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ELECTRONICS INFORMATION UPDATE

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FEATURES

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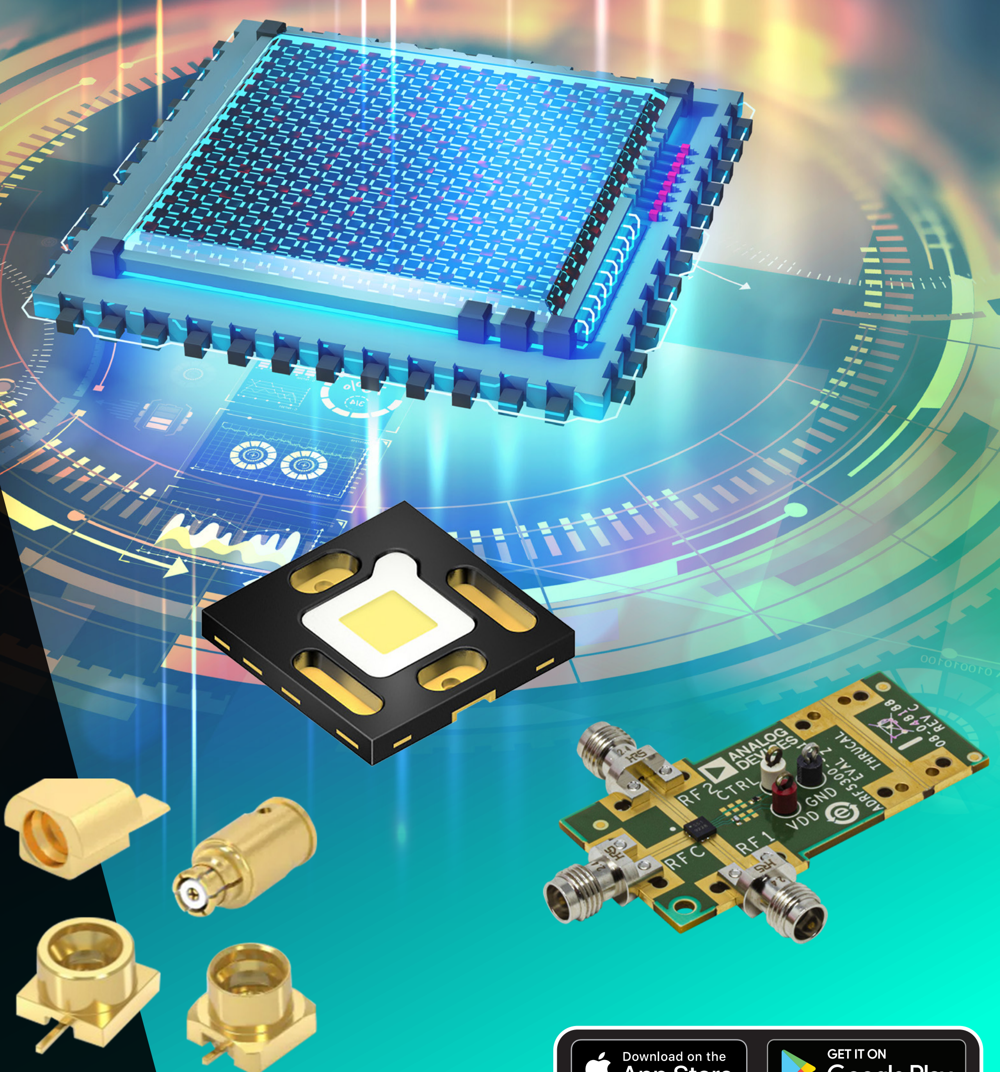

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ELECTRONICS INFORMATION UPDATE

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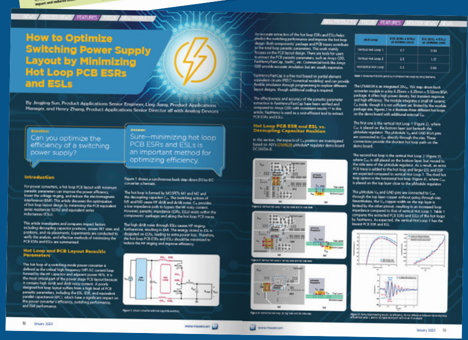
In this issue...

EIU wishes all its readers a heathy and prosperous 2023. Our January issue focuses on that most essential of functions, Power, and presents articles on: Optimizing PSU layout; Thermal efficiency for sustainable data centres; Redefining PoE; New microgrid technology; and how in-built motor drive fault diagnosis reduces field returns.



David 'Connector Geek' Pike considers power integrity, and Stuart Cording monitors power consumption. Tech Tips looks at how Machine Learning can help prepare us for wildfires. Plus the news round-up, Dev Kit Pick and, of course, a review of the most innovative products now in stock at Mouser.

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Claudia Bertaccini at
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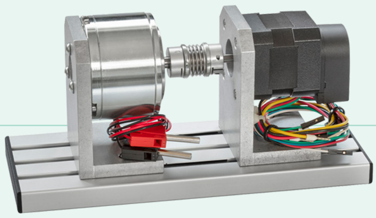
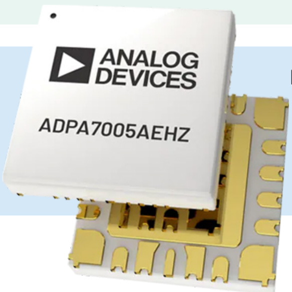




How New Technology Benefits Microgrids

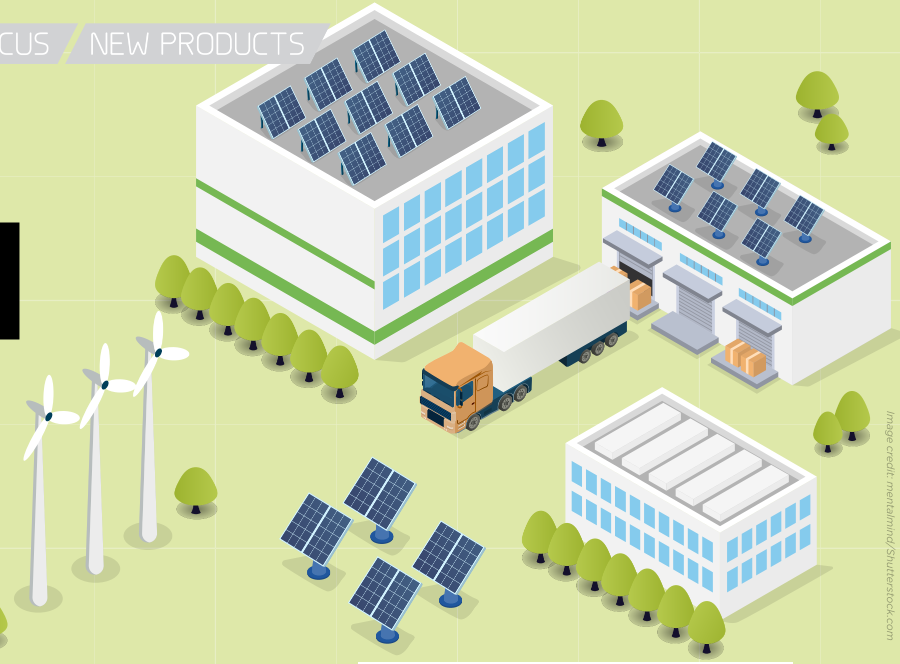


Image credit: mentalmind/Shutterstock.com

By Paul Lee for Mouser Electronics

Microgrids have been around for a long time in some form or another. The farmer that fired up his diesel generator in the early 20th century to keep his irrigation pumps and house lights working when the utility supply failed might not have recognized the term. Still, he was setting up what is now the definition of a microgrid–a group of locally interconnected loads and an energy source that can operate independently of the national grid.

Marketers have had fun with the nomenclature as usual, with macro- used for the main grid, milli- for larger installations or collections of independent grids, micro- and even nano-grids that might be no more than a backpack-mounted solar panel topping up your cellphone on a hike.

The microgrid is an area of intense interest today, typically powering an installation such as a farm, remote factory, hospital, or military site. With a global market projected to be around $47.4 billion (USD) in 2025 at a compound annual growth rate of more than 10 percent, a microgrid can be fully independent or islanded, a backup for the main grid on failure or even a contributor to the main grid when locally-sourced energy is in excess of local needs.

The drivers for the use of microgrids are power for remote locations where no utility infrastructure is present, resilience against main grid failure, and flexibility to use local renewable energy sources such as hydro, solar, wind, ground-sourced, and combined heat and power (CHP), for a smaller environmental impact and reduced costs.

Security is also a growing concern, especially for critical installations such as data centers, hospitals, and military bases where cyberattacks on the main utility supply are real possibilities. Here, we'll review types of microgrids and power-conversion arrangements and the benefits of each.

A Smart Microgrid Is Key to Effectiveness

A domestic microgrid arrangement might look like Figure 1, with fixed solar panels replacing or contributing to utility power via an inverter synchronized to the main grid. A high-capacity lithium-ion or lithium-iron-phosphate battery might be kept charged and available to provide power after dark or backup if the main power fails. Alongside typical household loads such as lighting, heating, and kitchen/utility equipment, electric vehicle recharging is increasingly in the mix. Ideally, it should be from a local renewable energy source such as solar to retain its green credentials.

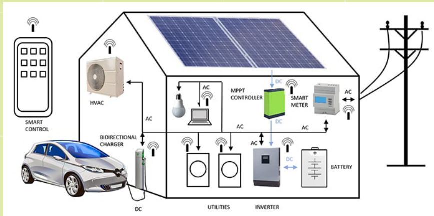


Figure 1: A typical domestic microgrid arrangement. (Source: Mouser Electronics)

Smart control, personalizing the microgrid installation, squeezes the maximum efficiency from solar panels while scheduling loads for minimum impact. Excess energy can be automatically returned to the main grid, either from the solar panels or even from the EV battery, for utility load balancing in return for monetary credit.

A factory would have a more complex microgrid arrangement, perhaps with multiple energy sources, as in Figure 2. The cost-benefit analysis for a factory environment is more complex than for a domestic situation. Lost production during a blackout is a real cost, and extra productivity and lower energy costs from a smart environment are real benefits.

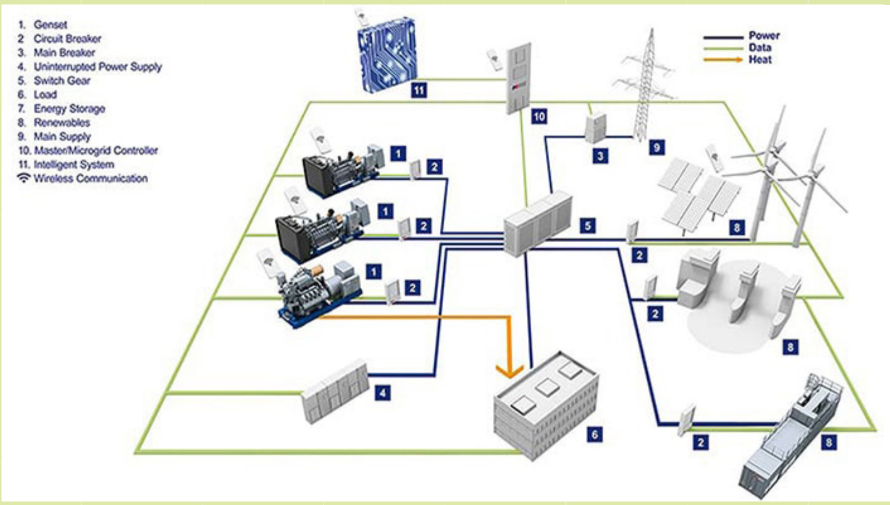


Figure 2: A typical microgrid arrangement in a factory environment. (Image reproduced with the permission of Rolls-Royce Power Systems AG)

How to Optimize Switching Power Supply Layout by Minimizing Hot Loop PCB ESRs and ESLs

By Jingjing Sun, Product Applications Senior Engineer, Ling Jiang, Product Applications Manager, and Henry Zhang, Product Applications Senior Director all with Analog Devices

Question:
Can you optimize the efficiency of a switching power supply?

Answer:
Sure—minimizing Hot Loop PCB ESRs and ESLs is an important method for optimizing efficiency.

Introduction

For power converters, a Hot Loop PCB layout with minimum parasitic parameters can improve the power efficiency, lower the voltage ringing, and reduce the electromagnetic interference (EMI). This article discusses the optimization of Hot Loop layout design by minimizing the PCB equivalent series resistances (ESRs) and equivalent series inductances (ESLs).

This article investigates and compares impact factors including decoupling capacitor positions, power FET sizes and positions, and via placements. Experiments are conducted to verify the analysis, and effective methods of minimizing the PCB ESRs and ESLs are summarized.

Hot Loop and PCB Layout Parasitic Parameters

The Hot Loop of a switching-mode power converter is defined as the critical high frequency (HF) AC current loop formed by the HF capacitor and adjacent power FETs. It is the most critical part of the power stage PCB layout because it contains high dv/dt and di/dt noisy content. A poorly designed Hot Loop layout suffers from a high level of PCB parasitic parameters, including the ESL, ESR, and equivalent parallel capacitance (EPC), which have a significant impact on the power converter's efficiency, switching performance, and EMI performance.

Figure 1 shows a synchronous buck step-down DC-to-DC converter schematic.

The Hot Loop is formed by MOSFETs M1 and M2 and the decoupling capacitor C_{IN}. The switching actions of M1 and M2 cause HF di/dt and dv/dt noise. C_{IN} provides a low impedance path to bypass the HF noisy content. However, parasitic impedance (ESRs, ESLs) exists within the components' packages and along the Hot Loop PCB traces.

The high di/dt noise through ESLs causes HF ringing, furthermore, resulting in EMI. The energy stored in ESL is dissipated on ESRs, leading to extra power loss. Therefore, the Hot Loop PCB ESRs and ESLs should be minimized to reduce the HF ringing and improve efficiency.

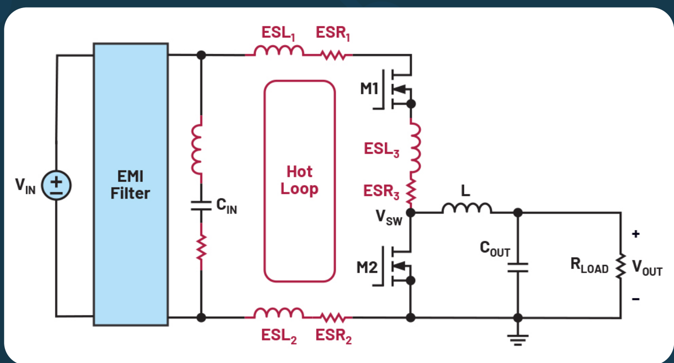


Figure 1. A buck converter with Hot Loop ESRs and ESLs.

Image credit: ctrlaplus/Shutterstock.com
Image credit: RedlineVector/Shutterstock.com

Talking Test

By Stuart Cording, Consulting Engineer

Whatever your new normal is – back in the lab, remote or hybrid – you'll need good test resources with the emphasis on accuracy, flexibility, portability and affordability. Electronics engineer and technical writer Stuart Cording, who focuses primarily on the semiconductor and embedded systems sectors, is here to help.

Peering into power

When developing battery-powered applications, operational life is a core concern. Determining the application's power profile on paper alone is exceptionally challenging, especially with the diverse range of radio technologies and operation modes of Internet of Things (IoT) applications. When deployed in different parts of the same building, the same devices may have substantially different power consumption due to poor reception and repetition of failed data transfers.

Further challenges arise when applications are deployed outdoors, as temperature impacts the battery's properties. Low temperatures cause the output voltage to drop due to increased internal resistance. Capacity also drops significantly below 0°C. As a result, a battery-operated device that worked in the fall may fail as winter arrives.

With current draw in low-power and sleep mode for microcontrollers dropping to the nanoamp range, multimeters are a poor choice of tool as they aren't designed to measure such low currents. Digital ammeters are another option. As the application switches from sleep to active modes, they provide the necessary dynamic range to deliver accurate measurements.

But developers aren't that interested in static measurements. Far more important is the dynamic power profile, which can be used to predict battery life under different operational conditions.

Ensuring application battery life

Accurate power profiling typically requires a collection of equipment, but today, highly integrated tools are available. One option is the Otii Arc Pro from Qoitech, a startup based in Sweden (Figure 1). Targeting battery-powered applications and IoT devices, it integrates a power supply, current measurement, and a programmable digital interface.

The compact anodized housing is rugged and portable, allowing the use of the tool in field measurements under realistic user conditions.

Powered via USB, it is accompanied by a year of access to the Otii Pro Software that provides access to a host of additional capabilities, including UART logging, battery life calculator, and customization of statistics. This builds on the basic feature set of measurements and statistics, calibration offset, and result export options.

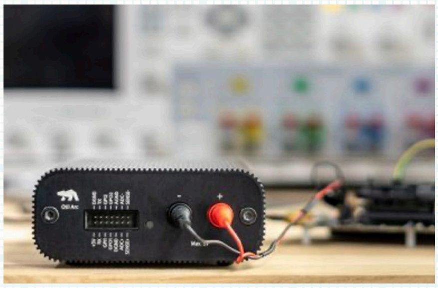


Figure 1: Otii Arc delivers the power profile of low-power and battery-powered applications. Using scripts, tests can also be automated. ***Source: Qoitech AB. (NOTE: source - https://www.qoitech.com/wp-content/themes/yootheme/cache/9f/lab_-scaled-9f26da9b.webp).***

The hardware unit provides output voltage control from 0.5 to 3.75V in 1 mV steps in auto-ranging mode, or up to 4.2V in the high current range, at a maximum output current of 250mA. Moving to an external power supply increases these to 5.0V and 2.5A continuous current (5.0A maximum). Current measurement accuracy is ±(0.1 % + 50nA) up to 19mA and ±(0.1 % + 150µA) beyond this, while voltages are accurate to ±(0.1 % + 1.5mV).

Additional analogue measurements, such as measuring an additional subsystem, are supported with an analogue-to-digital converter (ADC) that can be used in single-ended and differential modes. Digital I/Os are also available to support control of the device under test and provide UART functionality.

From the Connector Geek

Don't diss connectors! David Pike is proud to call himself the 'Connector Geek'. He has spent nearly 30 years in the interconnection marketplace, working with manufacturers and distributors, building a reputation throughout the industry for his passion and knowledge. So we gave him his own series...

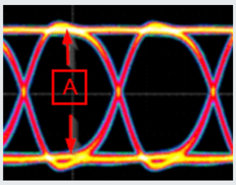
AN INTRODUCTION TO POWER INTEGRITY

The demand for high-speed connectivity is growing. The widespread adoption of 5G technology, the growth of the Internet of Things (IoT) and growing connectivity of devices such as cars and homes has driven the appetite for high data rates. Signal integrity has become hugely important to the electronics industry.

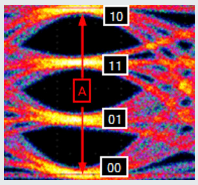
A few decades ago, engineers were predicting the end of copper connectivity. Speeds of 100Mbps (Megabits per second) were viewed by some as the limits of signal integrity when transmitted over copper-based infrastructure. Technology has advanced, and we are seeing the growing adoption of 112 Gbps communication over traditional copper cables and connectors. The latest installations are growing increasingly powerful as 400 and 800 Gigabit Ethernet becomes a reality, and many are looking towards 1.6 Terabit Ethernet in the near future.

Advances in transmission speed have been driven by the chip manufacturers. The introduction of PAM4 (4-level pulse amplitude modulation) signalling, in which data is transmitted in one of 4 voltage levels, has increased the need for clean signals. It can double the amount of information that can be transmitted when compared to NRZ (Non-return to zero) signalling but is more susceptible to interference.

This is easier to understand when we look at the eye diagrams for the two methods. The differentiation between the levels, as noted by the eye height "A" in both images, is vital for signal integrity. It should be clear that the smaller eyes of PAM4 transmission make it more easily affected by interference.



NRZ or PAM2 transmission



PAM 4 Transmission

The medium through which signals travel is vital to signal integrity, and these high speeds have forced us to revise some assumptions. The two-dimensional nature of printed circuit boards (PCBs) limits their ability to support high-speed signals, and so there is an increasing interest in the use of twinax cable assemblies as an alternative to traditional PCB.

Connector manufacturers have devoted considerable expertise to design connectors and cabling systems that preserve signal integrity.

The Limitations of PCB Connectors

However, the manufacturers also understand that their responsibility does not end with the connectors themselves. The inexorable rise in the demand for high data speeds has brought the transition from connector to PCB into focus.

Anyone who has spent any time looking at PCB mounted connectors over the last few decades will be familiar with PCB layout diagrams. They provide the detail that designers need to incorporate the physical arrangements for securing a connector onto the board, including the mounting points, spacings and plating details. For a long time, it was sufficient for the manufacturer to provide this information and leave the rest of the design detail to the customer.

The growing importance of signal integrity has highlighted the importance of the Break-Out Region (BOR), the name given to the zone in which signals leave the connector itself and make the transition onto the PCB.

The development tools you need

Top 5 Development Tools

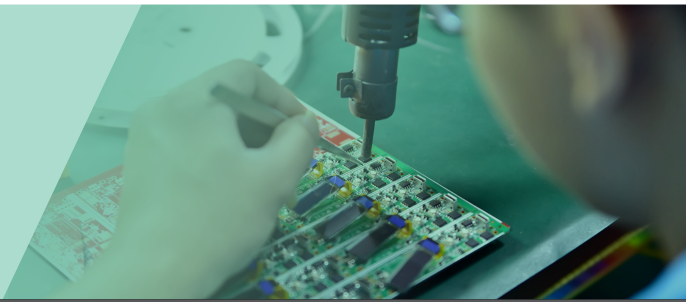
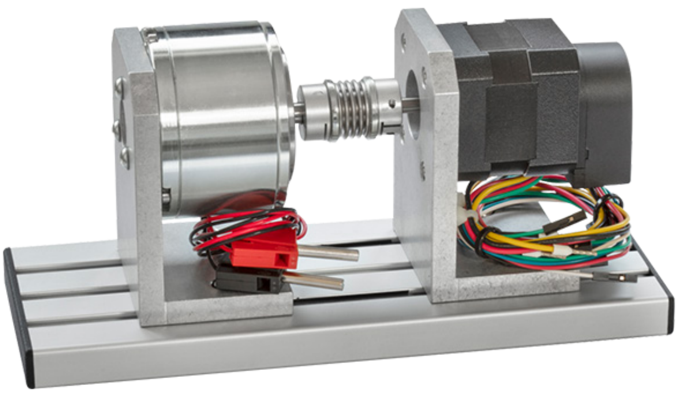


Image credit: Borya Galperin/Shutterstock.com

Mouser offers one of the widest ranges of development kits immediately available off-the-shelf to help designers get started. Here, Mouser's Technical Marketing Manager, EMEA, Mark Patrick, presents his 'Top 5 Pick' of recently-released dev kits. **www.mouser.com/Development-Tools-Center**



BLDC control

Infineon MOTIX™ Motor Bench

Infineon's MOTIX™ Motor Bench is a BLDC motor test bench combining Infineon evaluation boards and reference designs. Ideal for pumps, fans and 3-phase BLDC motor applications, the Infineon MOTIX motor bench includes a Nanotec DB42S03 brushless DC motor with the following specs: 8/3 No. of pol./phase; 24 VDC rated; 0.0625Nm/0.19Nm Torque rated/peak; 4000RPM/6200RPM Speed rated/no load.

Also included is a current controlled hysteresis brake (Mobac HB-50M-2) with 0.38Nm maximum torque and 15000 RPM maximum speed ratings.

FIND OUT MORE >>

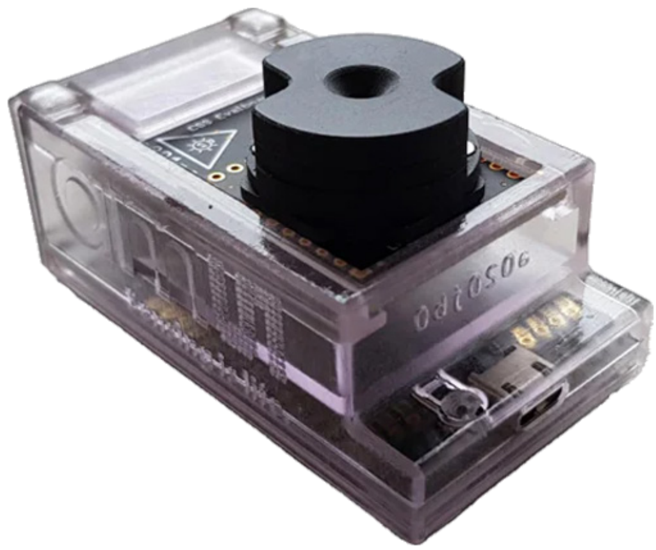
Initial sensor measurement

ams OSRAM AS7331 eval kit

This evaluation Kit allows initial sensor measurements by implementing the AS7331 spectral UV sensor. The AS7331-EVK hardware is split into two parts, consisting of a sensor board with an I²C interface and a communication board with USB output where the sensor board is connected.

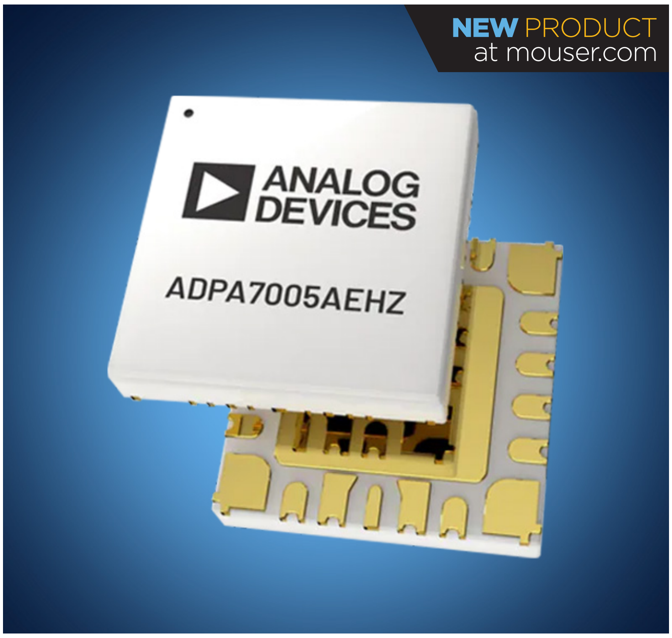
The ams OSRAM AS7331 kit supplies a comfortable GUI, enabling access to all sensor settings. Furthermore, measurements can be recorded and exported via a .csv file for further analysis. Also, a source development kit (SDK) is incorporated into the kit. This SDK furnishes prepared libraries and sample codes to support comfortable firmware design-ins.

FIND OUT MORE >>



ADI power amp now at Mouser

Mouser is now stocking the ADPA7005 gallium arsenide (GaAs), pseudomorphic high electron mobility transfer (pHEMT) monolithic microwave integrated circuit (MMIC) power amplifier from Analog Devices.



This amplifier features an integrated temperature-compensated on-chip power detector that operates between 18GHz and 44GHz. The ADPA7005 amplifier provides 15.5dB of small signal gain and approximately 32dBm of saturated output power at 32GHz from a 5 V supply voltage.

It provides an IP3 of 40dBm and is ideal for linear applications such as electronic counter-measure and instrumentation applications requiring >30dBm of efficient saturated output power.

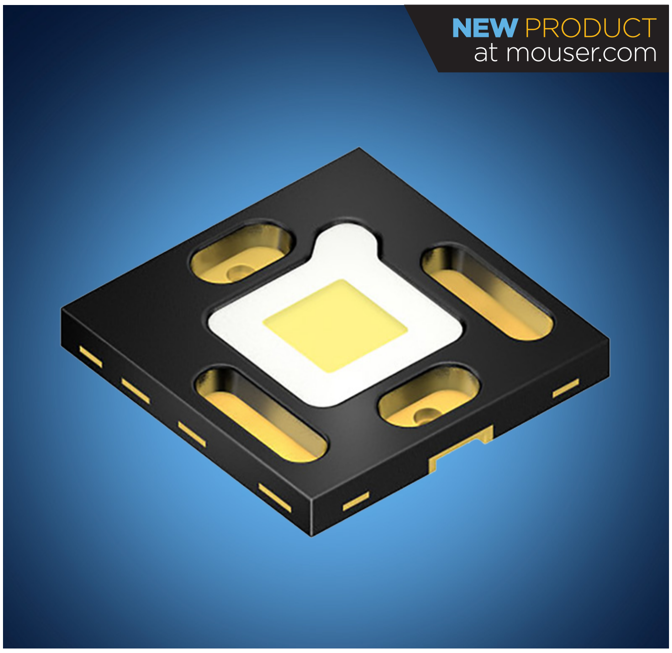
The ADPA7005 amplifier is packaged in a 7mm x 7mm and 18-terminal ceramic leadless chip carrier with a heat-sink (LCC_HS) that exhibits low thermal resistance.

Applications include military and aerospace, test instrumentation, electronic countermeasure, and communications.

Click for More Information

Durable LEDs for automotive exterior lighting

Mouser is now stocking the OSLON Black Flat X LED devices from ams OSRAM. Designed for forward lighting applications, including headlamps, night vision, and laser devices, the OSLON LED devices offer high efficiency and excellent thermal conditions.



The OSLON Black Flat X LED devices have a high focus on system cost, making them a durable, cost-effective option for a wide range of lighting solutions.

OSLON high-performance 3-chip Black Flat LEDs deliver 1350 lm at 1000mA. The LEDs' pad geometry offers exceptional thermal performance, allowing developers to reduce heatsink size in their lighting designs. The 3-Chip Black Flat X LEDs feature an extremely high contrast 1:200 design as a result of black case material and TiO2 casting.

The OSLON 4-Chip Black Flat X KW4 HPL631.TK LEDs are an ideal replacement for halogen lamps. Offering up to 2115 lm at 1000mA, the 4-Chip Black Flat X LEDs support a range of automotive functions, including headlamps and low-beam and high-beam applications. The devices are housed in a compact 7.59mm × 3.75mm × 0.50mm package, making them a suitable choice for high-density applications.

OSLON 5-Chip Black Flat X KW5 HQL631.TK LEDs high-performance are the most efficient lead-frame devices in the OSLON series, delivering exceptional performance in automotive exterior applications, including halogen replacement. The high-efficiency LEDs offer up to 2140 lm at 1000mA, and they boast an operating temperature range of -40°C to +135°C.

Click for More Information