed isolated gate driver 1EDI20H12AH, which is perfect companion for CoolSiC™ SiC MOSFETs.

- **EasyPACK™ 1B 1200 V CoolSiC™ MOSFET Power Module FS45MR12W1M1_B11**
- **Low Inductance Design**
- **PCB Size: 259 x 204 mm**
- **Input voltage range: 340 to 480 V_{AC}**

Features

- Overload and short-circuit hardware protection
- Overtemperature hardware protection
- Maximum 7.5 kW motor power output
- Integrated NTC temperature sensor
- On-board EMI filter
- Thermistor output
- All six switches turn off during protection
- Rugged gate driver technology with stability against transient and negative voltage
- Auxiliary power supply with 5 V
- Measurement test points compatible with standard oscilloscope probes
- Lead-free terminal plating & RoHS compliant

Key Applications

- Motor control and drives

Market Segment

- Industrial

Sub Market

- Motion Control, Servo Drives
- Robotics
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Human Machine Interface
- Elevators, Escalators

Technology Segment

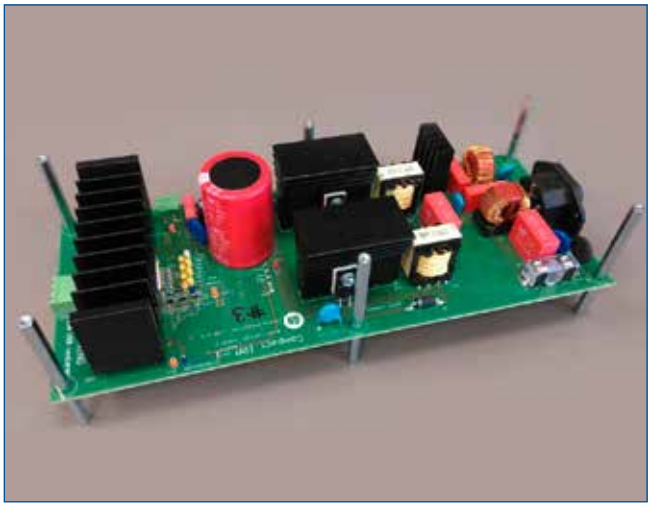
- Tool

The Eval-M5-E1B1245N-SiC is part of the iMOTION™ Modular Application Design Kit for motor drives (MADK). The MADK platform is intended for use at various power stages with different control boards.

These boards can easily be interfaced via the iMOTION™ MADK-M5 32-pin interface connector to control boards such as the XMC DriveCard 4400/1300.

SECO-1KW-MCTRL-GEVB

Reference Design for Three-Phase Motor Drives, Based on Intelligent Power Module (IPM)



SECO-1KW-MCTRL-GEVB

The SECO-1KW-MCTRL-GEVB is a complete reference design for three-phase motor drives, featuring the NFAQ1060L36T intelligent power module.
Rated for 230 V(AC) input voltage and delivering up to 850 W power the reference design includes all necessary system blocks for a complete motor drive solution: EMC filtering and rectification stage, interleaved two-channel PFC, auxiliary power supplies, three-phase inverter, measurement, and protection. The graphical user interface ensures an easy startup for evaluation purposes running voltage/frequency control.

- **850W Intelligent Power Module (IPM) Motor Driver**
- **Compatible with Three-Phase Motors: PMSM, BLDC or ACIM**
- **Cross-Conduction, Overcurrent, and Thermal Protection, Embedded in an Intelligent Power Module**
- **Highly Integrated Power Module with Power Stage for a High Voltage Three-Phase Inverter**

Features

- 850 W complete motor control solution with AC mains supply 230 V(RMS) ±15%, EMI filter, two-channel interleaved Power Factor Correction (PFC)
- Highly integrated power module NFAQ1060L36T containing an inverter power stage for a high voltage three-Phase inverter
- PFC stage using NCP1632 controller, FCPF125N65S3 power transistors, and FFSPF1065A diodes
- DC/DC converter producing auxiliary power supply 15 V(DC): non-isolated buck converter using NCP1063
- Three-Phase current measurement, using three NCS2003 operational amplifiers
- Over-current protection, using NCS2250 push-pull output comparator

Key Applications

- White Goods, Washing Machines
- Industrial Fans
- Industrial Automation
- Industrial Motor Control

Market Segment

- Industrial
- Smart Consumer & Building

Sub Market

- Motion Control, Servo Drives
- Home Appliances

Technology Segment

- Tool

The SECO-1KW-MCTRL-GEVB is a complete reference design for three-phase motor drives.

It uses an intelligent power module, enabling reliable, compact and fast time to market solutions.

Furthermore, the reference designs show ON Semiconductor's solutions for rectification, PFC, DC/DC, sensing, protection, and power modules.

STEVAL-STWINKT1

STWIN SensorTile Wireless Industrial Node Development Kit for Industrial IoT

STEVAL-STWINKT1 Photo - Top View

The STWIN SensorTile wireless industrial node (STEVAL-STWINKT1) is a development kit and reference design that simplifies prototyping and testing of advanced industrial IoT applications such as condition monitoring and predictive maintenance. The kit features a core system board with a range of embedded industrial-grade sensors and an ultra-low-power microcontroller for vibration analysis, and high precision local temperature and environmental monitoring.

- **Multi-sensing Wireless Platform Implementing Vibration Monitoring and Ultrasound Detection**
- **Wide Range of Industrial IoT Sensors**
- **Modular Architecture, Expandable via On-board Connectors**
- **Wireless BLE4.2, RS485 and USB OTG Connectivity**

Features

- Micro SD Card slot for standalone data logging applications
- Ultra-wide bandwidth (up to 6 kHz), low-noise, 3-axis digital vibration sensor (IIS3DWB)
- 3D accelerometer + 3D Gyro iNEMO inertial measurement unit (ISM330DHCX) with machine learning core
- Ultra-low-power high-performance MEMS motion sensor (IIS2DH)
- Ultra-low-power 3-axis magnetometer (IIS2MDC)
- Digital absolute pressure sensor (LPS22HH)
- Relative humidity and temperature sensor (HTS221)
- Low-voltage digital local temperature sensor (STTS751)
- Industrial grade digital MEMS microphone (IMP34DT05)
- Wideband analog MEMS microphone (MP23ABS1)
- STMOD+ and 40-pin flex general-purpose expansions
- 12-pin male plug for connectivity expansions
- 12-pin female plug for sensing expansions
- Li-Po battery 480 mAh
- STLINK-V3MINI debugger with programming cable
- Plastic box

Key Applications

- Predictive Maintenance
- Condition Monitoring
- Asset Tracking

Market Segment

- Industrial

Sub Market

- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Motion Control, Servo Drives
- Robotics

Technology Segment

- Smart Sensing & Connectivity

The STEVAL-STWINKT1 is a complete system for sensor data acquisition designed for predictive maintenance and cloud connectivity:

Wirelessly, via BLE, Wi-Fi (STEVAL-STWINWFV1), or LTE (P-L496G-CELL02), and wired via RS485 transceiver or USB OTG.

The kit also includes a 480 mAh Li-Po battery, a STLINK-V3MINI debugger, and a plastic box.

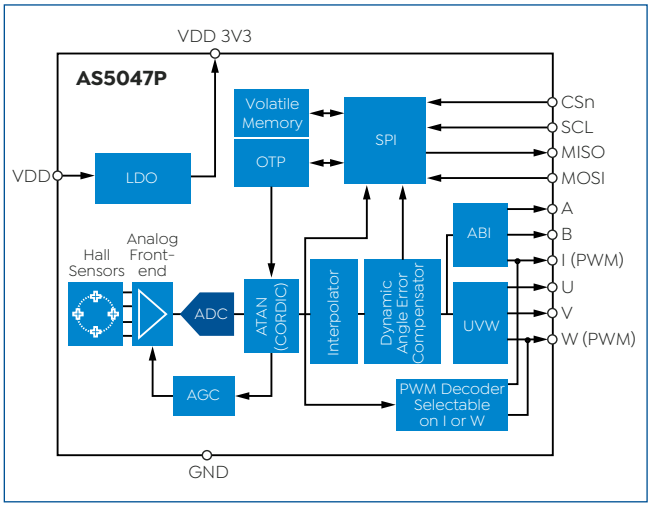
www.ams.com

Product order code

- 505580015
- 505580016
- 990601019
- 990600773
- 990600840
- 990600795

AS5047x family (U/P/D)

High-resolution Rotary Position Sensor



AS5047P Block Diagram

The AS5047x family is a high-resolution rotary position sensor for fast absolute angle measurement over a full 360-degree range. This position sensor is equipped with revolutionary integrated dynamic angle error compensation (DAEC™) with almost 0 latency at a higher rotational speed. The robust design of the device suppresses the influence of any homogenous external stray magnetic field. The sensor supports several interfaces such as standard UVW commutation interface, incremental ABI interface (16989 steps/4096 pulses per revolution) and PWM-encoded output for absolute angle position.

- **DAEC™ Dynamic Angle Error Compensation**
- **DFS™ Dynamic Filter System**
- **Magnetic Stray Field Immunity**
- **Independent Output Interfaces: SPI, ABI, UVW, PWM**

Features

- Easy to use
- Higher durability and lower system costs (no shield needed)
- Versatile choice of interfaces
- High resolution for motor & position control
- Simple optical encoder replacement
- No programmer needed (via SPI command)

Key Applications

- Potentiometer
- Stepper motor
- Robotics & Drones
- BLDC motor control
- Servo motors
- High-speed angle sensing

Market Segment

- Automotive
- Industrial

Sub Market

- Automotive Power Train and Chassis
- Elevators, Escalators, Moving Walkways
- Factory Automation (PLCs, I/O, Sensors & Actuators)

Technology Segment

- Smart Sensing & Connectivity

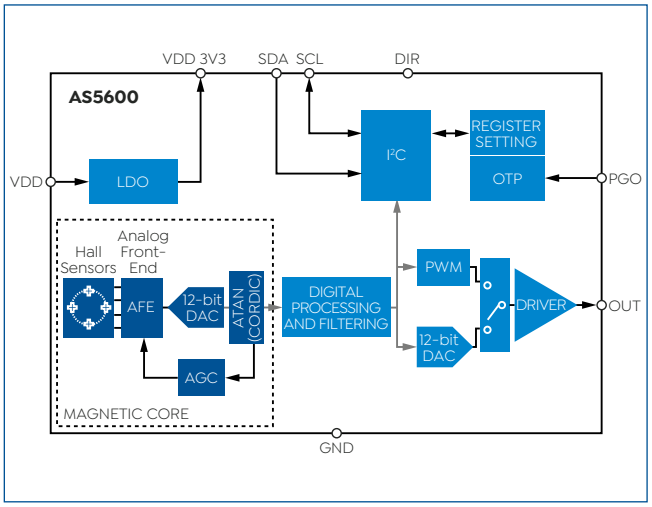
Additional resources are available for the ASS5047x family, including several adapter boards, accessories, application notes, as well as the USB I&P Box Evaluation Tool, with a PC-compatible software for easy evaluation!

Product order code

- 191240012
- 191240005
- 990600786
- 990600802
- 990600800
- 990600833

AS5600

Position Sensor



AS5600 Block Diagram

The AS5600 is an easy to program magnetic rotary position sensor with a high-resolution 12-bit analog or PWM output. This contactless system measures the absolute angle of a diametrically magnetized on-axis magnet. The AS5600 is designed for contactless potentiometer applications and its robust design eliminates the influence of any homogenous external stray magnetic fields. The industry-stand ard I²C interface supports simple user programming of non-volatile parameters without requiring a dedicated programmer.

- **Contactless Angle Measurement**
- **Simple User-programmable Start and Stop Positions Over the I²C Interface**
- **Maximum Angle Programmable from 18° up to 360°**
- **Automatic Entry into Low-power Mode**

Features

- 12-bit DAC output resolution
- Analog output ratiometric to V_{DD} or PWM-encoded digital output
- Highest reliability and durability
- Simple programming
- Great flexibility on an angular excursion
- High-resolution output signal
- Selectable output
- Low power consumption

Key Applications

- Rotary Knobs
- Potentiometer
- Stepper Motor
- Robotics & Drones

Market Segment

- Industrial

Sub Market

- Professional Gaming, Amusement & Casino Machines
- Point of Sales and Vending machines
- Motion Control, Servo Drives
- Instrumentation, Test and Measurement
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Elevators, Escalators, Moving Walkways
- Commercial, Construction and Agricultural Vehicles
- Robotics

Technology Segment

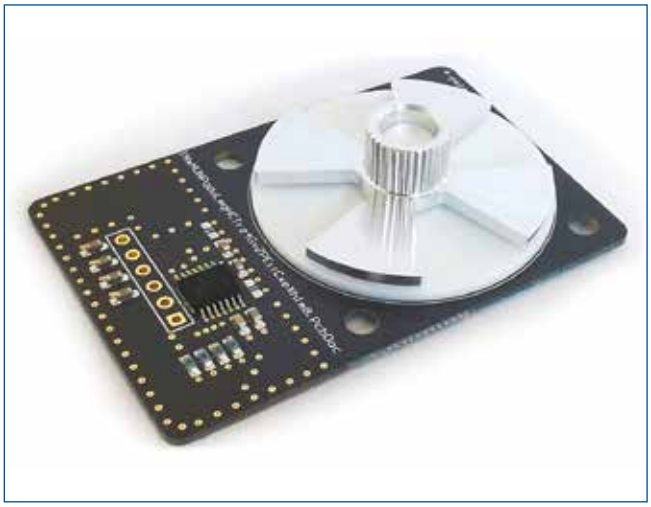
- Smart Sensing & Connectivity

There are additional resources for the AS5600 magnetic rotary position sensor IC available, including an adapter board, reference design, evaluation kit, and the AS5600-POTUINO shield.

The AS5600-POTUINO shield is compatible with the Arduino UNO board and it is designed for a quick evaluation of the AS5600 IC.

AS5715R

Inductive Position Sensing for Automotive Applications



AS5715R Reference Board

Based on inductive sensor technology, a new position sensor from ams measures the coupling between a TX (transmission) and two RX (receive) coils via a moveable target. The coils are executed as printed circuit coils, thus reducing the overall cost of the system. The target is a simple punched metal part. With the correct layout of the coils and the target, the IC outputs differential SIN/COS signals proportional to the angular position of the rotor, allowing the AS5715R to be used for motor commutation. The product is defined as SEooC (Safety Element out of Context) according to ISO26262.

- **On- and Off-axis Positioning Possible**
- **Adaptable Coil/Sensor Layout**
- **High Angular Accuracy (0.3° Electrical Error)**
- **Low Propagation Delay**

Features

- Works with motors up to 480,000 RPM
- Differential analog SIN/COS Output
- Easy replacement of resolvers, AMR/GMR sensors
- Enabler for safety-critical applications
- IC interface
- Suitable for automotive applications
- AEC-Q100 Grade 0 qualified

Key Applications

- Direct drives for electric vehicles
- EPS motor drive
- HVAC pumps
- Window lift

Market Segment

- Automotive

Sub Market

- Automotive Power Train and Chassis
- Commercial, Construction and Agricultural Vehicles

Technology Segment

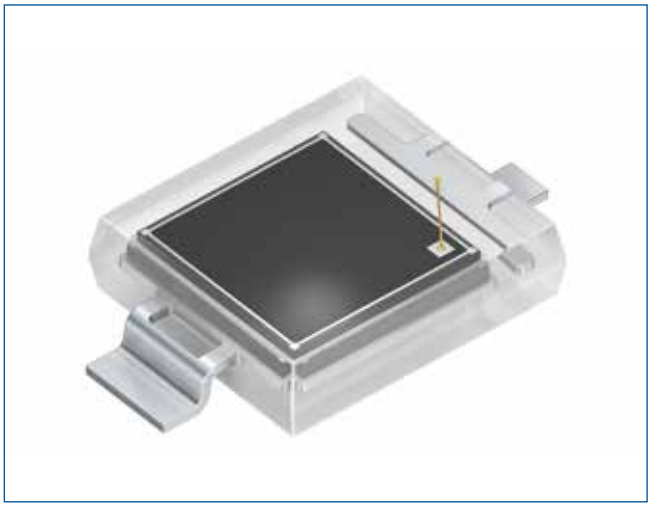
- Smart Sensing & Connectivity

Thanks to its flexibility, easy adaption, and low overall system costs, the AS5715 acts as the perfect resolver replacement and can be used for the on-axis as well as off-axis applications!

The AS5715R Reference Board is available for quick evaluation. A fully assembled board, target, spacer, and connector (plug-strip) are included in the kit.

SFH 2401 – DIL SMT

Silicon PIN Photodiode With Enhanced Blue Sensitivity



SFH 2401 Silicon PIN Photodiode

OSRAM Opto Semiconductors offers a broad portfolio for silicon photodiodes with various sensitivity ranges. The SFH 2401 silicon PIN photodiode is the latest member of the family, providing enhanced blue sensitivity to support Industrial Automation applications e.g., light barriers or vision controls.

- **Enhanced Blue and Green Sensititvity**
- **DIL Plastic Package (Clear Epoxy) with High Packing Density**
- **ESD: 2 kV acc. to ANSI/ESDA/JEDEC JS-001 (HBM, Class 2)**
- **Suitable for Reflow Soldering / Solder Control Structure**

Features

- SFH 2401 is a successor type for BPW 34BS
- Enhanced blue and green light sensitivity
- Total spectral range from 300 to 1100 nm
- Max. sensitivity at 950 nm
- Increased radiant sensitive area

Key Applications

- Industrial Automation
- Machine Controls
- Light Barriers
- Light Curtains
- Vision Controls

Market Segment

- Industrial

Sub Market

- Embedded Vision
- Factory Automation (PLCs, I/O, Sensors & Actuators)
- Human Machine Interface
- Instrumentation, Test and Measurement
- Robotics

Technology Segment

- Smart Sensing & Connectivity

The SFH2401-DIL SMT is a high sensitivity photodiode with high linearity.

It is a perfect solution for low-light applications when the high signal-to-noise ratio is required.

It also features enhanced blue light sensitivity, well-suited for IA-related applications.

Product order code

- MTFDHBL128TDP-1AT12AIYY
- MTFDHBL064TDP-1AT12AIYY
- MTFDHBL064TDQ-1AT12ATYY
- MTFDHBL128TDP-1AT12AIYY
- MTFDHBL128TDQ-1AT12ATYY
- MTFDHBL256TDP-1AT12AIYY

2100AI/2100AT

Micron® Industrial and Automotive SSDs

Micron Technology 2100AI M.2 Solid-State Drive

Available package options and densities:
BGA – 64 GB to 1 TB
M2 (22x30) – 128 GB to 1 TB

Thrive in Extreme Conditions Using Solid State Storage. Extend Micron's proven consumer Solid-State Drive (SSD) portfolio into automotive and industrial domains. Boost performance and reliability of leading-edge automotive electronics systems and industrial-grade applications with the Micron® 2100AI/AT SSDs.

- **Extended Temperature: (T_{CASE}) AI: -40 to 95 °C, AT: -40 to 105 °C**
- **Reliability: Vibration (M.2): 20 G at 7 – 2000 Hz**
- **Packages: M.2 (22 x 30), BGA (16 x 20 x 1.2/1.6 mm)**
- **Encryption: 256-bit AES, TCG Opal 2.0**

Features

- Withstands extended temperature ranges:
  - Industrial temperature range
  - Adaptive thermal throttling
- Robust security:
  - On-the-fly hardware-based data encryption
  - Secure firmware download
  - Cryptographic erase
- Data protection:
  - Data path protection
  - Data integrity protection in unexpected power-loss events
- Significantly faster boot, and application loading times
- Considerably lower power consumption than typical hard drives

Key Applications

- Adaptive Driver Assistance System, Black Box
- Heavy Robotics, Remote Communication Equipment
- Medical Equipment, Aerospace Solutions
- Smart Security, Home, Retail

Market Segment

- Automotive
- Healthcare & Wearables
- Industrial
- Hi-Rel
- Smart Consumer & Building
- Smart Grid

Sub Market

- ADAS, Automotive Infotainment & Cluster
- Human Machine Interface
- Embedded Vision
- Embedded Computing & Storage
- Aerospace, Defense and High Temp Electronics
- Medical Imaging
- Home & Building Security (Alarms, Access Control)
- Surveillance, Parking & Traffic Control
- Robotics
- Smart Grid Protection and Control

Technology Segment

- High End Processing

Micron's high-capacity industrial SSDs deliver the most reliable performance even in harsh industrial environments and at elevated operating temperatures.

Available in several small form factors, they are the perfect choice for applications in robotics, remote communication installations, and medical equipment.

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