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New NXP Semiconductors wireless module supports both Bluetooth and NFC standards

Design Note: Pages 10-11

Nexperia explains when to use constant-current LED driver ICs

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Driver and radio components from ON Semiconductor for wireless dimming

Technical View: Pages 34-35

New LED lighting and power technology for sports field lighting

EMEA EDITION

Application Spotlight on:

Intelligent Lighting

Linked in



First MCU-based solution qualified for Alexa Voice Service

NXP Semiconductors has unveiled the world's first microcontroller-based voice control solution qualified with Amazon's Alexa voice service. This enables OEMs to quickly, easily and inexpensively add voice control to their products, giving their customers access to rich voice experiences with Alexa.

The NXP solution is based on an i.MX RT crossover platform, and runs on the Amazon FreeRTOS operating system.

Extension of Vesta series of tunable-white light sources

Bridgelux has expanded its Vesta® series of tunable-white and dim-to-warm light sources to help customers meet the increasing demands for environment-specific, personalized lighting.

The company has introduced new proprietary packaging technology which significantly improves near-field color uniformity and enhances beam quality when used with secondary optics.

It has also expanded the product portfolio to offer more options for light-emitting surface sizes, and new color-temperature options.

New optical sensor from ams for mobile cardiovascular monitoring

ams has introduced the AS7026, an optical sensor for continuous cardiovascular health monitoring which performs blood pressure measurement to medical-grade accuracy when mounted in a consumer wearable device such as a wristband or smart watch.

The AS7026 provides continuous heart rate, heart rate variability, blood pressure, and electrocardiography (ECG) measurements. The blood pressure measurement accuracy of the algorithm that the AS7026 runs is rated as medical grade (Grade B) under certain conditions when tested according to the IEEE 1708-2014 industry standard.

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A vision for the luminaire of the future: producing and managing data as well as light

Just over 15 years ago, Future Electronics created a specialist division, Future Lighting Solutions, to enable customers and suppliers to generate revenue out of photons. At that time, much of the division's work was in helping customers to manage the transition from incandescent light sources to the then new technology of 'high-brightness' LEDs.

Such is the fast pace of change in technology that this transition is already in a mature phase, and now the lighting industry faces a new, different and equally disruptive change: the commoditization of LED-based general lighting products. In the face of a worldwide oversupply of standard luminaires, lighting OEMs have suffered from eight consecutive years of falling prices. General lighting has become a much tougher business in which to make money and a cost-cutting strategy offers diminishing returns.

The longer but surer route to success is to add value for which the end customer, or lighting scheme specifier, is willing to pay. In Future Lighting Solutions' view, the industry needs to draw on existing assets: know-how and infrastructure. The lighting industry is an expert in creating systems based on a large number of electrically powered, light-emitting nodes situated above things and people.

In fact, a luminaire is an ideal location for sensors which collect data about activity in and the environment of an indoor space or a street, while avoiding the privacy concerns and costs of a video camera. If the data are valuable enough, the light that the luminaire produces could end up as the remote-controlled auxiliary function of a ceiling-mounted data acquisition and transmission device.

Of course, the industry has to find a way to extract profit from the data, by marketing a more expensive luminaire equipped with sensors and controls which can measure and manage the operating environment. An infrared heat map, for example, might detect that 70% fewer people occupy an area at

slower times of the day compared to the busiest times. A 'smart building' system could then automatically adjust lighting and heating without manual intervention. The energy saving provides value for which end customers and consumers might be prepared to pay.

In this new smart lighting market, there are opportunities for businesses to:

- offer data services to facilities managers and municipalities through networked lighting infrastructure
- produce light-emitting data acquisition devices
- supply luminaires that can be controlled wirelessly

In every case, Future Lighting Solutions has the know-how and experience to help manufacturers. Our offering includes firmware, control software and hardware, with as much as possible of the complexity in licensing and other arrangements removed.

So now, with help from Future Lighting Solutions, OEMs can achieve differentiation and quality of light at the same time, and at an affordable cost.



Stéphane Rosa
EMEA Director
Future Lighting Solutions, a division of Future Electronics



Fully certified module provides Bluetooth and NFC wireless connectivity

NXP SEMICONDUCTORS

NXP Semiconductors has introduced the QN9080-001-M17, a fully certified module which supports both the Bluetooth® 5 and NFC wireless connectivity standards. It offers ultra low-power consumption, is highly integrated with a rich set of features, and is certified for compliance with the FCC, CE, IC and MIC regulations.

The module is based on the QN9080, a Bluetooth wireless microcontroller which is powered by an Arm® Cortex®-M4F core. It also integrates a dedicated fusion sensor co-processor. The 512kbytes of on-board Flash memory and 128kbytes of SRAM provide enough room and flexibility for complex applications as well as the connectivity stacks.

The QN9080-001-M17 module also integrates an NFC NTAG wireless tag, 32MHz and 32kHz crystals, RF matching circuitry and a 2.4GHz antenna.



It thus offers a complete, ready-to-use solution for applications requiring a combination of Bluetooth Low Energy wireless connectivity and simple pairing with an NFC tag.



Part Number	Package Style	Number of Terminals	Package Dimensions
QN9080-001-M17	Plastic low profile, fine pitch, land grid array package	56 terminals	6.0mm x 9.7mm x 1.2mm

Optically-coupled gate driver IC offers safety and noise isolation

VISHAY

Vishay has released a new isolated IGBT/MOSFET driver which produces a high peak drive current of 2.5A with a high-efficiency, low power-drop MOSFET output stage, sufficient to directly drive high-power IGBTs with a rating up to 1,200V and 100A.

The VOD3120 combines a control stage optically coupled to a rail-to-rail MOSFET power output circuit. This means it can provide safety and noise isolation for digitally-controlled power electronics systems such as AC inverters and motor drives.

The VOD3120 is rated for a maximum repetitive peak voltage of 891V. Intended for use in applications such as solar inverters, which often have digital controls close to noise-generating power devices, the VOD3120 benefits from a high common-mode voltage rejection rating of 35kV/μs to protect control circuitry from electrical noise.

The VOD3120 provides under-voltage lock-out protection with hysteresis. It operates from a supply-voltage range of 15V to 30V.



VOD3120: 35kV/μs common-mode voltage rejection



APPLICATIONS

- Wearable devices
- Consumer accessories
- Health and medical devices
- Sports and fitness trackers
- Building and home automation
- Retail and advertising beacons

FEATURES

- Peak currents via DC-DC converter
 - Transmit: 3.5mA
 - Receive: 4mA
- -92.7dBm sensitivity
- Transmit output-power range: -20dBm to +2dBm
- Compatible with Keil, IAR and MCUXpresso software development kits
- Bluetooth PHY supports up to 16 simultaneous links
- Integrated NT3H2211 NFC Forum Type 2 tag

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FREE BOARDS **FTM Board Club**
Orderable Part Number: QN9080SIP-DK

Apply now at my-boardclub.com
Fast-track board request code: FTM19-iiiA



APPLICATIONS

- Solar inverters
- Motor drives
- Uninterruptible power supplies
- Induction hobs

FEATURES

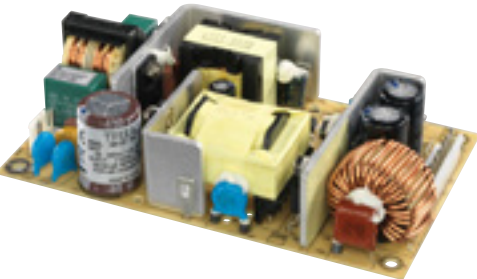
- Compatible with industrial three-phase line voltages
- Highly efficient output drive dissipation
- Can be triggered by embedded digital controllers
- 0.5μs maximum propagation delay time
- Low-power CMOS output stage
- 5mA threshold current

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Solutions for Power Noise Suppression and Filtering



Triad manufactures a wide range of popular off-the-shelf and custom designed chokes, inductors and other magnetic components designed for EMI/RFI suppression and noise filtering near power components. Our advanced chokes and inductors offer superior performance, rugged construction, high quality, long life and excellent value. All are RoHS compliant.



APPLICATION TECHNOLOGIES

- Class D amps
- di/dt inductors
- FETs
- IGBT modules
- LED drivers
- Output filtering
- Power converters

CMF Dual Function Chokes



Triad's dependable CMF Series Chokes provide common mode suppression and stray inductance to suppress differential mode noise. In effect, the CMF combines the features of two separate components into one.

KEY SPECIFICATIONS

- Rated current: 0.45A to 2.3A
- Rated inductance: 10mH to 100mH
- Resistance: 279mΩ to 1970mΩ
- Stray inductance: 200mH to 2100mH

CME Common Mode Inductors



Triad's CME Series Common Mode Inductors provide EMI noise suppression. They feature our e-core and are used in various types of power supplies. They also provide highly effective differential mode filtering and meet regulatory requirements. Normally placed close to the input source, these compact inductors are constructed with UL rated 130°C materials.

KEY SPECIFICATIONS

- Minimum inductance: 2mH to 67.5mH
- RMS current: 0.4A to 7.5A
- Maximum DC resistance: 0.5Ω to 2.02Ω
- Minimum leakage: 1.1μH to 720μH

CMT Common Mode Inductors

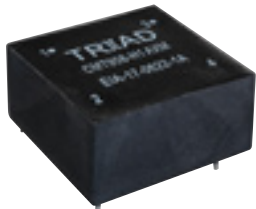


Triad's CMT Series Common Mode Inductors provide common mode EMI suppression for power supplies. They feature our precision coil windings to eliminate noise and to minimize the AC line transmitted interference often created by high frequency switching power supplies. They also meet various regulatory requirements and are constructed with UL rated 130°C materials.

KEY SPECIFICATIONS

- Minimum inductance: 1mH to 50mH
- Maximum current: 1.7A to 20A
- Maximum DCR: 0.006Ω to 0.45Ω

CMT908 Encapsulated Common Mode Inductor



Triad's CMT908 Series Common Mode Inductor features a sealed encapsulated design that is ideal for rugged environments and where reliability is critical. It provides superior common mode EMI noise suppression for power supplies and other power devices.

KEY SPECIFICATIONS

- Minimum inductance: 2.0mH to 16mH
- RMS current: 2.60A to 7.50A
- Maximum DCR: 0.020Ω to 0.160Ω
- Minimum leakage: 25.0μH to 180.0μH

UT/ET Common Mode Inductors



Triad's UT/ET Series Common Mode Inductors help prevent EMI/RFI in a wide range of applications. Features include low leakage flux, high self-resonant frequency, high impedance at applicable frequency and low stray capacitance in section winding. Precision coil winding ensures excellent performance and reliability

KEY SPECIFICATIONS

- Minimum inductance: 0.45mH to 120mH
- Maximum inductance difference: 100μH to 2500μH
- Maximum DCR: 0.1Ω to 3.7Ω
- Current rating: 0.5A to 4A

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Fast rectifiers help to lift power density and efficiency of converter circuits

VISHAY

Vishay Intertechnology has introduced dual 200V FRED Pt fast-recovery rectifiers in a compact package for use in automotive and telecoms power circuits.

Configured as dual-die rectifiers with separate cathode connections, the new FRED Pt parts enable power-system designers to simplify PCB layouts by replacing two smaller packages with one 5mm x 6mm QFN package. The Vishay FlatPAK™ housing, which is just 0.99mm high, has a standard QFN footprint shared with packages that are commonly used by other device types such as MOSFETs.



Vishay: Two rectifier dies in a single QFN package

The new rectifiers are supplied in commercial/ industrial and automotive versions. Their low forward voltage drop reduces power losses and helps to provide for high system efficiency. Offering low reverse recovery charge, these FRED Pt rectifiers help system designers to achieve high power density.

Part Number	VS-6DKH02-M3	VS-6DKH02HM3	VS-8DKH02-M3	VS-8DKH02HM3
Forward current	2 x 3A	2 x 3A	2 x 4A	2 x 4A
Forward voltage	0.71V	0.71V	0.7V	0.7V
Reverse recovery time	25ns	25ns	25ns	25ns
AEC-Q101 qualified	No	Yes	No	Yes

Dynamic 13.56MHz NFC tag provides configurable PWM outputs

STMICROELECTRONICS

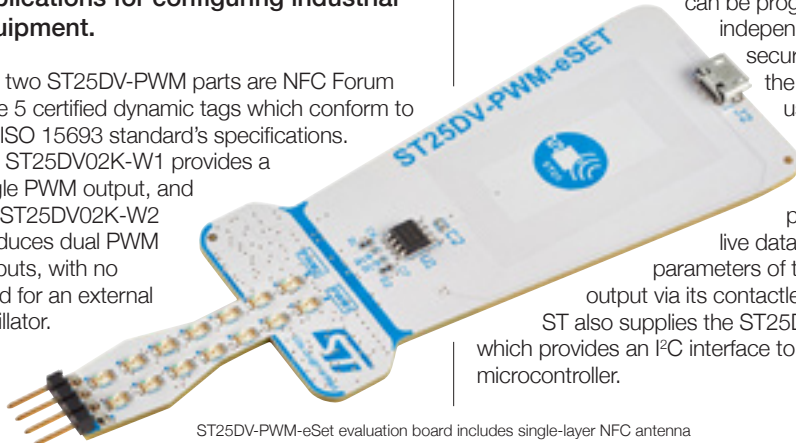
STMicroelectronics has extended its ST25 family of dynamic NFC/RFID tags with the ST25DV-PWM series devices, which provide Pulse Width Modulation (PWM) outputs suitable for use in applications for configuring industrial equipment.

The two ST25DV-PWM parts are NFC Forum Type 5 certified dynamic tags which conform to the ISO 15693 standard's specifications. The ST25DV02K-W1 provides a single PWM output, and the ST25DV02K-W2 produces dual PWM outputs, with no need for an external oscillator.

The frequency of the PWM outputs ranges from 488Hz to 31.25kHz. Pulse-width resolution of 62.5ns gives from 15-bit resolution at 488Hz to 9-bit resolution at 31.25kHz. The pulse width accuracy is ±10% over the entire operating-temperature range.

The ST25DV-PWM dynamic tags feature a 13.56MHz interface compatible with NFC phones and readers, giving a typical operating range of 1m. The PWM output

can be programmed independently and securely, enabling the tags to be used in a wide range of applications. The IC provides live data about the parameters of the PWM output via its contactless interface. ST also supplies the ST25DV-I2C series, which provides an I²C interface to a host microcontroller.



ST25DV-PWM-eSET evaluation board includes single-layer NFC antenna



APPLICATIONS

- DC-DC converters
- Telecoms power supplies
- Engine control units
- Anti-lock braking systems
- Automotive lighting

FEATURES

- 200V maximum reverse voltage
- 2,000 hours of high temperature reverse bias testing guarantees long-term reliability
- Soft recovery features
- Ideal for automated placement
- Supports automated optical inspection in automotive systems
- Operating-temperature range: -55°C to 175°C

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APPLICATIONS

- Industrial equipment

FEATURES

- 64-/32-bit password protection
- 2kbit user memory
- 5ms memory Write time for one block
- TruST25™ digital signature mechanism for authentication

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FREE BOARDS FTM Board Club

The ST25DV-PWM-eSET is a dynamic NFC tag evaluation board which includes a 22mm x 38mm single-layer inductive antenna etched on the PCB, and two LEDs showing the duty cycle of the PWM outputs.

Orderable Part Number: ST25DV-PWM-eSET

Apply now at my-boardclub.com
Fast-track board request code: FTM19-iiiA

Schottky rectifiers benefit from superior thermal performance of CFP package

NEXPERIA

Nexperia has developed the Clip-bonded FlatPower (CFP) package for a portfolio of Schottky rectifiers to help designers to implement efficient and space-saving designs in automotive, industrial, computing and consumer electronics applications.

High-power rectifiers in the CFP package style offer a superior alternative to the standard SMA package, and provide better thermal performance. The Nexperia portfolio of CFP rectifiers includes high-efficiency trench rectifiers featuring a combination of low forward voltage and low reverse current, even at high ambient temperatures. These devices are for applications fitting these specifications:

- 40V to 60V maximum reverse voltage
 - 1A to 15A maximum forward current
- Functions for which these devices are well suited include polarity and back drive protection, and blocking and ORing.

Nexperia also offers a group of low-leakage CFP planar rectifiers which offer ultra-low reverse current. They provide very good protection against the risk of thermal runaway. The specifications include:

- 60V to 100V maximum reverse voltage
- 1A to 10A maximum forward current

They are well suited to DC-DC boost conversion in automotive applications.

The Nexperia rectifiers, in forward voltage ratings ranging from 30V to 100V, are available in:

- CFP3 package measuring 2.6mm x 1.7mm x 1.0mm
- CFP5 package measuring 3.8mm x 2.5mm x 1.0mm
- CFP15 package measuring 5.8mm x 4.3mm x 0.8mm



Nexperia Schottky rectifiers: Three CFP package options



APPLICATIONS

- High-temperature automotive applications
- Transmission units
- Engine control units
- Automotive LED lighting
- LED display backlighting
- Powertrain systems in hybrid vehicles

FEATURES

- 175°C maximum junction temperature
- AEC-Q101 qualified
- CFP package features:
 - Solid copper clip for high thermal performance and power dissipation
 - Reduced package inductance for improved switching behaviour
 - Innovative silicon and reduced package resistance for better electrical performance

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Space-saving spring fingers maintain electrical connections in devices that vibrate

TE CONNECTIVITY

TE Connectivity (TE) has introduced a range of spring fingers which have a small footprint to enable the system designer to save PCB space.

Spring fingers (also known as shield fingers, grounding springs, universal ground contacts or antenna clips) can be used in all types of small PCBs. A spring finger is a single-contact, surface-mount internal connector which may be used for antenna feeds, low-voltage electrical connections, grounding or shielding.

They help to reduce the level of EMI and static caused by connectors at devices that vibrate, such as speakers, motors and microphones.

TE's ultra-small contact spring fingers are intended for use in the most space-constrained device designs. They feature a closed-loop contact design which ensures reliable connection to the PCB while providing a higher current rating of 1.5A.

Their robust side wall minimizes the scope for over-compression. In addition, a special anti-lifting design improves assembly efficiency by locking the tip of the contact within the sidewall of the spring finger, which helps to prevent the contact from getting caught on an operator's glove.



TE's spring fingers help to reduce EMI and static



APPLICATIONS

- Mobile phones
- Wearable devices
- Smart speakers
- Wireless earbuds
- Virtual reality headsets
- Tablets
- Laptop computers
- Infotainment devices
- Patient monitoring devices

FEATURES

- Supports auto-assembly processes
- Offered in various heights and styles

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HIGH POWER DENSITY

MDWI10 Series · 10W · DC-DC Converter

- High Power Density Up to 63.5 W/in³
- Ultra-wide 4:1 Input Voltage Range
- Low No Load Power Consumption
- I/O Isolation 1500VDC

For more similar family : MD Group 6-8W



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TVS protection diodes feature narrow 2% tolerance of maximum breakdown voltage

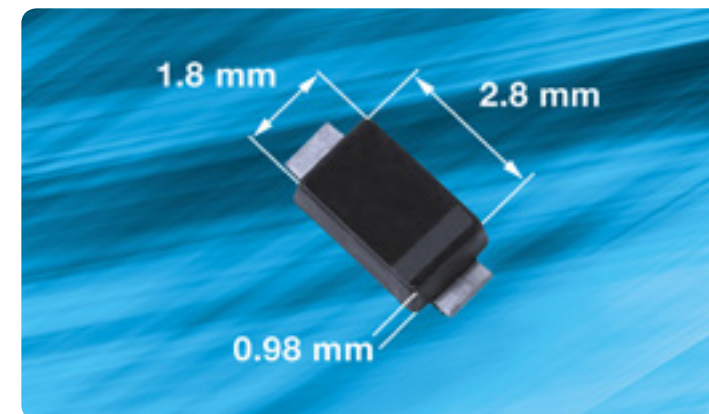
VISHAY

Vishay's VTVS series surface-mount Transient Voltage Suppression (TVS) protection diodes are the industry's first to offer tolerance of maximum breakdown voltage of as little as 2%.

Offered in a low-profile SMF package with a footprint of 3.7mm x 1.8mm, the VTVS devices provide an ideal way to protect portable electronics devices against momentary high power surges.

The latest additions to the VTVS series feature a working voltage of 3.3V. With the introduction of these new parts, the working voltages supported by the VTVS series span the range from 3.3V to 63V. They are supplied in versions with breakdown voltage tolerances of 2% and 5%.

Peak pulse current ratings range from 2.9A to 20.3A. The excellent clamping capability provided by the Vishay protection diodes extends from 14.8V to 103.5V. Parts with AEC-Q101 qualification for use in automotive applications are available.



VTVS series: Small surface-mount package fits in portable device designs



APPLICATIONS

- Laptop computers
- Notebooks
- Tablets
- Smartphones
- External hard drives

FEATURES

- 400W peak pulse power capability with a 10/1,000μs waveform
- ±30kV contact and air ESD discharge protection in accordance with IEC 61000-4-2
- Very fast response to transient voltage events
- Low incremental surge resistance
- Junction-temperature range: -55°C to 175°C

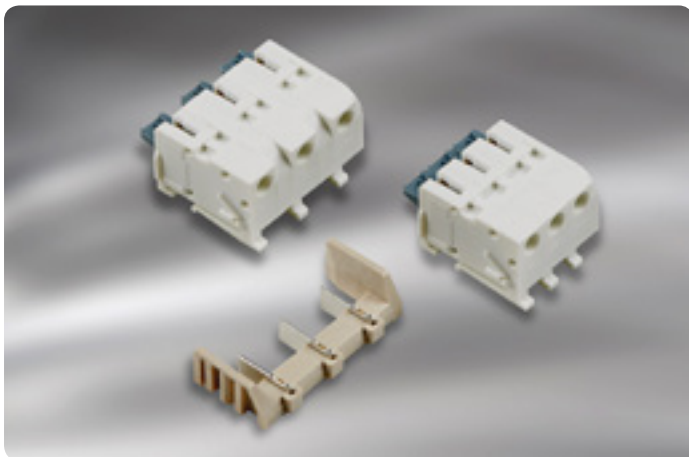
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Poke-in wire connectors make wall-mounting easy

TE CONNECTIVITY

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



TE's BUCHANAN WireMate: Flat connector surface reserved for wire marking

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

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

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



APPLICATIONS

- Thermostats
- Smoke detectors
- Control panels
- Environmental monitors

FEATURES

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

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TE Connectivity, TE, TE connectivity (logo), and BUCHANAN are trademarks.

High-current wire-to-board connector provides for secure locking

HIROSE

Hirose has introduced the DF63 series of small, high-powered wire-to-board connectors for use in industrial equipment which must achieve high levels of reliability.



DF63: Multiple connectors may be mounted side-by-side

The main connector range consists of cable-mount female crimp sockets and board-mount vertical and right-angle male headers. The connectors can handle a maximum current of 15A. Hirose also supplies in-line versions of the connector, and a waterproof DF63W series.

The connectors' form factor enables the designer to achieve space savings. The three-position header only occupies board space of 88mm² due to its small pitch.

Secure locking is assured by a robust lock which gives a clear tactile click when mated. This confirms the connector is fully engaged. The lock is on the centre of the housing, eliminating the risks of uneven locking and cable entanglement, which are common with side locks. This also enables multiple connectors to be mounted close together when side-by-side.

The header features square male pin contacts which have a wide conductive surface area of 1.14mm on each side to carry high currents. Each contact is protected by housing walls to avoid the risk of short circuits and to prevent it from being touched.

The cable-mount female socket housing uses crimp contacts which have an internal multi-point contact structure to ensure good contact wipe and high contact reliability. The design of the housing base is tapered to allow resin sealing up to 5mm high. The resin stopper, which is a step underneath the lock, stops the resin rising too far.



APPLICATIONS

- Robots
- Medical devices
- Industrial machinery
- Smart meters
- Gaming equipment
- Home appliances

FEATURES

- 1 to 6 contact positions
- 3.96mm or 7.92mm pitch
- 630V AC-DC voltage rating
- Rated for 30 or 50 mating cycles
- Cable sizes: AWG 16 to AWG 22

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Rotary switches cut board footprint with up to eight positions in 9.2mm body diameter

C&K COMPONENTS

C&K Components' RM single-pole rotary switches have a body diameter of just 9.2mm, providing a multi-position switch option which saves board space at a low bill-of-materials cost.



C&K's RM rotary switches provide tactile feedback to the user

The RM series is supplied in eight versions, offering design engineers a variety of options for the number and position of switch functions, from a simple on/off two-position format up to eight positions with no stop.

The switches feature positive detents which provide tactile feedback. Gold-plated contacts ensure users benefit from reliable operation over a rated lifetime of 2,000 cycles at an operating force range of 170 to 370gf/cm. Insert molded terminals prevent contamination during soldering.

RM series contacts are rated for 0.5A at 24V DC and 0.2A at 48V DC.



APPLICATIONS

- Building automation
- Lighting and fan controls
- Telecoms equipment
- Audio equipment
- Test and measurement equipment

FEATURES

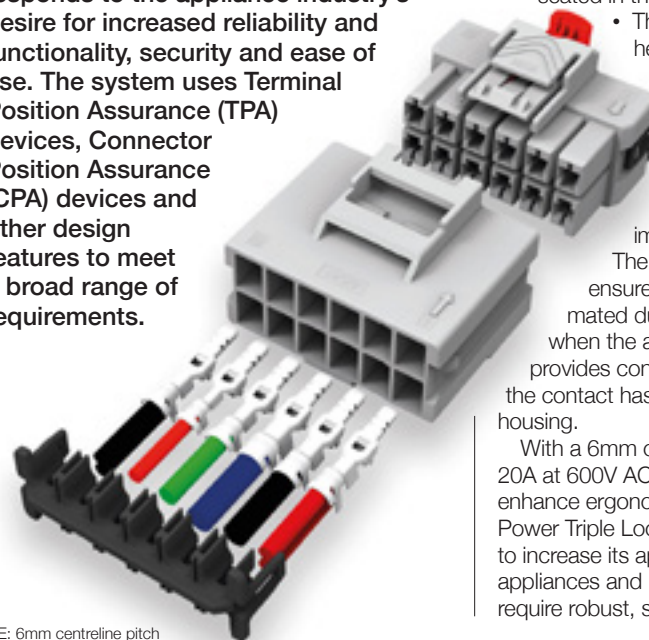
- 100M Ω insulation resistance at 500V DC
- 500V AC dielectric strength for one minute
- Operating-temperature range: -40°C to 85°C

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Secure three-in-one connector mechanism ensures appliance terminals remain fully seated in their housings

TE CONNECTIVITY

The Power Triple Lock connector solution from TE Connectivity (TE) responds to the appliance industry's desire for increased reliability and functionality, security and ease of use. The system uses Terminal Position Assurance (TPA) devices, Connector Position Assurance (CPA) devices and other design features to meet a broad range of requirements.



TE's Power Triple Lock connectors offer polarization and keying to help prevent connectors from mismatching. The connector locks in three ways:

- The cap or header and plug latch together
- The TPA device helps ensure terminals are fully seated in the housing and remain that way
- The CPA device locks the cap or header and plug together

The Power Triple Lock connector's built-in latching capability comes from reducing two latches to a single, robust latch which makes it easier to connect, and improves connector reliability.

The optional CPA device helps to ensure a fully mated connector stays mated during shipment, installation or when the appliance is in use. The TPA provides confidence that when installed, the contact has been properly inserted in the housing.

With a 6mm centreline pitch, ratings up to 20A at 600V AC and numerous features to enhance ergonomics and ease of assembly, the Power Triple Lock connector system continues to increase its appeal to manufacturers of appliances and many other product types that require robust, secure connections.



APPLICATIONS

- Refrigerators
- Dishwashers
- Washers and dryers
- Cooking appliances
- Water heaters
- Vacuum cleaners
- Garage door openers
- Automotive systems
- Industrial machinery
- Railway equipment

FEATURES

- Three material options for standard 105°C, high-temperature 150°C and glow-wire applications
- Four keying options
- Multiple colors
- Snagless design features help ensure fast, accurate connections on the assembly line
- 20A maximum current rating

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Constant-current LED drivers: the simple, reliable and low-cost way to supply low- and mid-power LEDs

NEXPERIA

By Dr-Ing. Jan Preibisch
Application Marketing Manager, Nexperia



The drive circuits for high-performance, high-power LEDs tend to use boost-buck converters with complex controllers that require a deep understanding of the topology to create reliable designs which comply with EMC regulations.

For low- and mid-power LEDs, however, the driver circuit can be very simple and robust: the solution is to use a constant-current LED driver which operates as a simple linear regulator. It is true that constant-current LED drivers are less efficient and lose more power than switching power converters. But their excellent EMC performance, reliability and simplicity, as well as the markedly lower cost at the system level, make them the preferred option for driving LEDs at currents of up to 500mA.

Drivers referred to in this article with the prefix NCR are available from Nexperia. They are used in constant-current source and automotive applications such as interior and exterior lighting, including lights for door handles, dashboards, number plates, indicators and rear clusters.

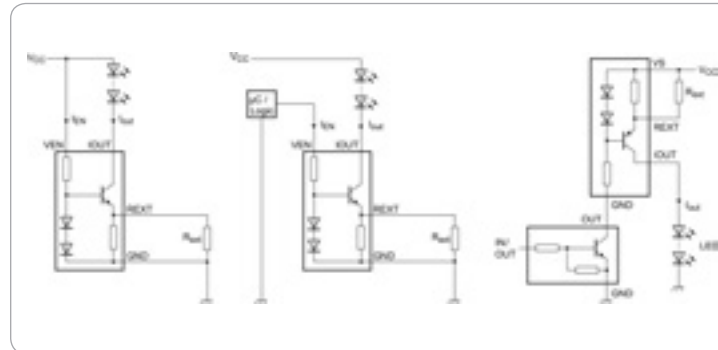


Fig. 1: Low- and high-side constant-current LED driver topologies

Figure 1 shows the basic circuits for driving LEDs with a single constant-current driver. Internally, such a driver consists of a Bipolar Junction Transistor (BJT), two diodes and two resistors. Constant-current drivers with a PNP BJT operate as high-side drivers, while those with an NPN BJT are low-side parts. One resistor defines the minimum output current; the other tunes the bias voltage and plays an important role in the Enable function.

The high-side constant-current driver has an Enable pin which is connected to ground; both the driver and thus the LED can be turned off by disconnecting this pin. In practice, this is performed by a Resistor-Equipped Transistor (RET), as illustrated in Figure 1, or by a MOSFET.

Low-side drivers, on the other hand, need a certain potential to be enabled. NCRx20x series drivers require a voltage in the range of the supply voltage to enable them. The NCRx21x driver can be enabled at a much lower voltage of 3.3V. This part draws a current of around 1 to 2mA at the Enable pin so it can easily be driven by the output pin of a microcontroller or a logic device. This is convenient for turning the LED on and off, and also for dimming with a PWM controller.

The dimming function is illustrated in Figure 2, which shows the mean of the output current as a function of the duty cycle for a NCR321Z driver for various switching frequencies with an external resistor of 6Ω. The graph displays a linear relationship between the duty cycle and the measured average output current. Even for frequencies above the recommended 10kHz, this linear relationship is maintained. The frequency should not exceed 10kHz however in the interest of compliance with EMC specifications.

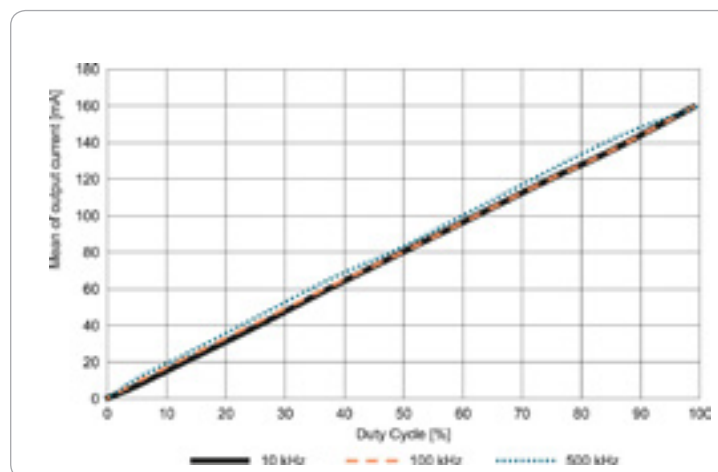


Fig. 2: Mean of the output current as a function of the duty cycle of a NCR321Z constant-current driver with an external resistor of 6Ω

The output current of most constant-current LED drivers is adjustable by an external resistor. Some types are tuned to commonly used currents. As they do not feature an external resistor, they are available in three-pin packages. In circuits which include an external resistor, it will be in parallel to the internal resistor, thereby lowering the effective resistance.

Low-side constant-current drivers with an NPN transistor – the NCRx2xx devices from Nexperia – have an internal resistor of 95Ω. An analysis of the measurement curves produces the following formula which enables the relationship between external resistor and output current to be estimated:

$$I_{out} \approx 0.5 \text{ mA} \left(\frac{R_{ext}}{\Omega} \right)^{-0.75}, \quad R_{ext} \approx 1 \Omega \left(\frac{I_{out}}{0.5 \text{ mA}} \right)^{-1.33}$$

The value of the external resistor must not be so low that the maximum output current is exceeded. The majority of the output current will flow through the external resistor if it is smaller than the internal resistor; this is significant when the external resistor is small and the output current high. Nevertheless, a 0.25W resistor will be sufficient, since the power losses will not exceed 170mW even for a 250mA output current.

Constant-current drivers show a temperature dependence. At high temperatures the output current decreases slightly. The output current remains independent from the voltage drop across the driver, however. As the output current decreases with temperature, there is no risk of thermal runaway.

The minimum voltage drop across a constant-current driver is about 1.4V. Below this voltage, linear regulation does not work properly. Above it, the voltage drop across the constant-current driver dynamically adjusts to maintain the desired output current.

In low- and high-side configurations, the output voltage is always calculated as:

$$V_{out} = V_{CC} - V_{LED}$$

where:

V_{LED} = voltage at the LEDs and V_{CC} = supply voltage

Constant-current LED drivers are used when the brightness of an LED should be independent of the supply voltage to some degree. For example, the 12V power supply in a car fluctuates between 11V and 15V during normal operation. If the desired drive current and the voltage drop across the LEDs are known, the minimum possible supply voltage can be calculated by adding the voltage drop across the driver plus the voltage at the LEDs. The maximum allowed voltage is governed by the maximum-permitted voltage drop across the driver, or the total power dissipation, which can be estimated by the formula: $P_{tot} \approx V_{out} \times I_{out}$.

Hence the allowed operating range, if datasheet limits are not exceeded, can be specified as:

$$V_{LED} + 1.4V < V_{CC} < V_{LED} + \frac{P_{tot}}{I_{out}}$$

Constant-current drivers in the SOT457 package usually have a maximum power rating of 0.75W. For an output current of 50mA, this relates to a margin of 15V. Newly released devices in a SOT223 package from Nexperia have a higher maximum power rating of 1.25W, which raises the voltage margin to 25V.

Additionally, the voltage margin can be increased by reducing the output current. Placing two or more constant-current drivers in parallel, as illustrated in Figure 3, effectively doubles the current. Using this method, a current exceeding the capability of a single driver can be driven, or a smaller current per driver can be used to increase the voltage margin.

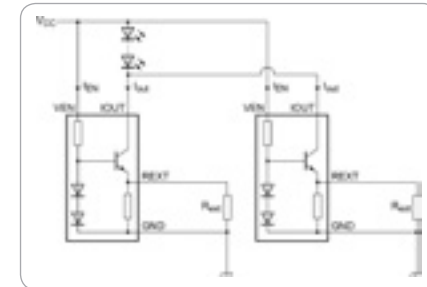


Fig. 3: Two low-side drivers in parallel operation

The use of two constant-current SOT223-packaged drivers with a drive capability of 250mA enables the circuit to drive 500mA LEDs with a voltage margin of 5V. When driving constant-current drivers in parallel, the accuracy of the external resistors is the most important factor for the symmetry of the output currents of the individual

drivers. Figure 4 illustrates the voltage margins depending on the output current for single and parallel drivers in SOT457 and SOT223 packages.

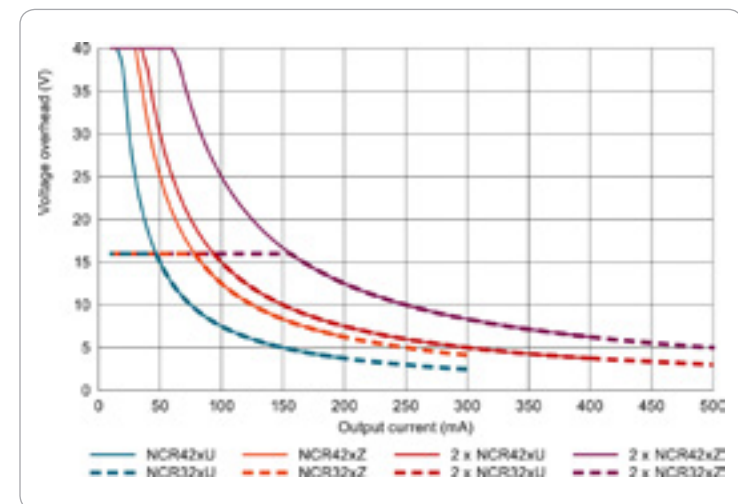


Fig. 4: Voltage margin of single and parallel drivers in SOT457 and SOT223 packages

In conclusion, constant-current LED drivers offer a very low-cost and easy-to-implement solution for driving low- and mid-power LEDs. Using packages with a higher maximum power rating provides a higher margin in the supply voltage, and parallel drivers can be used to increase the current capability.



Fig. 5: Nexperia NCRx2xx LED drivers in SOT457 and SOT223 packages

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Lighting Technology Matrix

Manufacturer Technology		ams	Bender & Wirth	Bridgelux	Carclo	Casambi	Efore	ERP	FlashNet	Fraen	General Luminaire	Herculux	Inventronics	Ledil	Littelfuse	Lumileds	Magnum ES	McWong	Murata	Nichia	Osram DS	Rena	Rigado	Seoul Semiconductor	Seoul Viosys	Silvair	TE Connectivity	Vishay	
LED Light Source	Low/Mid-Power LED			●												●				●				●				●	
	Hi-Power LED															●				●				●					
	CoB LED			●												●				●				●					
	CSP LED															●				●				●					
	Color LED															●				●				●				●	
	Horticulture LED															●				●				●					
	Infra Red LED															●												●	
	Ultra Violet LED															●				●					●			●	
	Standard LED Light Engine and Module			●								●					●					●	●		●	●			
	Custom LED Light Engine and Module											●					●					●	●		●	●			
Optic	Lens				●					●	●	●		●							●			●					
	Reflector				●									●															
	Light Guide															●													
LED Driver	Mains LED Driver						●	●			●		●								●	●							
	DC/DC LED Driver						●				●										●	●					●		
	AC Direct LED Driver										●											●		●					
	Surge Protection										●		●		●						●	●						●	
Light Management	Motion & Presence Detector																●	●	●		●								
	Light Sensor	●															●	●	●		●				●		●	●	
	Wired Lighting Management							●			●		●								●	●							
	Wireless Lighting Management					●		●			●		●				●	●	●		●	●	●						
	Wireless Networking					●		●	●				●				●	●	●		●	●	●			●			
	Lighting Management Infrastructure					●			●								●				●		●			●			
	Cloud Services								●								●									●			
EMech	Connector																										●		
	CoB Holder		●											●								●					●		

Driver IC supplies up to 85mA to each of 16 channels of LEDs

STMICROELECTRONICS

STMicroelectronics' LED7708 is an LED driver IC which may be used to supply multiple LEDs from a single low-voltage input rail.

It integrates a boost controller implementing fixed-frequency current-mode control, 16 current generators rated for up to 85mA per channel, and a four-wire serial interface. The boost controller regulates the output voltage in response to the requirements of the LED array, giving high system efficiency.



LED7708: Implements independent PWM dimming at each of 16 channels

All the current generators are rated for a maximum voltage of 40V, allowing the LED7708 to drive several LEDs in series on each channel. The channels can be configured in parallel to give a higher output current.

The brightness of the LEDs is controlled via the serial interface. A selectable 12- or 16-bit grayscale brightness control allows independent PWM control at each channel. A programmable on-chip dimming oscillator is provided, simplifying the design of the external circuitry.

The device has dedicated pins to lock to an external synchronization signal shared with other devices for noise reduction in multi-device applications.

The LED7708 can detect and manage open-LED and shorted-LED faults, and various fault-management options are available which cover the needs of most applications.



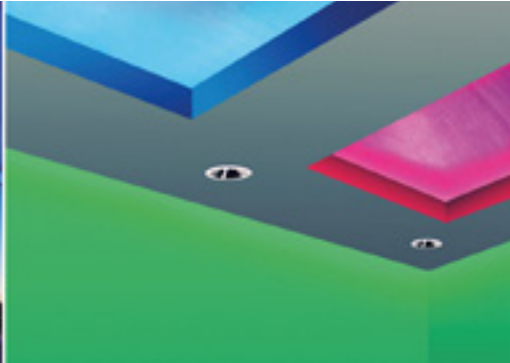
APPLICATIONS

- TV and monitor backlights
- Backlights for medium-sized and large LCD panels
- RGB/RGGB backlights

FEATURES

- Input-voltage range: 3.6V to 36V
- Over-voltage protection
- Over-current protection
- Thermal shut-down protection
- ±2% channel current accuracy
- ±2% channel-to-channel current matching

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LUXEON 2835 Color Line
The best performance, the most colors.



Lumileds is enabling a new era of color lighting with the newly introduced LUXEON 2835 Color Line

This mid power line consists of 12 colors (including whites) that achieve the best performance in its class. The superior flux and efficacy of this line of phosphor-converted and direct color LEDs enable flawless color mixing for the rapidly growing markets of color-tunable lamps and architectural and entertainment lighting. Flawless color mixing is achieved using the same technology that characterizes every Lumileds color LED offering. The new LUXEON 2825 Line contains LEDs with matching focal lengths, which enables minimal halos and superior color mixing in all color applications. In addition, all 12 colors have matching polarity which simplifies the PBC design versus competitive LEDs.

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Create better lighting designs using Future Lighting Solutions tools

Lighting System Creator: www1.futurelightingsolutions.com/lsc
Usable Light Tool: www1.futurelightingsolutions.com/ult
Driver Selector Tool: www1.futurelightingsolutions.com/dst

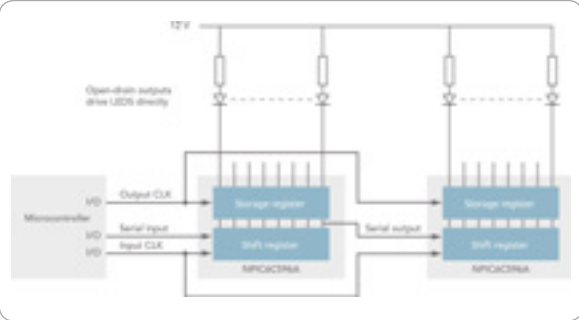


Power logic shift register with multiple open-drain outputs reduces footprint of LED lighting boards

NEXPERIA

Nexperia supplies various series of shift registers which enable designers of LED lighting systems to save space by using a compact, low-cost microcontroller to control the power supply to multiple LEDs. Suitable shift registers from Nexperia for this application include standard 8-bit devices such as the popular 74HC595, and also the newer NPIC6C series, which offers more advanced features.

Nexperia's NPIC6C is a range of 12- and 8-bit power logic shift registers which meet the needs of 5V control logic circuits, as well as other applications. These devices include a serial output for cascading and allow for an input clock frequency of at least 10MHz. The NPIC6C shift registers can be used to replace the 74HC595 in existing designs.



The NPIC6C596A can replace an 74HC595 and 16 external MOSFETs

Some parts in the NPIC6C portfolio offer a serial output delay to provide a longer data hold time, improving the timing margin and making it easier to cascade many shift registers. The NPIC6C series is available in TSSOP packages, and also in DQFN packages which save space and include a heat-sink, ideal for use at higher currents. NPIC6C functions are also available in Nexperia's Q100 portfolio of AEC-Q100 qualified parts for use in automotive applications.

APPLICATIONS

- Signage
- Graphical status panels
- Fault status indicators
- Automotive lighting

FEATURES

- Low on-resistance
- Simple control interface
- Supports I/O expansion
- Low power consumption
- Cascadable
- Operating temperature range: -40°C to 125°C

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The perfect module for any application

Take control with Seoul Semiconductor for faster and more competitive ways to market

Seoul Semiconductor provides customers with advanced module capabilities and technology solutions that extend across a wide range of application and performance requirements. As the number two LED manufacturer in the world (non-captive), Seoul Semiconductor has a proven track record of success in helping customers to simplify their processes and save on production costs, all while taking advantage of Seoul Semiconductor's vertically integrated technology and quality.

Partner with Seoul Semiconductor to increase your speed to market or expand your capabilities into new areas without investing in added equipment or staff expertise. From linear DC designs to complex AC engines driven by proprietary Acrich and Wicop technologies, Seoul Semiconductor can seamlessly support even the most complex custom and reference module designs in a timely and professional manner.

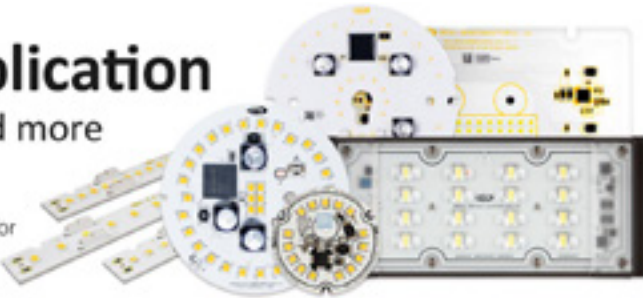
Linear reference modules are available as an excellent turnkey solution for projects of any size. The HE, SE, and Industrial series reference modules utilise Seoul Semiconductor's flagship high efficacy 5630 LEDs to deliver efficacies from an upper range of 189 to 202lm/W at typical driving currents.

The Value series is the perfect alternative for cost-sensitive projects, featuring similar technologies but with a high performing and cost effective 3528 package in place for efficacies up to 189lm/W at typical driving currents. Each linear reference module is UL and CE recognised, features uniformity of light and color (3 SDCM standard), and comes with a Zhaga compatible mounting pattern for easy installation.

Seoul Semiconductor takes pride in offering a variety of modules for specific lighting applications including round, tunable white, outdoor Wicop engines with heat-sinks and optics, proprietary blackhole lenses for increased uniformity and decreased optical depth, and Acrich AC modules that range from 4 to 105W with an added benefit of being Triac dimmable. Seoul Semiconductor can also integrate the NanoDriver into modular solutions for a product that is both low flicker and Title 24 compliant.

Features

- Vertical integration allows variety of technology and footprint choices including 3030, 5630, 3528, Wicop, 3535 and 5050
- Custom and reference designs available
- DC and AC designs

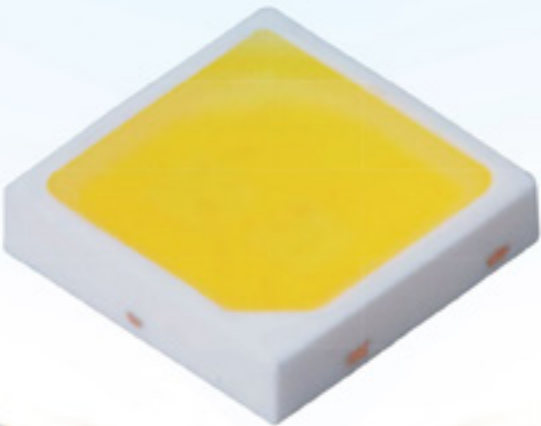


- Several lens options for both high-power and mid-power designs
 - 3 SDCM standard
 - Multiple design, manufacturing, and support locations
 - Numerous reference designs available through Future Electronics
- Applications**
- Street and area
 - Indoor commercial
 - Industrial and residential
 - Driver on board
 - Color tuning

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The Mid Power race began with NICHIA. We continue to lap the pack.



NICHIA's new 757 V3 Series

Features & Benefits

Industry's leading performance plus the highest level of quality for Mid Power LEDs.

Applications

Office (linear, spotlight), architectural, streetlight, tunnel, wall mount, healthcare, industrial, downlight, and many more.

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Constant-current LED driver ideal for use in low-voltage lighting systems

STMicroelectronics

STMicroelectronics' STCS2A is a 2A BiCMOS constant-current source designed to provide a precise supply to LEDs from a variable input-voltage source.



STCS2A: Voltage regulation is accurate to ±1%

The STCS2A is an ideal choice for designers who intend to replace an LED driver circuit composed of discrete parts which operate from a low input voltage of 5V, 12V or 24V. By using the STCS2A instead, they can benefit from more precise regulation: the STCS2A regulates the output voltage to an accuracy of ±1%. A driver circuit based on the STCS2A also benefits from higher integration and hence a smaller board footprint, and from improved reliability.

The current is set with an external resistor to an accuracy of ±10%. PWM dimming may be implemented via a dedicated pin. The designer can configure slope settings with an external capacitor to control the current rise over a period ranging from tens of microseconds to tens of milliseconds, providing close control of EMI.

An Open-drain pin output signals disconnection of the load.

ENERGY
 INDUSTRIAL
 LIGHTING
 MEDICAL
 AUTOMOTIVE
 SECURITY
 CONSUMER
 TELECOMS

APPLICATIONS

- Low-voltage lighting
- LED lighting in small appliances
- Car LED lights

FEATURES

- Input-voltage range: 4.5V to 40V
- <0.5V voltage overhead
- 2A maximum output current
- Shut-down pin

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UNRIVALED: LUXEON 5050

High efficacy and lumens in a multi-die, high power package.



Lumileds achieves disruptive performance breakthrough on LUXEON 5050 and easily surpasses lumen maintenance requirements for outdoor and industrial fixtures.

LUXEON 5050 features the highest flux, efficiency and robustness at excellent cost-per-lumen, compatible with existing 2W optics.

- 2 x better Lm/\$ at comparable Lm/W
 - 15% higher Lm/W at comparable Lm/\$
 - 30% lower thermal load
- Compared to 2W HP 3535 domed and flip chip emitters*

- Higher Flux
 - Greater Sulfur resistivity
 - Excellent LM80
- Compared to other 5050 packages*



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Over the years LEDiL has released a successful and diverse range of linear solutions to meet different lighting requirements. These solutions offer a variety of beam angles from mechanically different product families that follow industry trends and specifications. Optics can be used to control cutoff, colour uniformity, uniform illumination in the target area, and minimal glare according to application. Aesthetics are important, and what the lens looks like when the lights are on also needs to be considered.



THE LATEST LINEAR SOLUTIONS FOR INDOOR LIGHTING

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Linear Series Reference Guide

Seoul Semiconductor is one of the top two independent (non-captive) LED manufacturers in the world, with an extensive portfolio of more than 12,000 patents in LED and driver technology. This linear series reference guide features an array of solutions that provide uniformity of light and color as well as easy installation with a Zhaga compatible mounting pattern. Working with an innovative leader like Seoul gives customers leading-edge technology, along with security against IP litigation.



HE	SE	Value	Industrial
High efficacy 5630 LEDs deliver efficacies up to 202lm/W	High efficacy 5630 LEDs deliver efficacies up to 189lm/W	High performing and cost effective 3528 LEDs deliver efficacies up to 183lm/W	High efficacy 5630 LEDs deliver efficacies up to 194lm/W

	Part Number	Dimensions (mm)	Typ Lm	Typ Lm/W	Typ IF (mA)	Typ VF (V)	Max IF (mA)	LED Package
HE	SMJD-3606036B-XXN100B33E038AII	560*20	1330		195		390	STW8Q14D-E3
	SMJD-3611060B-XXN100C21E038AII		2210	202	325	33.6	650	
	SMJD-3622120B-XXN100E42E038AII	1120*20	4420		650		1300	
SE	SMJD-3607024B-XXN100B30E038AII		1300		200		300	STW8Q14D-E3
	SMJD-3614048B-XXN100C60E038AII	560*20	2600	190	400	33.6	600	
	SMJD-3621072B-XXN100D91E038AII		3910		600		900	
Value	SMJD-3606024C-XXN100B10E038AII		1100		175		280	STW8A2PD-E1
	SMJD-3612048C-XXN100C20E038AII	560*20	2200	183	350	34.2	560	
	SMJD-3618072C-XXN100D30E038AII		3300		525		840	
Industrial Standard	SMJD-3624144B-XXN100E35E038AII	560*20	4350	196.5	660	33.4	1650	STW8Q14D-E3
	SMJD-4253182B-XXN100J70E038AII	1120*20	9700	182.5	1300	40.8	1820	

*Each series tested @ 25 degrees C 4000K Ra80

Key Applications



Certifications



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Simple circuits implement low-cost LED driver with Bluetooth Low Energy wireless dimming

ON SEMICONDUCTOR

ON Semiconductor supplies highly integrated radio and power-conversion products which make it possible to implement a simple, low-cost system for wirelessly dimming LEDs powered by a direct AC LED driver.

The circuit is based on a highly integrated Bluetooth® Low Energy radio System-In-Package (SIP), the RSL10 SIP, which enables wireless control of an LED fixture's brightness. At the fixture, the ON Semiconductor NCL30170 implements a direct AC power-conversion circuit to provide a tightly regulated current to an LED lamp. Light intensity can be dynamically set by the user via a programmable dimming function, controlled with a smartphone app. Thanks to the devices' low-power technology, the overall system offers stand-by consumption of less than 200mW even though it does not use a switch-mode power supply.

Bluetooth Low Energy SIP includes radio transceiver and antenna

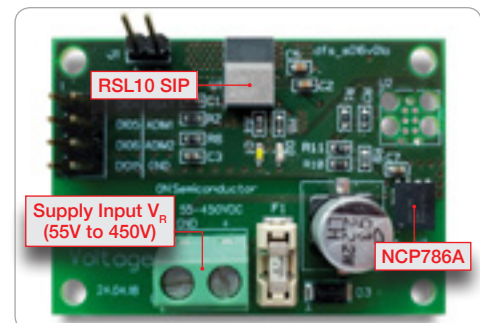
ON Semiconductor's RSL10 SIP is a complete Bluetooth® 5 certified Low Energy wireless SIP including a 2.4GHz radio transceiver, antenna and passive components. It provides the easiest way to implement low-power Bluetooth Low Energy technology in wireless applications including wireless dimmer modules.

The RSL10 SIP, which has the part number NCH-RSL10-101S51-ACG, supports both Bluetooth Low Energy and proprietary 2.4GHz radio protocols. Featuring ON Semiconductor's RSL10 2.4GHz System-on-Chip (SoC), the RSL10 SIP offers very high radio performance, including Receive sensitivity of -94dBm and Transmit power of up to +6dBm. It supports Firmware Over The Air (FOTA) updating.

The RSL10 SIP provides a complete radio system for devices connecting to a Bluetooth Low Energy network. It includes two processor cores, an Arm® Cortex®-M3 controller core and an LPDSP32 for intensive signal-processing functions. It also has built-in power management, 384kbytes of Flash memory and configurable analog and digital sensor interfaces. Both the RSL10 and RSL10 SIP feature an AES-128 encryption engine to protect transmitted data.

Fully certified to worldwide wireless standards, the RSL10 SIP markedly reduces time-to-market and cost by removing the need for antenna design.

In a dimmer module circuit, the RSL10 SIP may be supplied by an ON Semiconductor NCP786A ultra-low quiescent current linear regulator operating directly from an AC input rectified by an RS1A.



Ultra low-power smart lighting dimmer with RSL10 SIP



APPLICATIONS

- Smart and connected lighting systems

FEATURES (RSL10)

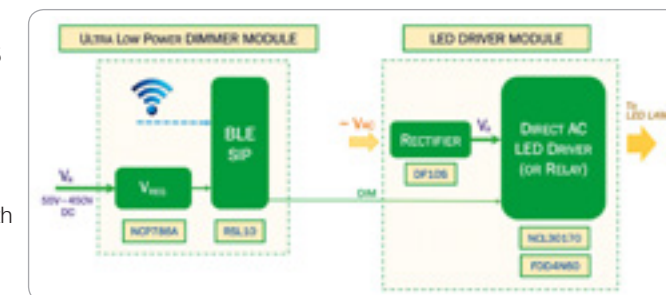
- Certified to worldwide wireless standards including FCC, CE, IC, KCC and MIC
- Supply-voltage range: 1.1V to 3.3V
- I²C and serial peripheral interfaces
- Pulse-width modulation interface

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FREE BOARDS FTM Board Club

The RSL10 eval board is supplied in an Arduino®-compatible form factor and features an on-board J-Link adaptor. Orderable Part Number: RSL10-SIP-001GEVB

Apply now at my-boardclub.com Fast-track board request code: FTM19-iiiA



ON Semiconductor: Selection of power and radio parts for wireless LED dimming and power

Direct AC drive LED driver provides PFC and precise constant-current regulation

The NCL30170 from ON Semiconductor is a linear, constant-current LED controller for use in smart lighting and phase-cut dimming systems.

The controller manages multiple LED channels in series using ON Semiconductor's proprietary auto-commutation topology. It offers highly accurate regulation of the constant-current output, as well as giving a high power factor of 0.99 and total harmonic distortion of less than 10%.



When designers use the NCL30170 to implement a direct AC LED driver circuit, they can achieve a very low system bill-of-materials cost as well as robust driver performance.

The device provides a wide analog dimming range down to 5% of maximum brightness with a linear dimming curve. In phase-cut dimming applications, input-current shape modulation provides both a good power factor and excellent dimmer compatibility.



APPLICATIONS

- Smart and connected lighting systems
- Indoor and outdoor LED lighting

FEATURES (NCL30170)

- High-voltage start-up
- Flexible selection of the number of LED channels
- Single controller for LED arrays rated up to 300W
- Over-voltage protection
- Short-circuit protection
- Thermal shut-down protection

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Linear dimming LED driver for smart connected lighting fixtures









DIODES INCORPORATED

The AL1781 from Diodes Inc., is a single-channel linear LED driver which offers PWM dimming control. The AL1782 is a dual-channel version of the device.



AL1781/2: Flicker-free PWM dimming

The AL1781 is intended for use in dimmable Smart Connected Lighting (SCL) applications in which the dimming control regulates the brightness of the LEDs’ output but does not affect its color temperature. The AL1782 is for color-tunable dimmable SCL lamps. These parts are integrated LED power solutions, providing both the LED driving element and an AC-DC power conversion block. The AL178x provides power both to the LEDs and to the intelligent wireless microcontroller in connected lighting fixtures. The AL1781 and AL1782 offer sophisticated dimming control features. High-frequency PWM dimming control eliminates electronic flicker. Deep dimming down to 4% of maximum brightness is possible at a high PWM frequency of 40kHz. At 10kHz, the devices can dim down to 1.0%, at 4kHz to 0.4%, and at 1kHz down to 0.1% with good dimming linearity. When no PWM signal is detected by these devices, they automatically enter a low-power mode in compliance with the standby power requirements of the ENERGY STAR® standard for connected lighting.

APPLICATIONS

- Smart connected lamps
- LED tubes
- Panel Lights
- Troffers
- Ceiling lights

FEATURES

- 1.5A maximum drive current
- Input-voltage range: 6.5V to 30V
- ±4% current regulation accuracy
- Automatically enters or exits low-power standby mode
- Adaptive thermal management to minimize non-productive power dissipation

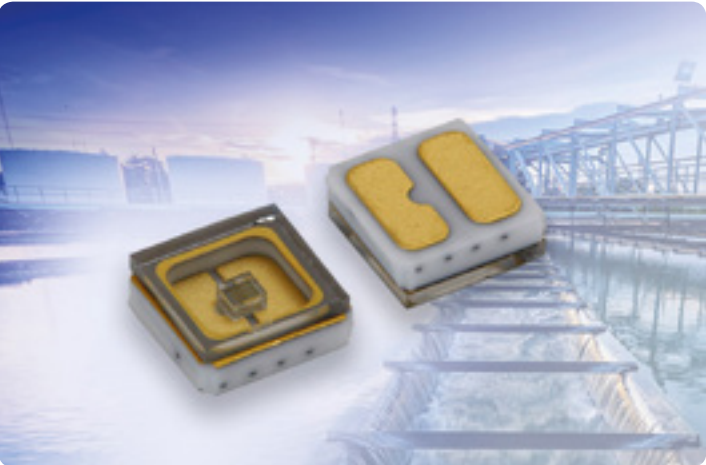
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New mid-power ultraviolet LED with quartz window gives very long lifetime









VISHAY

Vishay Intertechnology has introduced a ceramic mid-power ultraviolet (UV) LED for use in sterilization, sanitation and purification applications.



VLMU35CM00-280-120: Up to 18mW radiant power output

In the Vishay AlGaN technology-based VLMU35CM00-280-120, UVC light is emitted through a quartz window, a feature which enables the device to operate for a very long lifetime. Intended to replace mercury UVC lamps, the Vishay VLMU35CM00-280-120 features an angle of emission of ±60° and radiant power output of up to 18mW at a forward current of 100mA without the need for an external lens. The maximum forward current is 150mA. This Vishay emitter diode is housed in a compact 3.5mm x 3.5mm x 1.2mm surface-mount package. Bin selection options are available for the parameters of radiant power and forward voltage.

APPLICATIONS

- Water and air purification
- Physical surface sterilization
- Medical disinfection
- Portable sanitizers
- Gas sensing

FEATURES

- Radiant-power range: 8mW to 18mW at a drive current of 100mA
- 0.28 radiant intensity/radiant power ratio
- Forward-voltage range: 4V to 7V
- Wavelength range: 270nm to 290nm at 100mA
- 2kV ESD rating on the human body model
- 85°C maximum junction temperature

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Solutions to Increase Light Output and Perfect Color Consistency

LUMILEDS

Architectural Lighting Solutions

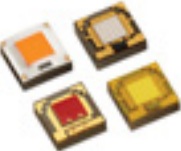
For the perfect effect.

We work closely with architects and lighting designers to engineer unparalleled LED solutions that deliver functionality and pure aesthetics. Fixture and luminaire designers require a comprehensive portfolio of solutions for indoor and outdoor architectural lighting to create stunning lighting effects for a variety of venues. Lumileds understands lighting’s performance needs and the driving force behind the desire for lighting fixtures with integrated wireless lighting controls and other Internet of Things (IoT) based functionality.

Products – Top picks from our portfolio that add the best value



LUXEON C Color Line: With an advanced portfolio of color and white LEDs, this innovative line is designed for flawless color mixing. By featuring a single focal length for all colors, LUXEON C Color Line provides consistent radiation patterns from secondary optics and maximizes optical efficiency. Along with a low dome design that keeps the effective light source small while improving light extraction, these LEDs are optimal for the most demanding architectural applications.



LUXEON CZ Color Line: Delivering up to 48% higher “punch” and available in 21 color options, these high performance solutions eliminate crosstalk and ensure a true color point when LEDs are closely packed. Created with the same robust building blocks as the award-winning LUXEON C Color Line, these powerful products feature identical focal length in an undomed design.



LUXEON 2835 Color Line: LUXEON 2835 Color Line is a complete color portfolio offering design flexibility for the dynamic needs of architectural applications.



LUXEON MultiColor Module 0.5W: The LUXEON MultiColor Module 0.5W is a compact 3-in-1 package that offers flexibility and versatility. With the ability to control individually or all at the same time the color control is precise.

What makes Lumileds solution better and different?

- Tight beam control, producing a smoother image or allowing for perfect color mixing
- Industry’s broadest color gamut offering ensuring any color point can be achieved in customer’s designs
- Industry leading performance in output, punch and quality of light
- World-class, in-house phosphor capabilities delivering vivid colors and superb color matching for perfectly consistent scenes and effects

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Solutions with the Highest Punch and Best Quality of Light

Sports Lighting Solutions

Change the game.



LUXEON LEDs usher in a bold new era in sports lighting

To satisfy the unique demands associated with illuminating sports venues, Lumileds offers transformative Sports Lighting Solutions. Available as application-optimized LEDs or using Lumileds Matrix Platform, these innovative lighting products enable consistent performance and adhere to precise optical and electrical specifications—attributes essential for sports lighting fixtures.

LUXEON LEDs are optimized for sports venues large and small. Recognizing the need for effective and efficient stadium and arena lighting, Lumileds created its category-defining Sports Lighting Solutions. Working closely with leading sports lighting manufacturers, these state-of-the-art LUXEON LEDs can be found in many of the highest-profile venues.

Products – Top picks from our portfolio that add the best value



Matrix Platform: Simplifying system design through integrated connectivity, controls and application specific driver topologies, enabling smaller and more elegant luminaires. Reducing system costs through a patented circuitry for CCT tuning and dim to warm electronics that pairs with single channel drivers and can achieve high definition pulse width modulation dimming down to 0.1%.



LUXEON V/LUXEON V2: Designed for outdoor stadium lighting, LUXEON V is a Chip Scale Package-based higher light output single package LED that supports directional applications and enables smaller fixtures and optics with high-intensity beams. With the new LUXEON V2, manufacturers can design with a proven package that delivers the most usable light and unmatched performance. In addition, it is compatible with existing optical designs and easily leverages existing ecosystems—making it ideal for indoor arenas and recreational fields.



LUXEON MX: Providing industry-leading efficiency and double the flux compared to previous designs, this high power LED enables cost-effective, high-reliability fixtures for a range of outdoor lighting applications.



LUXEON 5050: Setting the standard for high lumen per watt (lm/W), this advanced solution enables compact fixture design and optimal performance, plus its cost-effectiveness allows manufacturers to produce energy-saving fixtures that frequently qualify for utility rebates.

What makes Lumileds solution better and different?

- Matrix Platform, including Oberon algorithmic LED mixing technology, provides identical and predictable fixture-to-fixture system performance (system lumen output, uniformity and electrical characteristics)
- High efficacy at high drive currents enables high flux density fixtures
- Optimized radiation pattern and small source size enable fixtures with narrow beam angles that minimize glare, spill light and allow for the use of smaller optics. This in combination with the lowest thermal resistance in the industry support reduced heatsinking, size and weight

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DEXAL interface provides streamlined way to convert lighting fixture into smart wireless network node

OSRAM

The DEXAL interface developed by OSRAM offers a new, simpler way for luminaire manufacturers to add smart lighting management components, such as radio transceivers and sensors, to their products.

DEXAL is a non-proprietary intra-luminaire interface based on the familiar DALI lighting system interface.

It provides a channel for a power supply and bi-directional communication between an LED driver and fixture-integrated components. The DEXAL interface may be used to communicate precise luminaire-specific data, including diagnostics, to light management systems.

The DEXAL technology has recently been adopted by industry standards bodies, and is supported by the Digital Illumination Interface Alliance (DiiA) and by the ANSI C137.4 standard.

DEXAL enables luminaire manufacturers to supply system integrators with smart fixtures without complicating their own design and manufacturing process.

With the building management industry in the middle of a transition to a new 'smart building' model of operation, the ability to add network nodes to conventional LED lighting fixtures has become of growing importance.

Furthermore, cities are investing in smart infrastructure for better traffic control, a more efficient way of finding spaces in car parks, and for asset management.

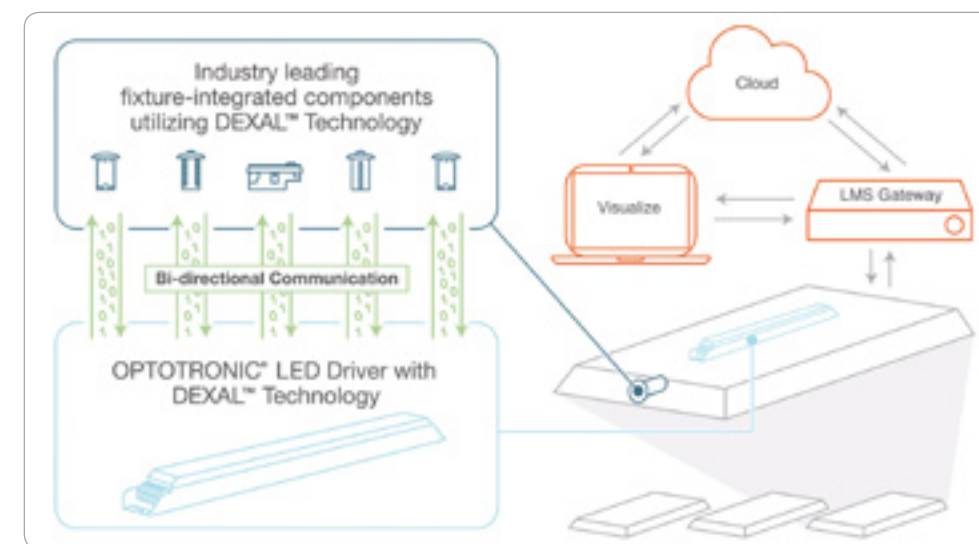
New partners join the DEXAL program

Co-operation between Osram and its DEXAL partners ensures that their luminaire components are fully compatible with Osram's DEXAL OPTOTRONIC LED drivers when integrated in a lighting system.

This is beneficial for lighting planners, who can choose from a broader range of products when configuring the lighting management system and luminaires which best suit the needs of their project.

The DEXAL program focuses on three categories of partner:

- Smart sensor manufacturers
- Lighting and building management system manufacturers
- Smart city solution providers



DEXAL: Channel for power and communication between an LED driver and fixture-integrated components

New 35W and 75W linear non-isolated LED drivers include DEXAL interface

OSRAM has extended its family of OPTOTRONIC linear LED drivers that support the DEXAL interface, introducing the non-isolated OTi DX 35/220-240/400 D NFC L, which has a 35W power rating, and the 75W OTi DX 75/220-240/600 D NFC L.

OSRAM already supplied two Safety Extra-Low Voltage (SELV) OPTOTRONIC linear drivers with DEXAL capability, the 30W OTi DX 30/120-277/1A0 DX L and the 50W OTi DX 50/220-240/1A4 DX L.

The use of an LED driver with DEXAL capability offers scope to provide valuable additional functions to an LED luminaire, including support for lighting system analytics based on luminaire-specific data about its power profile, energy usage and operating times.

The OPTOTRONIC DEXAL drivers also provide a simple way to implement new designs for networked luminaires which connect to wireless lighting control systems and sensors.

The drivers include an integrated DALI-2 bus power supply for sensors and radio transceivers. They offer very high efficiency of up to 93% at full load from a 230V AC supply.

The new non-isolated drivers are suitable for luminaires of protection Class I.



OPTOTRONIC linear driver: Integrated DALI-2 bus power supply for sensors and radio transceivers



APPLICATIONS

- Office and classroom lighting
- Factory and warehouse lighting
- Retail lighting

FEATURES

- Fully digital programming via DALI, NFC and LEDset (current)
- Wide operating window of up to 700mA
- Dimming down to 0.1% configured via OSRAM Tuner4TRONIC™ software
- Prepared for -250, -251, -252 and -253 DALI standards
- Over-temperature protection via external temperature sensor
- End-of-life indicator

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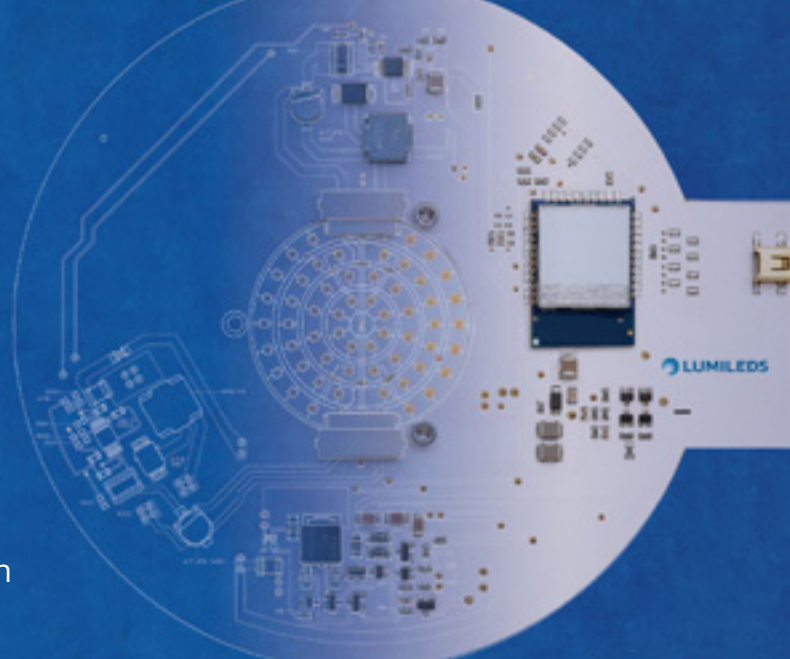
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Every feature you want, and a few you didn't know you needed.



Matrix Platform

Infinitely configurable, integrated LED light engines tailored to the most demanding design requirements. **Yours.**



Luminaire manufacturers often view their design challenges as unique, yet virtually all share a common imperative: the need to get to market fast with highly differentiated lighting solutions capable of outpacing the competition. Fortunately, there's a proven solution that brings increased agility and next-generation designs within reach:
Matrix Platform from Lumileds.

The shortest distance from inspiration to innovation

Matrix Platform challenges status quo manufacturing models by combining industry-leading LUXEON LEDs with the power of proprietary Advanced Technologies – then custom configuring them on substrates to fit manufacturers' specific requirements. The result is a game-changing solution tailored to meet the most demanding design specifications and yield maximum supply chain value.

Matrix Platform Advanced Technologies pave the way for design and manufacturing breakthroughs

What truly sets Matrix Platform apart is its portfolio of exclusive Advanced Technologies. Tapping into decades of optical, electrical, mechanical and thermal expertise – as well as global LED design and manufacturing experience – Lumileds has once again raised the bar with its first wave of Advanced Technologies.

Advanced Technologies optimize Matrix Platform performance, efficiency and predictability

An integrated approach to supply chain simplification.

At Lumileds, providing luminaire manufacturers with a streamlined process for achieving optimal design and engineering outcomes has always been a primary goal. Matrix Platform takes this commitment to new levels by leveraging Lumileds many years of in-house production expertise – from individual LED die to integrated LED light engines – to deliver a single-source solution for the highest quality luminaires and lighting systems. This holistic approach reduces LED inventory, dramatically minimizes waste and yield loss, and improves product reliability. And the benefits don't end there. Manufacturers also have access to the Lumileds technology roadmap to help lay a solid foundation for future product planning.

By combining the industry's finest LEDs with proprietary technologies and unparalleled design expertise, Matrix Platform delivers tailored, application-specific light engines that are ready for installation into final luminaire assemblies, reducing complexity and accelerating time to market – and time to revenue.

Matrix Platform Advanced Technologies



Oberon Intelligent Assembly

This proprietary pick-and-place system features the industry's only algorithmic LED mixing technology—guaranteeing consistent characteristics and performance board to board.



Integrated Light Guides

These advanced components soften high-intensity LED pixels to create a more uniform light surface, an increasingly important end game as luminaire form factors become smaller and smaller.



Integrated Drivers

These application-specific topologies are designed to address the trend of incorporating more electronic components—including the all-important power source—into a fully integrated, driver-on-board LED system. Integrated Drivers can also be tailored to unique manufacturer requirements, helping amp up system-level optimization.



Connectivity and Controls

This sophisticated functionality allows lighting designers to bring cutting-edge luminaires to market that can be controlled remotely, using an app or other device.



Color Tuning Electronics

This patented circuitry technology allows LEDs to mimic the warm, yellow dimming pattern that is the hallmark of halogen bulbs by controlling both a warm and a cool LED with two drivers that pair seamlessly with simple single channel drivers.

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Shorting caps provide long-lasting method for closing or opening circuits in outdoor lighting fixtures

TE CONNECTIVITY

TE Connectivity's (TE) LUMAWISE Endurance N Shorting Caps provide a safe, convenient and economical method to close or open the primary circuit path across a NEMA-compliant receptacle on an outdoor light.



TE's LUMAWISE shorting caps: High resistance to impacts

Description	Part Number
LUMAWISE Endurance N Shorting Cap assembly	2328118-1
LUMAWISE Endurance N Shorting Cap assembly with surge protection	2328118-2
LUMAWISE Endurance N Shorting Cap assembly, open cap	2328118-3

The ANSI-compliant LUMAWISE Endurance N caps have an IP66 rating for use in harsh outdoor environments. They are used to disconnect service (Open Cap) or to provide continuous power from the pole to the luminaire (Shorting Cap). A shorting cap with an integrated Metal Oxide Varistor (MOV) provides surge protection for LED luminaires that are required to be on continuously.

The LUMAWISE Endurance N Shorting Caps provide an alternative to light-sensing control units. Their distinctive cap shape provides an obvious visual distinction from standard photo-controls. The IK08 construction provides high resistance to impacts.



APPLICATIONS

- Highway lighting
- Streetlights
- Area lighting

FEATURES

- 15A maximum current
- Voltage-rating range: 0V to 480V AC
- Ultraviolet-stabilized material
- UL recognized
- C-UL listed

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LUMAWISE, TE Connectivity and TE Connectivity (logo) are trademarks.

LED modules for outdoor lighting compatible with standard optics and drivers

SEOUL SEMICONDUCTOR

Seoul Semiconductor supplies two series of compact, high-brightness LED modules which provide for a low bill-of-materials cost because of their compatibility with standard, off-the-shelf optics and drivers.

WICOP Y22 LED-based modules

One module series is offered in 2x6 and 2x8 LED configurations which are compatible with the Zhaga Book 15 footprint. Featuring an array of Seoul Semiconductor WICOP Y22 single-chip high-power LEDs, these modules offer a typical 5,000lm luminous flux at a module-level efficacy of 165lm/W when operating at 85°C.



Outdoor LED modules: Wide choice of CCT options

The modules are supplied with CCT options from 2700K to 6500K, specified with a four-step ellipse tolerance of chromaticity. As standard the minimum CRI is 70, with CRI 80 available on request.

These robust modules are ideal for use in streetlights and other applications in which operators are concerned to minimize maintenance and repair costs. They are rated for an L90 lifetime of longer than 100,000 hours at a continuous operating temperature of 85°C.

These Seoul Semiconductor modules include an NTC temperature sensor for active thermal protection. They are most commonly supplied with LEDiL STRADA-2X2CSP or HB-2X2 lenses, although custom lens arrays are available from Seoul Semiconductor.

5050 multi-chip LED-based module

Seoul Semiconductor also supplies an outdoor lighting module in a 2x6 array based on its 5050 multi-chip high-power LED. This module is optimized for use with the LEDiL STRADA-IP-2X6 streetlight lens. It is also compatible with the LEDiL HB-IP-2X6 lens.

The product, which offers an excellent cost:brightness ratio, typically produces 4,000lm at an efficacy of 160lm/W at 85°C. Maximum light output is 8,000lm.

This module is available as standard in 3000K and 4000K color-temperature options, with a minimum CRI of 70 and 5 SDCM binning. Other ANSI-compliant CCT options are available on request.



APPLICATIONS

- Streetlights
- Industrial lighting

FEATURES

- Compatible with common off-the-shelf LED drivers
- CE compliant
- UL recognized
- Five-year warranty

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Ambient light sensor provides accurate illuminance and color temperature measurements

ROHM SEMICONDUCTOR

The BH1749NUC from ROHM Semiconductor is a digital sensor IC which accurately measures the intensity and color temperature of ambient light incident on the surface of the chip.











BH1749NUC: Color measurements support human-centric lighting systems

Light measurement data supplied by the BH1749NUC enables automatic adjustment of the brightness and color of the backlight in LCD display panels, and of the light output from smart lighting, tunable white and human-centric lighting systems.

The BH1749NUC senses ambient light via red, green, blue and infrared sensor channels, and converts their measurements to digital values for lighting intensity (lux) and color (Correlated Color Temperature, or CCT).

The device is notable for its high sensitivity and wide dynamic range, which allow it to provide usable measurements in all conditions from an almost-dark indoor room to bright outdoor sunlight.

Circuitry integrated in the BH1749NUC rejects flicker noise generated by the 50Hz/60Hz cycle of mains-powered lighting.

APPLICATIONS

- Mobile device display backlighting systems
- Digital cameras
- Portable games machines
- Smart lighting controls

FEATURES

- Supply-voltage range: 2.3V to 3.6V
- Detects illuminance up to 80klux
- Built-in infrared blocking filter over RGB photodiodes
- I²C bus interface
- 190µA operating current
- 0.8µA power-down current
- Operating-temperature range: -40°C to 85°C

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Robust 8-, 12- or 16-LED module for outdoor lighting offers high brightness and efficacy

OSRAM

Osram's PrevaLED BRICK HP LED modules are robust, high-performing and durable LED light sources for streetlights and other outdoor lighting applications.

The modules provide a powerful and efficient output: luminous flux is up to 7,800lm, and module efficacy is up to 176lm/W.



PrevaLED BRICK HP: Minimum 70 CRI for good outdoor colour rendering









The modules, which are available in 2x4, 2x6 and 2x8 LED configurations, are rated for a lifetime of 100,000 hours on an L80/B10 basis. Osram supplies the PrevaLED BRICK HP modules in 2200K, 2700K, 3000K and 4000K color temperature options, and with a minimum CRI of 70 or 80.

The advantages of the PrevaLED BRICK HP modules are reinforced when paired with 1DIM or 4DIM configurable outdoor LED drivers from Osram, which can be programmed via its Tuner4TRONIC smartphone app. Programming options include adjustment of the light output and dimming times. This enables a single

luminaire design to be used in different configurations for different installations.

The 4DIM driver provides four dimming functions: DALI-2, AstroDIM, StepDIM and MainsDIM.

In addition, the 1DIM and 4DIM drivers' innovative Driver Guard function helps to extend the service life of luminaires. An extended system guarantee covers both the LED module and its driver.











APPLICATIONS

- Streetlights
- Outdoor lighting
- High-bay lights
- Area lighting
- Industrial lighting

FEATURES

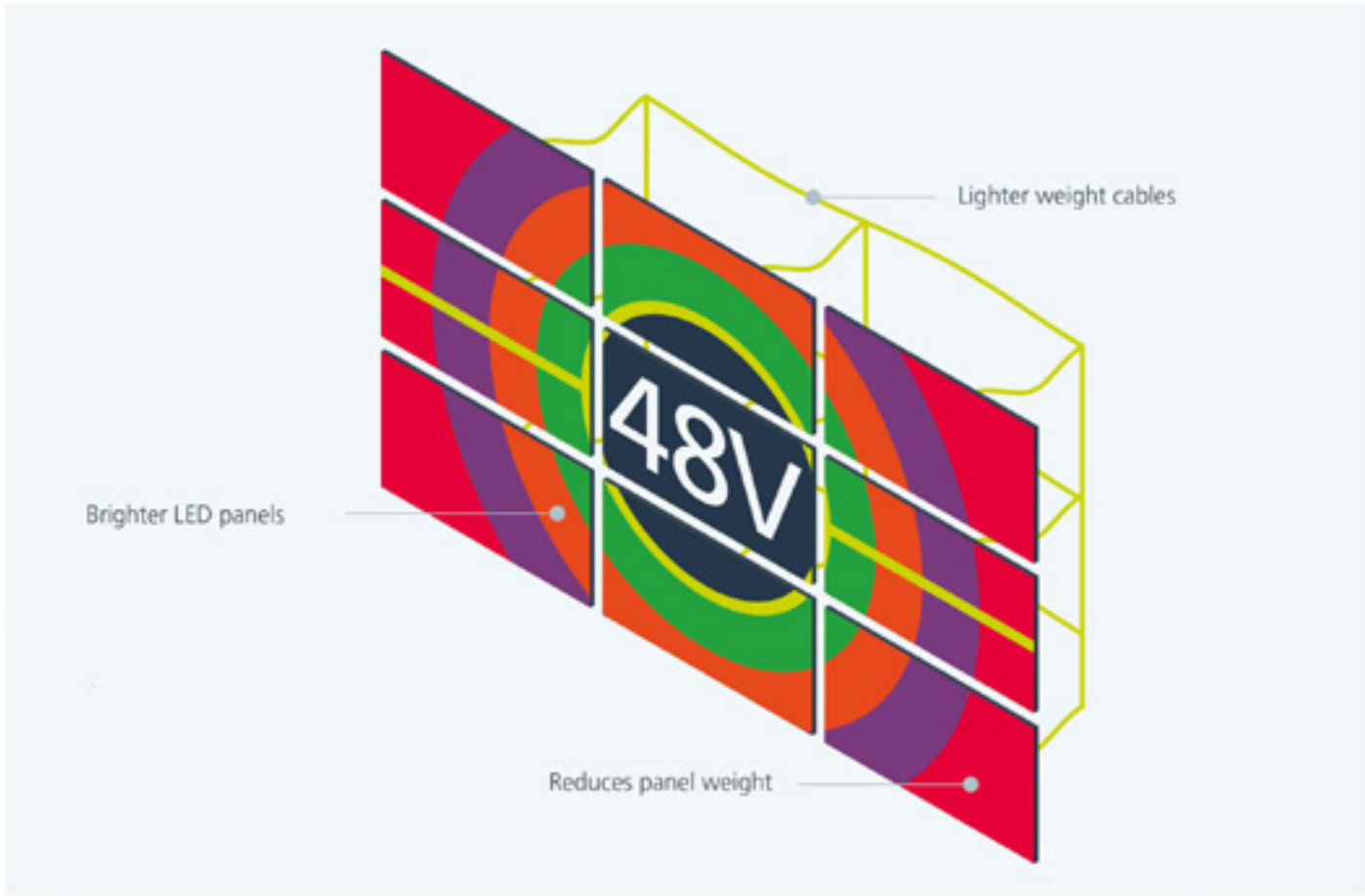
- Dimensions compatible with specifications of Zhaga Book 15
- Compatible with standard third-party optics
- Integrated NTC sensor for on-module temperature monitoring
- CE marked
- ENEC certified



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Delivering lighter, brighter LED panels with 48V high-density, high-efficiency converters





PI354x

ZVS buck regulators offer 48V input and 2.5V to 12V output up to 10A with efficiency >95%.

10.0 x 10.0 x 2.5mm



NBM2317

Bidirectional DC-DC converter enable 12V to 48V or 48V to 12V at 800W with 98% efficiency.

22.8 x 17.3 x 7.4mm

Learn a more efficient way to power your LEDs at vicorpower.com

VICOR

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New mid-power LED achieves class-leading efficacy of 223lm/W

SEOUL SEMICONDUCTOR

Seoul Semiconductor has introduced a new version of its 3030 mid-power LED which offers best-in-class efficacy, as well as excellent resistance to sulfur corrosion for use in outdoor and harsh environments.

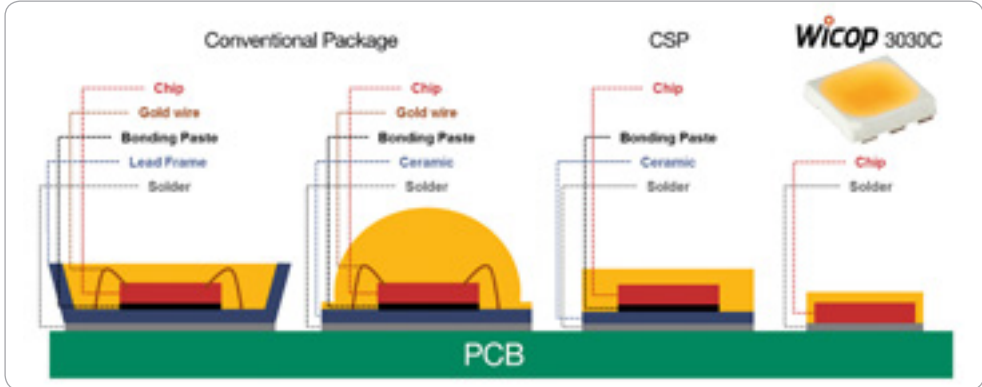
The new 3030C series LEDs are specified with efficacy of up to 223lm/W, making them ideal for use in high-performance luminaires. Excellent efficacy is maintained at all drive current levels: the 3030C LED shows very little droop up to the maximum drive current of 200mA, which means that the designer does not have to trade-off lm/\$ against lm/W.

A new architecture implemented by Seoul Semiconductor in the 3030C provides

outstanding thermal performance and corrosion resistance, as well as giving a small board footprint. Based on Seoul Semiconductor's WICOP package technology, the 3030C is a flip-chip device with no wire bond.

It offers excellent resistance to sulfur corrosion: it achieves 98.4% lumen maintenance after 504 hours' 15ppm H2S exposure at 40°C/80% relative humidity.

Junction-to-solder thermal resistance is just 7.5°C/W.



3030C series' WICOP package technology provides excellent corrosion resistance

APPLICATIONS

- Industrial lighting
- Outdoor lighting
- Commercial lighting
- Residential lighting
- Bulb replacement

FEATURES

- Available in seven CCT options from 2700K to 6500K
- CRI >80
- 120° viewing angle

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Efficient DC-DC converter supplies up to 3A constant current to LED light source

STMICROELECTRONICS

The ST1CC40 from STMicroelectronics is a step-down DC-DC converter IC which operates as a constant current source for LEDs. The output is adjustable up to a maximum of 3A. The regulated output current is set by connecting a sense resistor to the Feedback pin.



ST1CC40: 850kHz fixed-frequency operation

The device offers high conversion efficiency thanks to its implementation of synchronous rectification as part of its peak current-mode control architecture, and a low 100mV voltage drop across the sense resistor.

Operation at a high 850kHz fixed frequency means that the driver circuit can use small external magnetic and capacitive components, reducing the size of the LED power system.

The ST1CC40 is supplied in an eight-lead quad flat package measuring 4mm x 4mm, or in a standard SO8 package.

APPLICATIONS

- Signage
- Emergency lighting
- General lighting
- Battery chargers

FEATURES

- Input-voltage range: 3V to 18V
- 6µA stand-by current
- ±7% output current accuracy
- Over-temperature protection
- Over-current protection
- Output short-circuit protection

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Optisolis™

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- Full spectrum close to natural sunlight
- Less disruptive circadian rhythm
- High color fidelity (Rf)
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Reveal the Whitest White and Highlight Rich Colors

High Impact Retail Lighting Solutions

Lighting that sells.

Creating branded experiences with high impact lighting.

The retail sector provides an attractive business opportunity for luminaire manufacturers. Savvy retailers are seeking lighting solutions that produce a branded experience aimed directly at their target customers. This creates an excellent opportunity to market high impact lighting solutions that use modern, connected technology to attract and motivate today's consumer.

Lumileds understands what drives retailers' lighting decisions and offers a comprehensive portfolio that allows luminaire manufacturers to create limitless lighting effects. These solutions can help manufacturers create the unique experiences their retail customers desire – whether that's warm and inviting, cool and edgy, or anything in between.

Products – Top picks from our portfolio that add the best value



Matrix Platform: Simplifying system design through integrated connectivity, controls and application specific driver topologies, enabling smaller and more elegant luminaires. Reducing system costs through a patented circuitry for CCT tuning and dim to warm electronics that pairs with single channel drivers and can achieve high definition pulse width modulation dimming down to 0.1%.



LUXEON CoB Core Range: Due to its small Light Emitting Surface (LES) and industry-leading thermal resistance, LUXEON CoB is easy to work with, enabling simplified and less expensive luminaire designs.



LUXEON CoB Core Range – High Density: Providing unsurpassed performance, lifetime and quality of light for spotlights and downlights, including ultra-efficient 90+ CRI that eliminates the tradeoff between efficacy and quality of light.



LUXEON CoB Stylist Series: Accentuates merchandise through special color points and spectrally engineered solutions.



LUXEON 2835 Line: A collection of compact devices that allows for design freedom and provides a superior overall system solution when a project requires high lumen output and good efficacy.



LUXEON 2835 Stylist Series: Mid power series offering industry leading efficiency and reliability in a wide variety of voltage and lumen output options for linear lighting solutions.

What makes Lumileds solution better and different?

- The only 90CRI with breakthrough efficacy, which eliminates the tradeoff between desired light quality and required lm/W
- Specifically created for retail lighting, LUXEON Stylist Series creates impactful lighting, revealing the whitest whites and highlighting rich colors to increasing contrast
- Both LUXEON Stylist Series and custom white color points are offered across CoB and Mid Power products for perfectly consistent spot, downlight and linear lighting
- Enables the design of high punch miniature fixtures with superior quality of light and crisp uniform beams

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PFC controller for LED driver circuits keeps line current distortion at very low levels

STMICROELECTRONICS

The HVLED007 from STMicroelectronics is an AC-DC power controller IC for use in driver circuits for indoor or outdoor LED lighting systems.

It provides current-mode Power Factor Correction (PFC) control for isolated flyback converters operated in transition mode, otherwise known as quasi-resonant operation.

The special feature of the HVLED007 is its input current shaper circuit, which enables quasi-resonant flyback converters to draw a theoretically sinusoidal input current from the power line, while maintaining a high power factor.

This makes it possible to achieve total distortion of the input current of less than 10% at full load, and less than 20% at 30% load over the entire input-voltage range.

The IC has a control input driven by an optocoupler's output, to close a secondary-regulated isolated control loop. With the addition of a simple external circuit it can be used to close a primary-regulated voltage loop instead.

The totem-pole output stage, which is rated for 600mA source and 800mA sink currents, makes the device an excellent low-cost solution for EN61000-3-2 compliant switch-mode power supplies for loads up to 100W.



HVLED007: For use with isolated flyback converters



APPLICATIONS

- Flyback PFC converters for:
 - AC-DC LED drivers for domestic, commercial and industrial lighting
 - Street lighting
 - EN61000-3-2 compliant switch-mode power supplies

FEATURES

- Overload, short-circuit and over-voltage protection functions
- ≤60μA start-up current
- ≤4mA quiescent current
- Digital leading-edge blanking on current sense

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www.osram.com/ds





Light is dynamic

Constant-current LED drivers for TW/HCL systems

The OSRAM LED drivers OTi DALI 35 TW and OTi DALI 75 TW are ideal for Tunable White or Human Centric Lighting solutions. Perfectly matched to OSRAM TW LED modules and easily configured via our Tuner4TRONIC® tool, they help to enable biologically effective white light at an impressive price-performance ratio.

Create amazing TW/HCL solutions – with OSRAM LED drivers!

Light is OSRAM



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RGB + white multi-die LED provides high luminous flux for use in entertainment lighting

SEOUL SEMICONDUCTOR

The RGBW 40W from Seoul Semiconductor is a color-tunable, high-power red/green/blue/white multi-die LED for use in entertainment lighting and architectural lighting applications.











RGBW 40W: Optimal color mixing from closely spaced dies

The 40W device, which has the part number S1C0-4758400003, provides a high luminous flux from its surface-mount 4.7mm x 5.8mm package. Light-output values at a nominal drive current of 1A are rated at:

- Red: 122lm
- Green: 216lm
- White: 302lm
- Blue radiant power: 1,321mW

The maximum drive current is 2.5A. The construction of the multi-die package allows the dies to be mounted close together underneath a flat lens for optimal color mixing. The device can achieve a narrow beam width with the use of a secondary optic.

In addition to the 40W LED, a 15W RGBW version is available in a package with the same footprint. The 15W version, which has a part number S1C0-4758150000, has a nominal drive current of 0.7A. A 60W version is also available for applications which require a higher power output. It is supplied in a 5.8mm x 6.4mm surface mount-package and has the part number S1C0-5864600000. Specified with a nominal current of 1.4A, its maximum rated drive current is 4.5A.

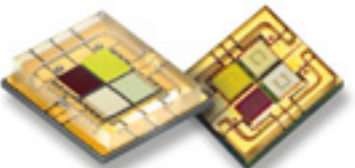









APPLICATIONS

- Entertainment lighting
- Architectural lighting
- Outdoor lighting
- Spotlights

FEATURES

- Dominant wavelengths:
 - Red: 625nm
 - Green: 525nm
 - Blue: 453nm
- White CIE co-ordinates: x = 0.31, y = 0.32
- 120° viewing angle



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24-channel LED driver gives independent gain control of red, green and blue output channels

STMICROELECTRONICS

The LED2472G from STMicroelectronics is a low-voltage 24-bit shift register IC which can be used to drive large LED display panels. It offers features which are particularly useful to the operation of indoor and outdoor LED billboards.



LED2472G: 20V maximum output per channel

The LED2472G supplies a constant-current LED driver output to 24 channels of LEDs at an output voltage of up to 20V, enough for several LEDs connected in series.

The device is configured in three groups of eight red, eight green and eight blue independently-controlled channels. The LED current can be separately regulated for each color within a range from 4mA to 72mA. This range is divided into two sub-ranges, and the current can be adjusted within each range in 64 steps of resolution, or six bits per color.

The LED2472G includes an LED failure-detection circuit which checks for three error conditions:

- Short to ground
- Short to the LED power-supply rail
- Open channel

All the controls and the shift register data are accessible via a serial interface. A selectable gradual output delay controls in-rush current.










APPLICATIONS

- Full-color large displays
- LED signage
- LED advertising displays

FEATURES

- Current programmable through external resistor
- Supply-voltage range: 3V to 5.5V
- Programmable shorted LED detection thresholds
- Automatic power-saving mode and wake-up
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LEDs promise dramatic cost savings and important operational benefits in new generation of sports field lighting equipment

By François Mirand
EMEA Technical Director, Future Lighting Solutions

While most other lighting applications are now completing their transition to LED light sources, the manufacturers of the floodlights which illuminate football pitches, tennis courts and other large outdoor sports fields have until recently retained a preference for conventional High Intensity Discharge (HID) lamps. HID lamps offer high flux and a high-quality light output, and the electrical and optical considerations in using them are easy for floodlight designers to deal with, as shown in Figure 1.



Fig. 1: The ArenaVision MVF404 metal halide lamp from Philips Lighting, part of its range of high-flux HID lamps for sports lighting. (Image credit: Philips Lighting, a brand of Signify.)

But there are signs that the tide might be turning towards new and improved LED and driver solutions: for instance, Philips Lighting grabbed headlines with its installation of LED luminaires to light the playing surface of the Ekaterinburg Arena in Yekaterinburg, one of the Russian stadiums that hosted 2018 World Cup football matches.

So which factors are encouraging the switch to LED light sources in sports field lighting? And how different is the design of an LED-based sports field luminaire from that of an HID-based floodlight?

High cost of HID lamp replacement

There are two strong reasons why operators of stadiums and sports arenas will be happy to see the end of HID lamp technology. First is the limited operating lifetime of the lamps: a typical B50 lifetime (mean time before failure) of just 5,000 hours. This means that HID floodlights require frequent lamp replacements. And since the lamp to be replaced might be as much as 25m in the air at the top of a narrow pole, special access and safety equipment and skilled technicians are required, at a considerable cost.

The other main drawback of HID lamps is their behaviour in the event of an unexpected shutdown, for instance when a stadium's power circuit fails. HID lamps require a 10-15 minute cool-down period before restarting, and then after re-starting take 5 minutes to reach full brightness. This period of darkness and partial lighting is potentially catastrophic if a power failure occurs during a well-attended match: the safety and public order consequences of holding a crowd of tens of thousands of people inside a dark stadium, with play suspended, are extremely serious.

READ THIS ARTICLE TO FIND OUT ABOUT:

- The factors which have deterred manufacturers of stadium lighting equipment from using LED light sources
- The safety, performance and cost advantages of LEDs in stadium lighting
- New LEDs, drivers and lenses which are suitable for use in large LED lamps for stadium lighting

An LED-based light source eliminates both these problems: the lifetime rating of an LED light source in a floodlight depends on the way in which the design is implemented, but will typically be in the range of 50,000 to 100,000 hours; and LEDs can be turned on instantly at full brightness when the power is switched on or restored after a mains power outage.

Other important benefits to the use of LED light sources for sports field lighting include higher efficacy, low voltage at start-up, and support for dimming and dynamic lighting effects.

Considerations in LED floodlight system design

The advantages to be gained from the use of LEDs in floodlights are, then, very considerable. But the nature of the application puts particular constraints on the design of high-mast LED lighting, and until recently these have hindered OEMs' attempts to use LEDs in sports field lighting. In 2018, however, suppliers of LEDs, drivers and optics introduced a number of new products which addressed the special requirements of high-mast stadium lighting, and it is now easier than before to create an effective floodlight design based on an LED light source.

The difficulty of making LED floodlights stems from a combination of strict requirements. The playing surface which needs uniform illumination and no shadows is large: for tennis, the court itself is 260m² and the total area including space for line judges, players' seating and so on is around 680m². For football the space is even larger: the pitch is around 7,000m² and the total illuminated area is around 10,000m². The illumination requirement depends on whether the field is for use by amateurs, and requires less bright light, or for a high-level professional spectator sport: in the latter case, illuminance of >1,000lux might be required at the playing surface.

Depending on the height of the mast and the size of the playing area, this calls for a light output ranging from hundreds to thousands of kilolumens from the light source. This high light output has to be provided from the smallest possible light-emitting surface, to avoid obstructing spectators' view, and to impose the lowest possible wind loading on the pole.

In professional stadium lighting, light quality is also tightly specified by TV broadcasters through its Television Lighting Consistency Index (TLCI) specification for color rendering.

The HID lamp is a particularly good solution to the problems of size and weight: a single 2kW HID lamp produces 150,000-200,000lm, so few lamps need to be mounted on each mast, as shown in Figure 2.

The challenge when designing with LEDs is to keep the Light-Emitting Surface (LES) as small as possible, difficult when using general-purpose LED chips, which typically produce around 300lm each. With such devices, a high-mast floodlight would require too many units and would occupy too large an area.

Suitable LED options, however, are now available. Nichia's NV9W149AM is a multi-die LED which produces a nominal output of 2,490lm of CRI 90 light at a drive current of 2.1A, although it can be driven at a continuous current of up to 3A.



Fig. 2: Philips ArenaVision floodlighting lit up the Phoenix Snow Stadium at the South Korea winter Olympics in 2018. (Image credit: Philips Lighting)

It is supplied in a package measuring 7mm x 7mm x 3.1mm. Offering high efficacy and light quality, it enables system designers to achieve the very high light output required even by professional sports stadiums in a luminaire with a small total footprint.

Positioning of high-power drivers

The design challenge is not limited to the selection and integration of the LEDs: the choice of the power supply to the LEDs also has serious consequences.

Two important factors determine the choice of LED driver. First, the driver supplies a high load, potentially more than 500W in lighting systems for professional football stadiums, for instance. No driver is 100% efficient, and the power loss is dissipated from the driver as waste heat. Designers of LED lighting equipment tend to think of an integrated driver unit as a self-managing black box that requires no external thermal management. In this case, however, the designer would do well to consider how large amounts of heat can be safely drawn from the case of the driver to the ambient air without overheating the air in the system's enclosure.

The other concern in driver selection is weight: the lighter the luminaire, the narrower the pole can be, and the less structural support is required for canopy-mounted lighting. The EFD-1K2SxxxDV series of 1.2kW LED drivers from Inventronics, for instance, is an excellent choice for high-flux luminaires. A robust 6.6kg, as shown in Figure 3, it weighs less than an equivalent power system consisting of multiple drivers each with a lower power rating.



Fig. 3: An EFD-1K2SxxxDV 1.2kW LED driver from Inventronics weighs 6.6kg

An alternative to mounting the driver at the top of the mast, next to the LEDs, is remote mounting at the foot of the pole. This is a novel approach to LED power-system design, for which there is no requirement in other applications. Because of the long distance that control signals must travel between a remote driver and the LEDs, remote mounting can impair the operation of the feedback loop, leading to instability in the power output and in turn causing perceptible impairment of the light output. In addition, the designer will have to account for the voltage drop along the cable, and handle system EMC requirements. Driver manufacturers, however, are beginning to take the requirements of remote mounting into consideration as they develop special new driver products.

In their choice of LED driver, high-mast floodlight designers will also want to consider the specifications for output ripple, which causes light flicker and so is of critical importance for the lighting of broadcast events: it should be limited to less than 2%.

The choice of the dimming interface is also of importance to enable dynamic lighting features, such as flashing or dimming patterns. Fixture manufacturers tend to look for DMX control because of its faster response time compared to DALI. Few high-power drivers offer a DMX interface, and this makes DMX-to-0-10V converters such as Inventronics' CNV-DMXR valuable.

Optical design considerations

The last important element of the system for consideration in sports field lighting is beam control. In a typical four-mast topology, with a mast at each corner of a rectangular playing area, the light must throw light precisely onto a quadrant of the total surface from a great height.

Conventional LED collimators provide for excellent beam control from a small point source of light. The small optical losses in a collimator are dissipated as waste heat. In very high-flux systems, this generates a lot of heat, and in fact too much for the polycarbonate (PC) or PMMA materials normally used in lenses for LEDs, which tend to deform at high temperature.

Here too, component suppliers have been developing specialist products suited to sports field lighting. For example, LEDiL supplies the FN16258 STELLA-RS, a lens which produces a 23° spot beam with an LES of 19mm and which is compatible with LEDs with an LES of up to 30mm, as shown in Figure 4. It is made of silicone, a material which is resistant to very high temperatures, but which is heavy and less mechanically stable than PC or PMMA.



Fig. 4: The FN16258 STELLA-RS lens from LEDiL is made of high temperature-resistant silicone. (Image credit: LEDiL)

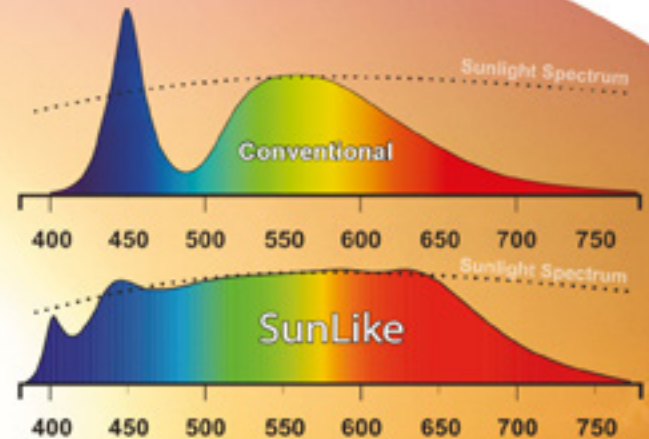
Improving the total cost of ownership and much more

As so often with LED technology, the extra initial cost of LED-based sports field lighting will be recouped over the lifetime of the system, in reduced maintenance and replacement expenses and lower energy bills. The quality and the flexible operational controls of an LED lighting system provide important additional benefits. As this article has shown, the development of an LED-based replacement for traditional HID lamps requires careful consideration of various electrical, thermal, mechanical and optical issues, but as Ekaterinburg's World Cup stadium shows, the LED is the light source of the future for stadium lighting.

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