



WEBINAR
EMBARCADOS

ILUMINAÇÃO AUTOMOTIVA

PROJETANDO COM LED DRIVERS E LEDS EM SISTEMAS ELETRÔNICOS



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Switching LED Drivers for Headlamps and Fog Lamps Webinar

August 2026

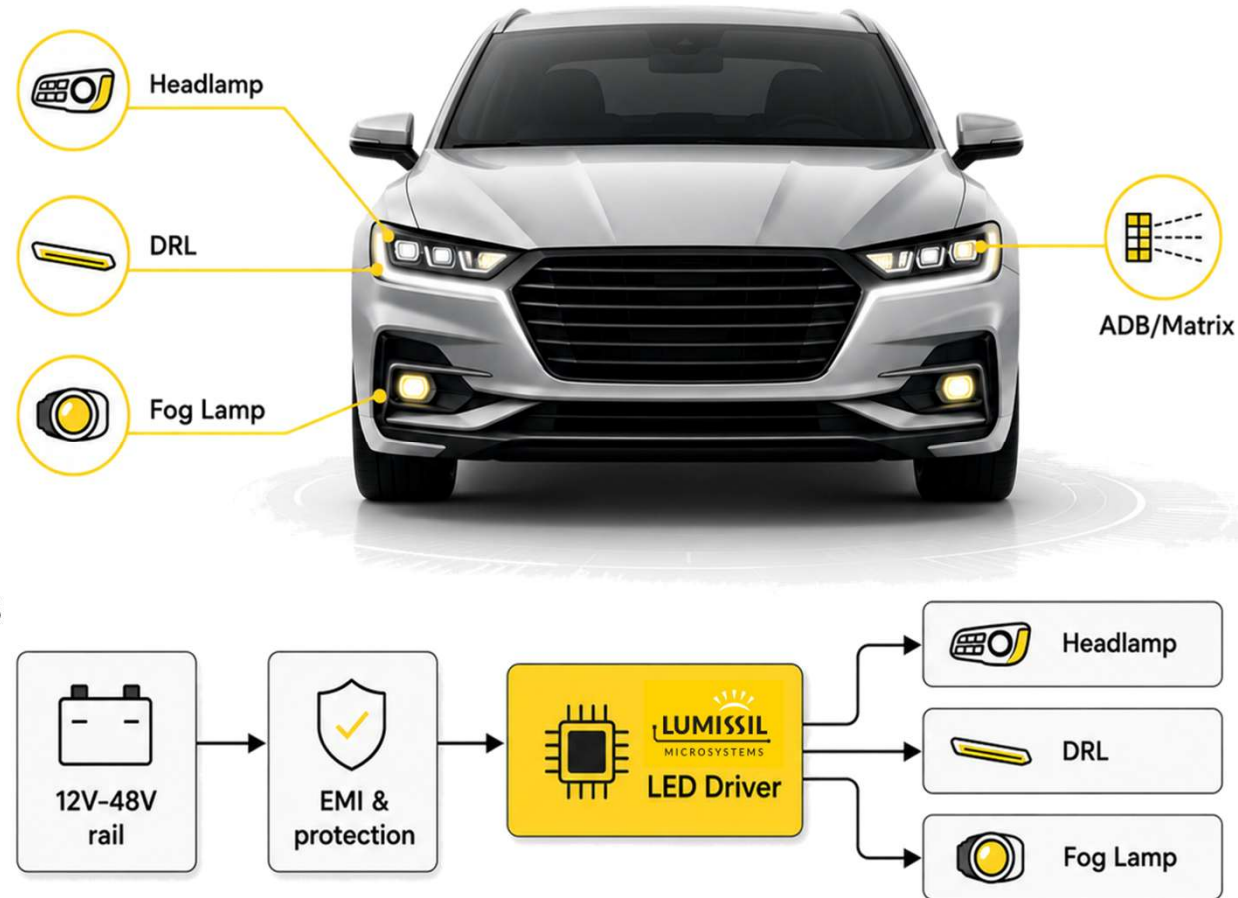
Webinar Agenda



Automotive headlamp and fog lamp designs rely on efficient switching conversion

Discussion Topics

- Automotive lighting traction and application examples
- Switching-driver and topology selection fundamentals
- Lumissil headlamp, foglamp, and ADB solutions
- Reference designs, EMI results, and system architectures
- Device-selection criteria and customer value



Why Customers Choose Lumissil

Our Winning Value Proposition for Automotive Lighting

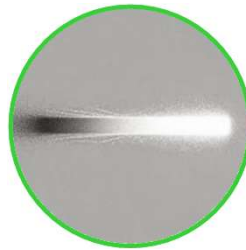


System-Level Value

Integrated power, control, dimming and diagnostic functions reduce design complexity and help shorten development time

Functional Safety Support

ISO 26262-compliant process with diagnostics, fault reporting and fail-safe functions to support ASIL-B system designs

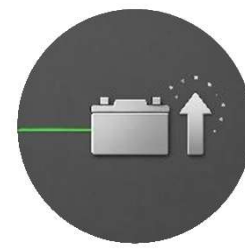


EMI Optimized Design

Spread spectrum, phase management and synchronization help reduce conducted and radiated emission peaks and simplifies external filtering

Dimming & Fade Control

Analog, external PWM and internally generated PWM, plus optimized fade control enable accurate brightness control and smooth visual transitions



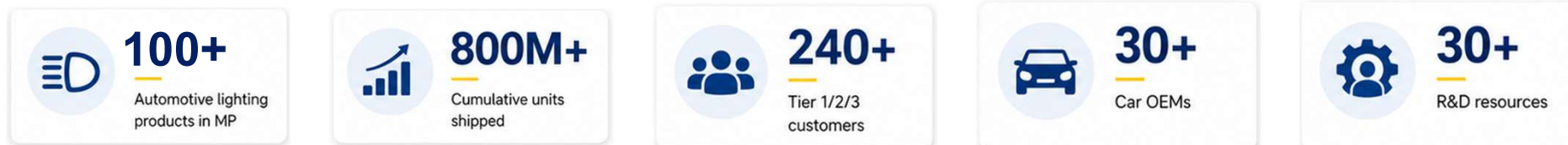
48V Ready Options

Designed for next-gen 48V systems application, providing design headroom for emerging automotive power architectures

Lower Standby Current

Microamp shutdown current helps reduce key-off battery drain and quiescent system power to help EVs meet stringent energy efficiency targets.

Automotive Lighting Traction

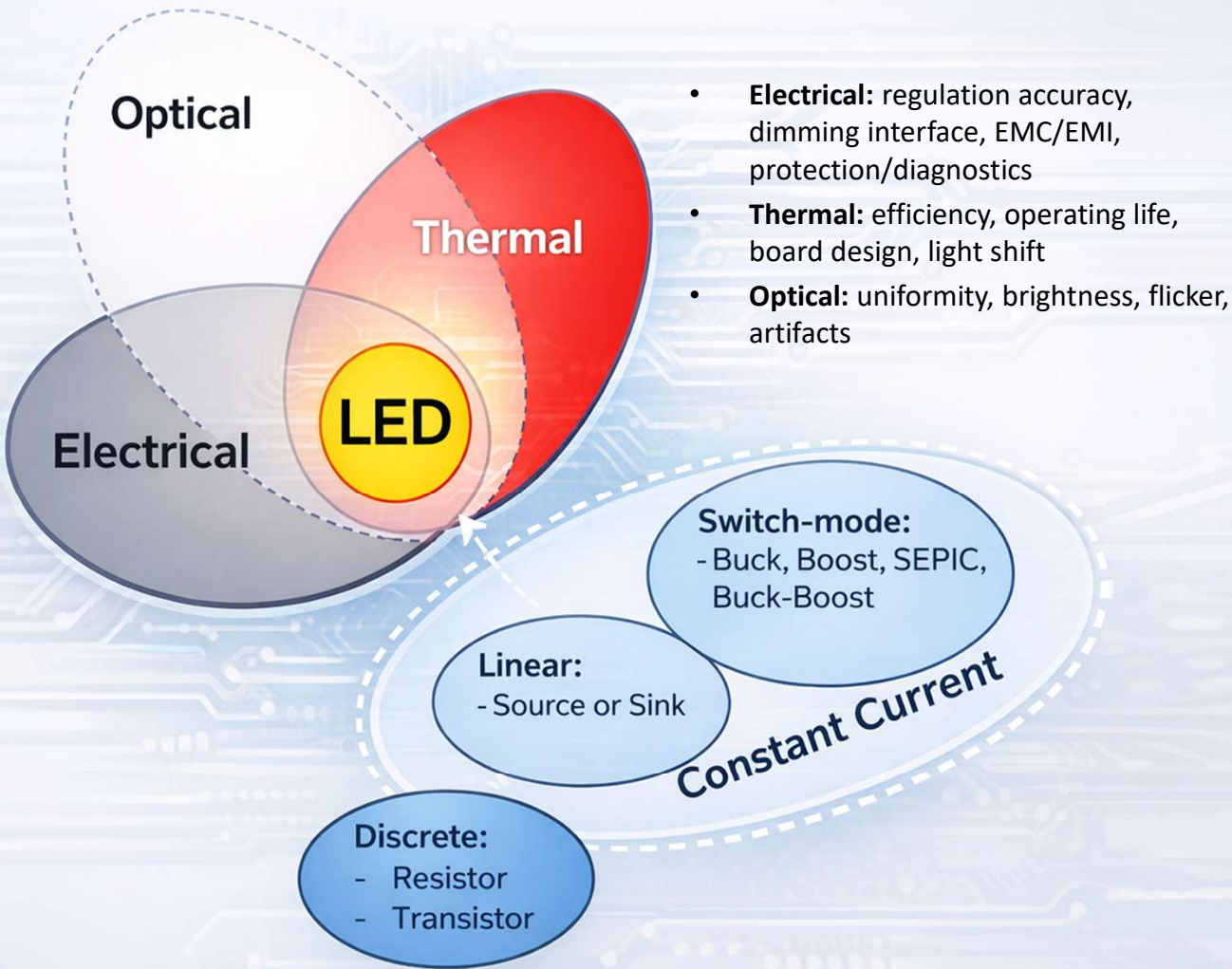


Proven Automotive Lighting Traction

Device	Application / customer use		Volume / timing
IS32LT3957A		Freightliner Headlamp / de-icing LED Headlamp	600k x 2 pcs/yr Mass Production 2026
IS32LT3952		Automotive Logo Lamp	200k pcs/yr Mass Production 2026
IS32LT3961		Cargo Van Room Lamp	5 per car x 60k cars/yr Mass Production 2027
IS31LT3961 + IS32LT3959		Headlight/Indicator Lamp	120k x 2 pcs/yr Mass Production 2026

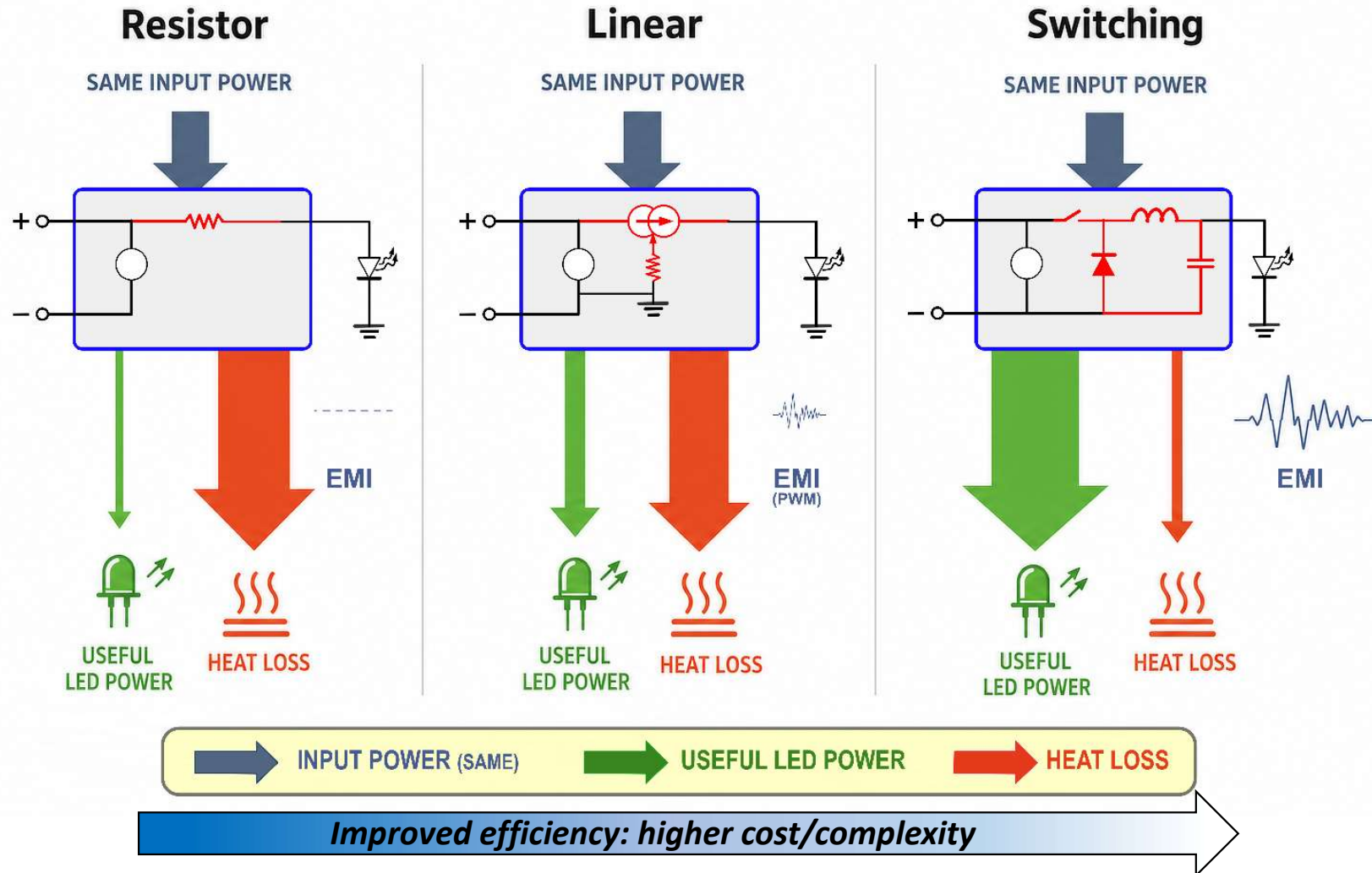
Topology selection fundamentals

LED Driving Options



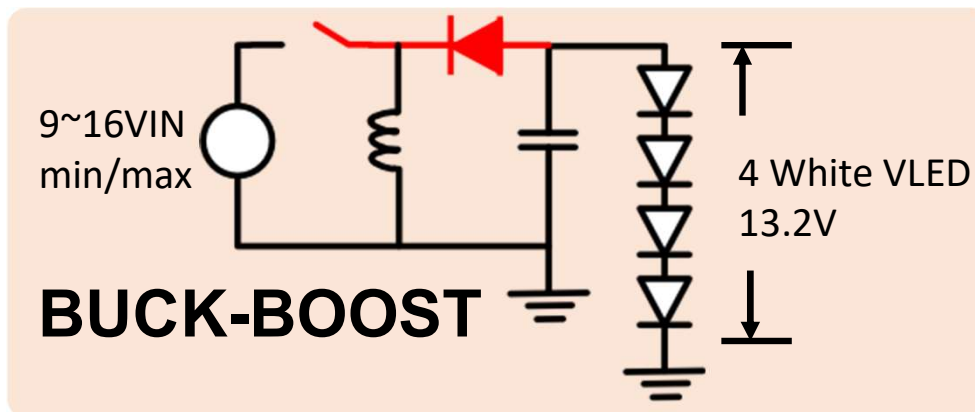
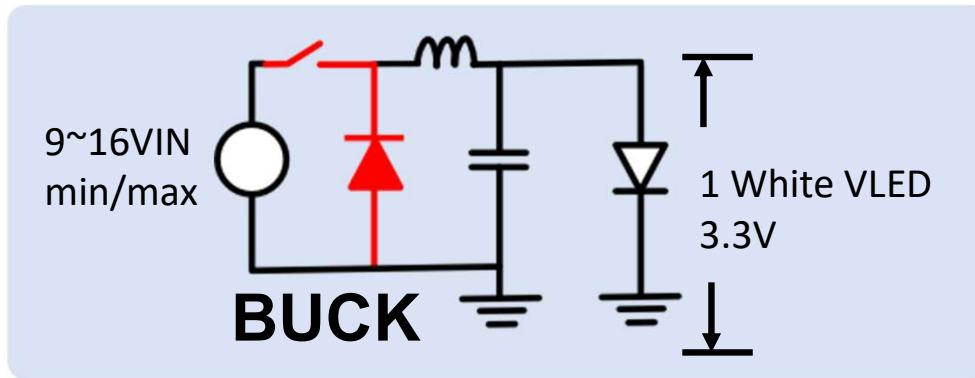
- **Discrete Resistor:** lowest cost, No active current regulation; efficiency depends on voltage headroom
- **Linear CC:** good regulation, thermal limited when $V_{IN} - V_f$ is large
- **Switch-mode CC:** best efficiency over wide V_{IN} , requires layout/EMI discipline, energy storage (L/C) + feedback for constant current

When Switching Becomes the Preferred Solution

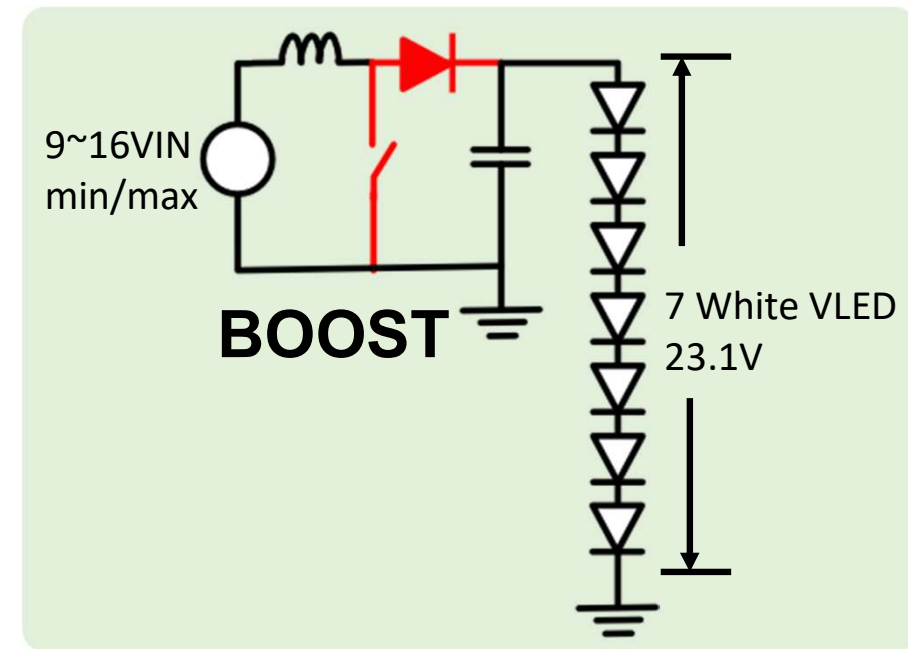


Selecting Switching Regulators

- 'Right' topology selection is driven by VIN range vs VLED
- A 12V battery voltage can range from 9 to 16V



LED Driver IC Topology Types			
Topology	Efficiency	Cost	Output Voltage
Buck	High	Low	<Input Voltage
Buck (Hysteretic)	High	Very Low	<Input Voltage
Boost	High	Low	>Input Voltage
Buck-Boost	Middle	Middle	Wide +/- (invert out)
SEPIC	Middle	High	Wide +/- (non-invert)
Linear	Low	Lowest	<Input Voltage

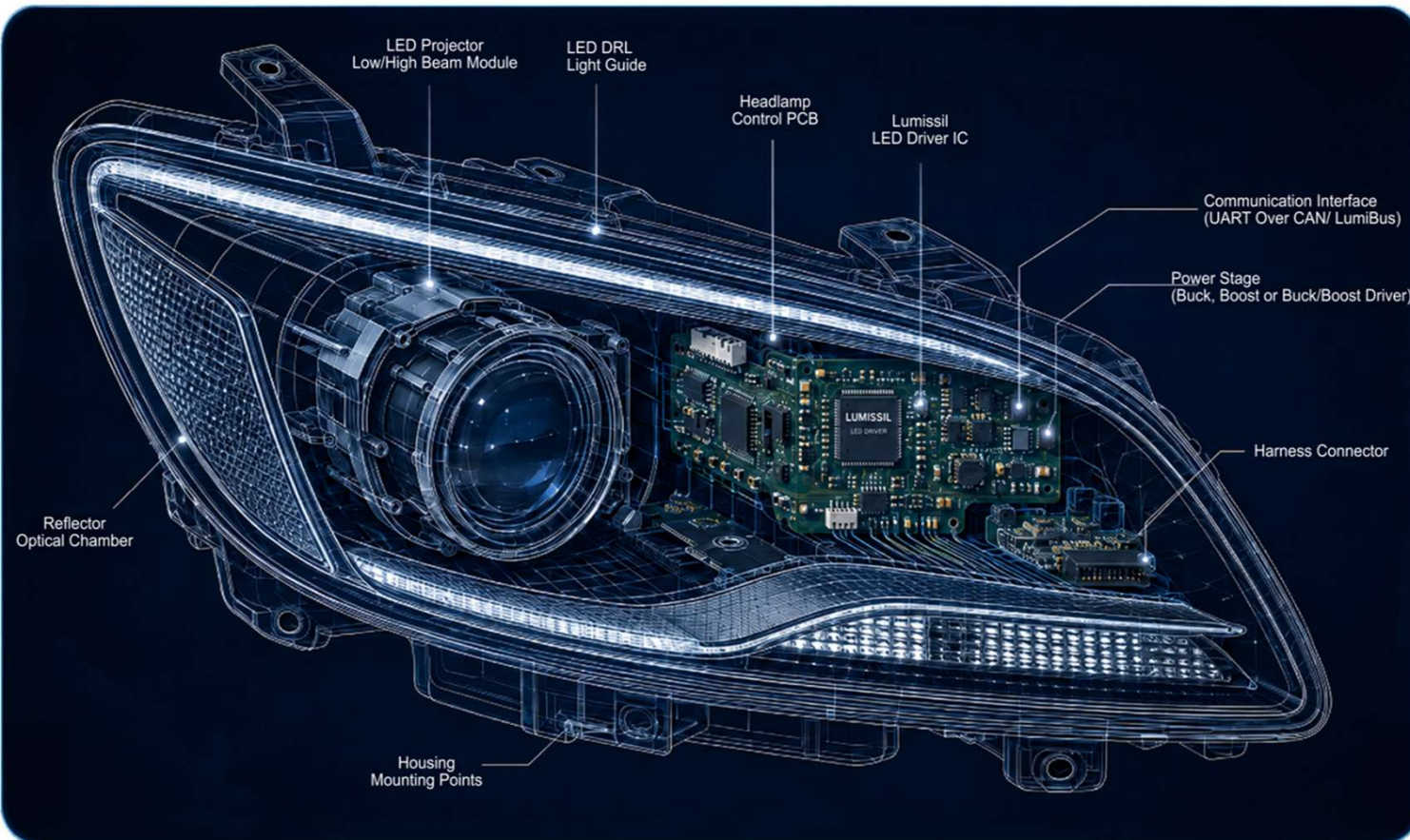


Lumissil Architectures for Auto Front Lighting



Application	Typical Architecture	Key Priorities	Lumissil Parts
Fog/logo Lamp	Single Synchronous Buck	Compact module, lower thermal burden, and easier EMC optimization	IS32LT3965: 1.5 A synchronous (Dual Internal FETs) buck IS32LT3951/2: 1.5A A-synchronous (External Diode) buck
High/Low Beam	Buck, Boost, or Buck-Boost	High optical output with fault protect/detect and reliable beam availability	IS32LT3958B / IS32LT3967A/B: multi-topology options for high-power exterior lighting
Combination Headlamp and DRL	Dual or Multi-channel Controller	Fewer ICs, lower BOM, independent lighting functions, and faster fault isolation	IS32LT3962: two independently configurable channels IS32LT3960 + IS32LT3963/4: scalable CV/CC platform
ADB Headlamp	Boost Pre-regulator + Buck Stages + Matrix Managers	Adaptive-beam LED control with communication and safety-support mechanisms (ASIL-B)	IS32LT3960 + IS32LT3964 + IS32LT3365B: voltage pre-regulation, LED current regulation, and matrix pixel control
48V Lighting	65-80V Controller with External FETs	Future-ready 48V with flexible power scaling and thermal design	IS32LT3958B or IS32LT3962: for emerging 48V architectures

Headlamp Solutions



• Dipped(Low)/Main(High) Beam

–IS32LT3958B

- 80V LED driver with external FET
- Buck, Buck-Boost, Boost, SEPIC
- Internal PWM for dual brightness

–IS32LT3962

- Dual 80V LED driver with external FET
- Buck, Buck-Boost, Boost, SEPIC
- Internal PWM for dual brightness

–IS32LT3967A - **April 2027**

- 6A/65V LED driver with integrated NFET
- A = Buck boost, B = Buck
- PWM & ICTRL for dual brightness

• Adaptive Driving Beam (ADB)

–IS32LT3365

- ADB matrix 12 LED bypass switches

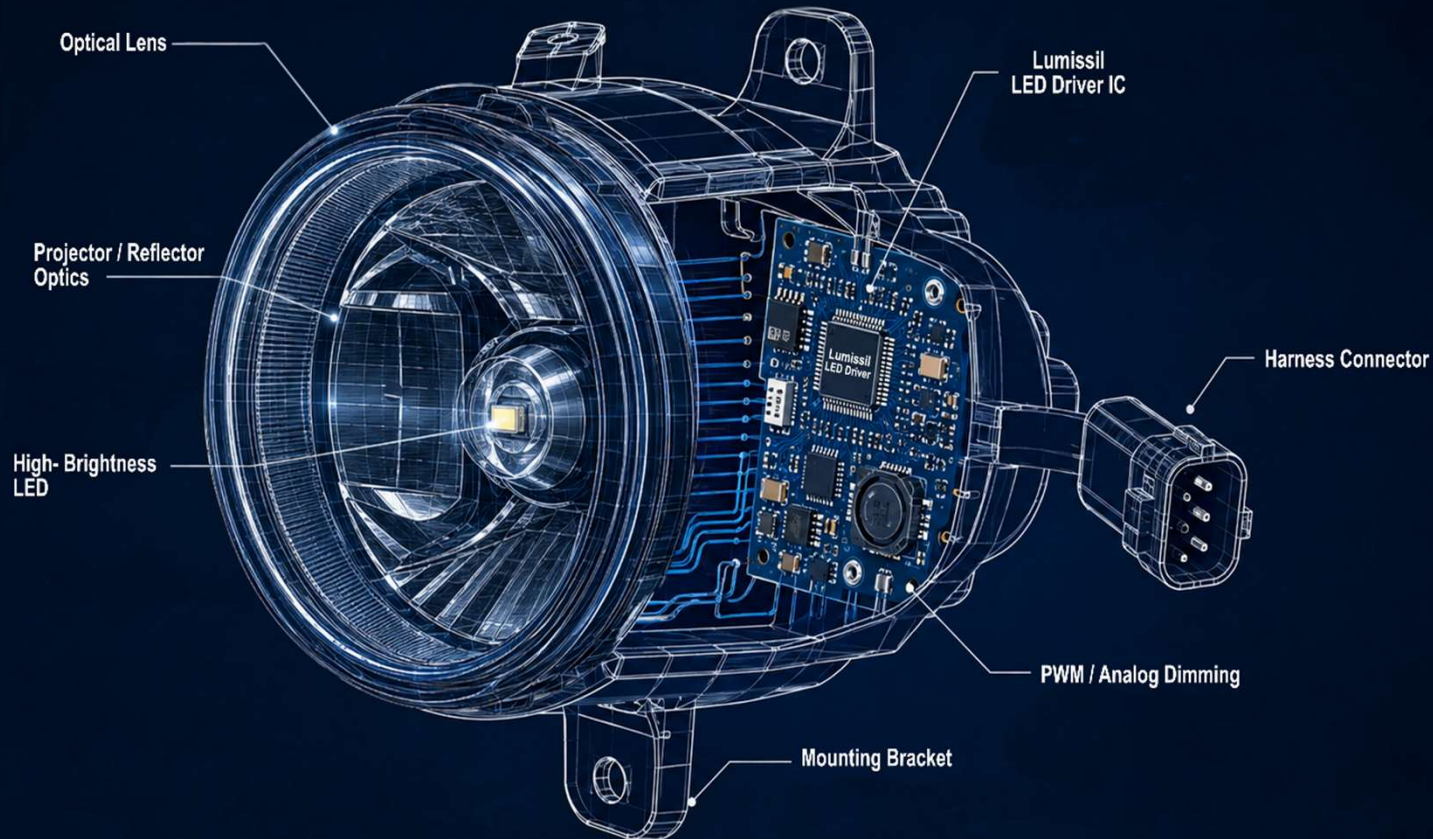
–IS32LT3960 – **Sept 2026**

- Dual 65V Constant Voltage (CV) and Constant Current (CC); (Buck, Buck-Boost, Boost, SEPIC) w/SPI for Diagnostic

–IS32LT3964 – **Sept 2026**

- Dual 65V Synchronous Buck Controller w/SPI for Diagnostic

Foglamp Solutions



- Lumissil LED Drivers
 - IS32LT3961
 - 60V / 2A synchronous buck
 - IS32LT3965
 - 38V / 1.5A synchronous buck
- Family of Buck Drivers (8 pin)
 - IS32LT3951 / 52
 - 38V / 1.5A asynchronous buck
 - IS32LT3953 / 54
 - 38V / 3.0A asynchronous buck

Compact Fog Lamp Demo (Lower EMI, Higher Efficiency)



IS32LT3965:

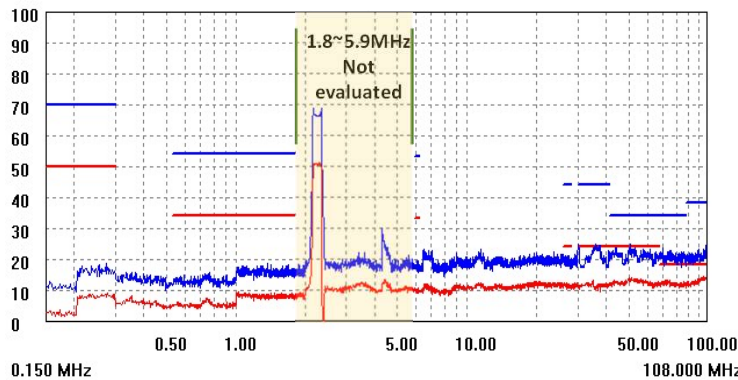
- 3.8–38V input; up to 1.5A continuous LED current
- Compact 3 × 4mm WFCQFN-14 wettable-flank package
- Integrated synchronous MOSFETs reduce component count
- Up to 2.2MHz FCCM operation with spread-spectrum frequency dithering
- Analog and PWM dimming
 - ICTRL pin supports NTC based LED thermal monitoring and current roll-off
 - Supports high/low brightness operation using PWM or analog-current selection

Compact synchronous architecture supports reduced component count, lower power loss and EMI-optimized operation

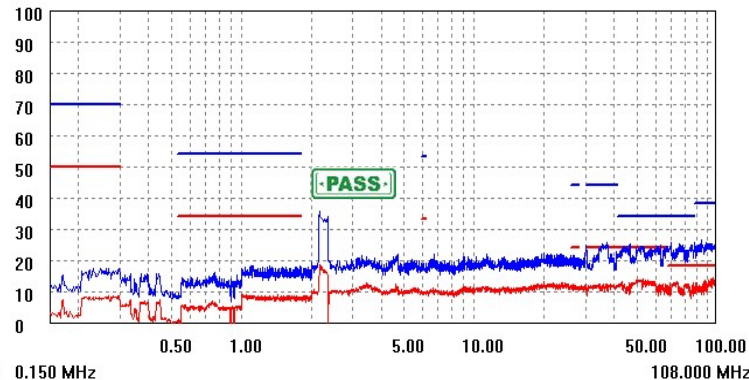
1.5A/38V Sync Buck LED Driver – IS32LT3965/A



Logo Lamp DEMO: CISPR 25 Class 5 Conducted EMI Result

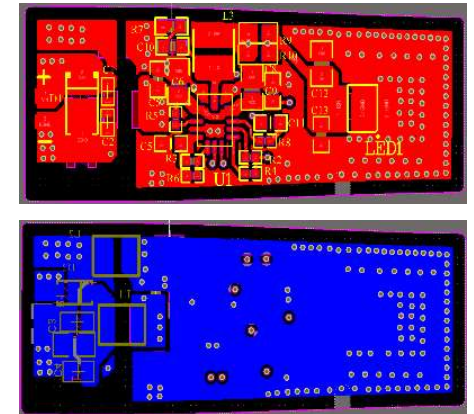


Pass - Recommend Ferrite for Margin



VIN Ferrite Bead (Meets Class 5 Limits with Margin)

Logo Light DEMO



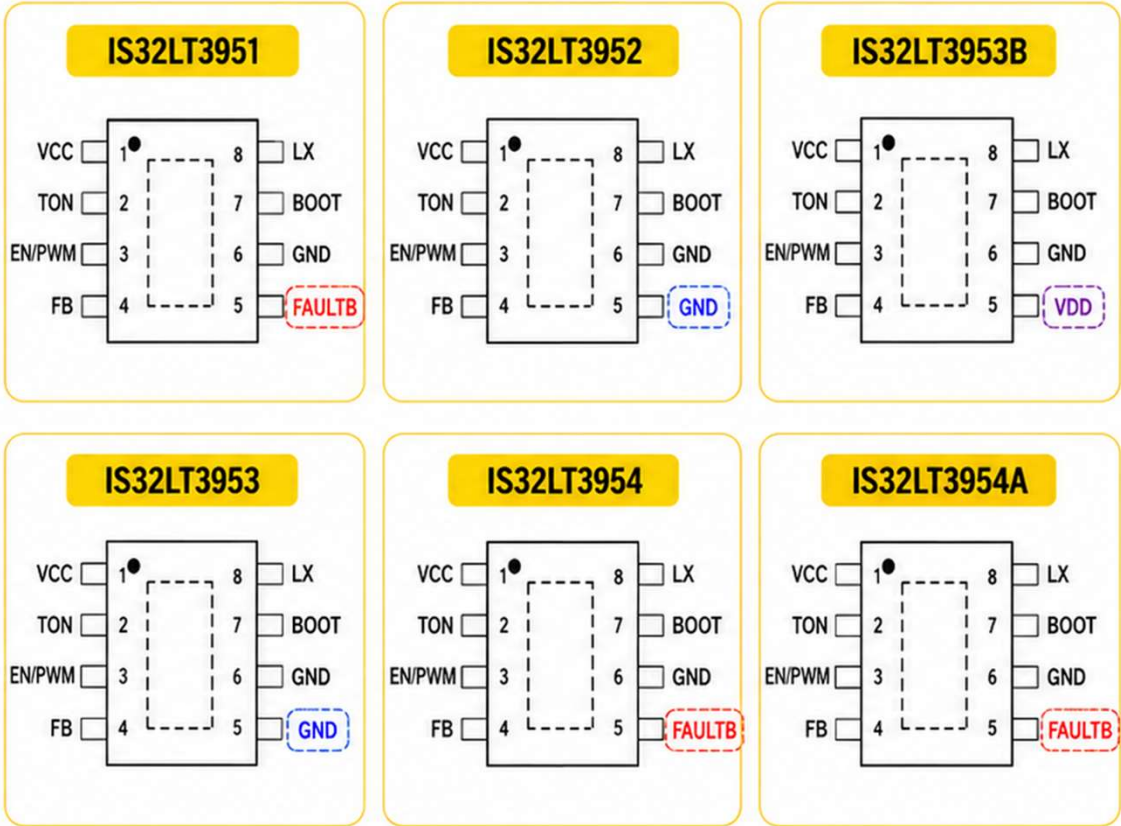
Size: 1.2cm x 3.5cm

Supports small size PCB board designed to pass class-5 EMI:

- 3×4 mm WFCQFN-14 package
- Integrated synchronous MOSFETs eliminate the freewheel Schottky diode
- 2.2MHz operation supports smaller magnetics and capacitors
- Spread spectrum and the optimized VIN filter reduce conducted-emissions peaks

Family of SOP-8-EP Switching Buck LED Drivers

Part Number	Topology	Volt	Out Current	Features
IS32LT3951/2	Fixed Freq Asynch Buck, Integrated FET	4.5V to 38V	1.5A	• Spread Spectrum • 2μA Shutdown • Logic input dimming • Fault output pin (LT3951)
IS32LT3953/B	Fixed Freq Asynch Buck, Integrated FET	4.5V to 38V	3.0A	• Spread Spectrum • 2μA Shutdown • Logic input dimming • 5V LDO voltage output (LT3953B)
IS32LT3954/A	Fixed Freq Asynch Buck, Integrated FET	4.5V to 38V	3.0A	• Spread Spectrum • 2μA Shutdown • Logic input dimming • Fault output pin • Fault output bi-directional (LT3954A)



Select the driver according to required LED current, fault-reporting interface, and auxiliary 5 V supply needs.

IS32LT3365A/B - LED Matrix Manager

Key Features and Functions

LED Control: Integrated shunt FET switches to control individual LEDs or LED groups.

High-Resolution Dimming: PWM dimming to create detailed light patterns.

Adaptive Functionality: Work with LCM, ADAS and cameras.

Communication Interfaces: CAN lite or UART.

Advanced Capabilities

EMI Mitigation: spread spectrum technology and slew rate control on PWM.

Safety Compliance: ISO 26262 ASIL-B.

Thermal Management: FET shunt low on-resistance.

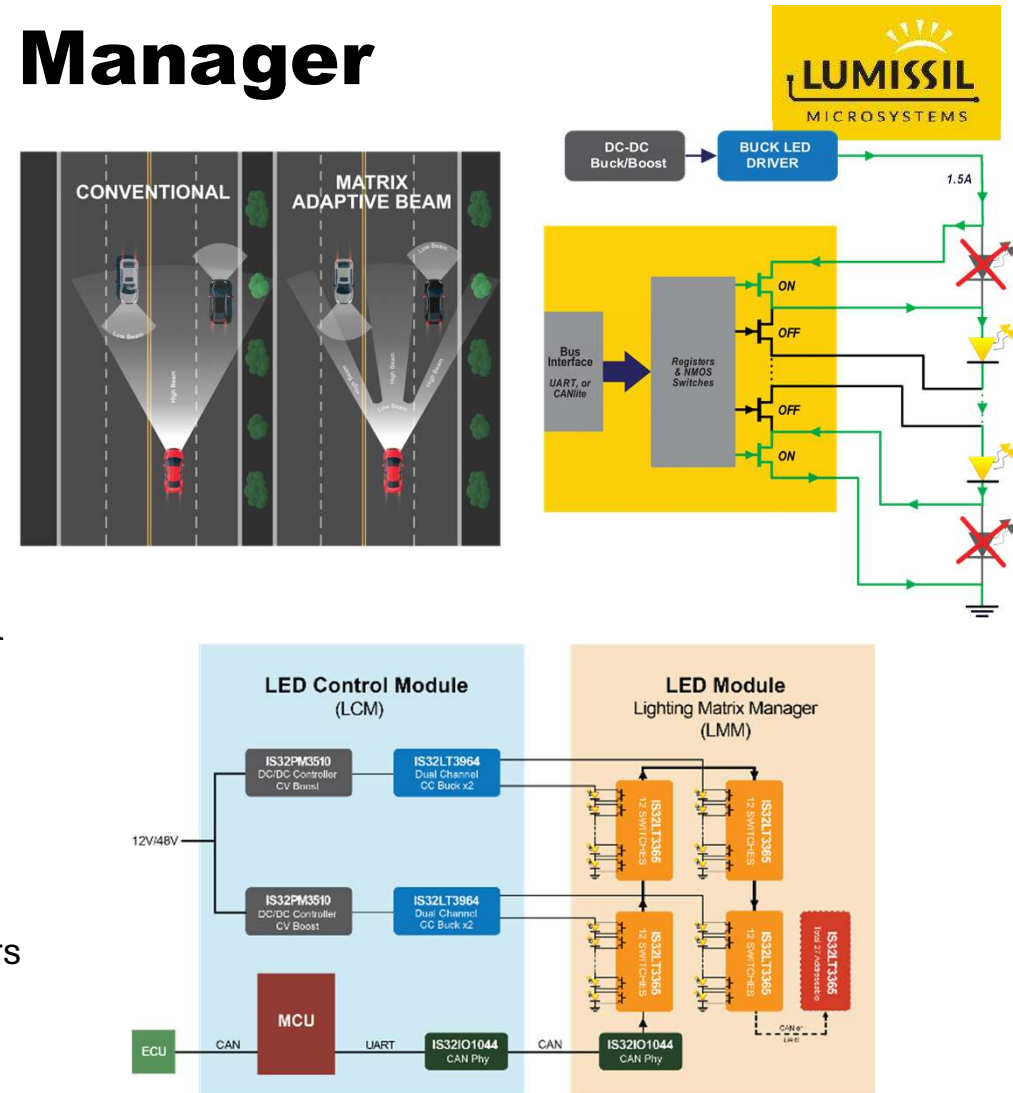
Fault Detection: Open, and short LED detection.

Applications and Benefits

Glare-free high beams that adjust to avoid dazzling other road users

Dynamic light distribution that adapts to road curvature

Selective illumination of obstacles, pedestrians, or animals



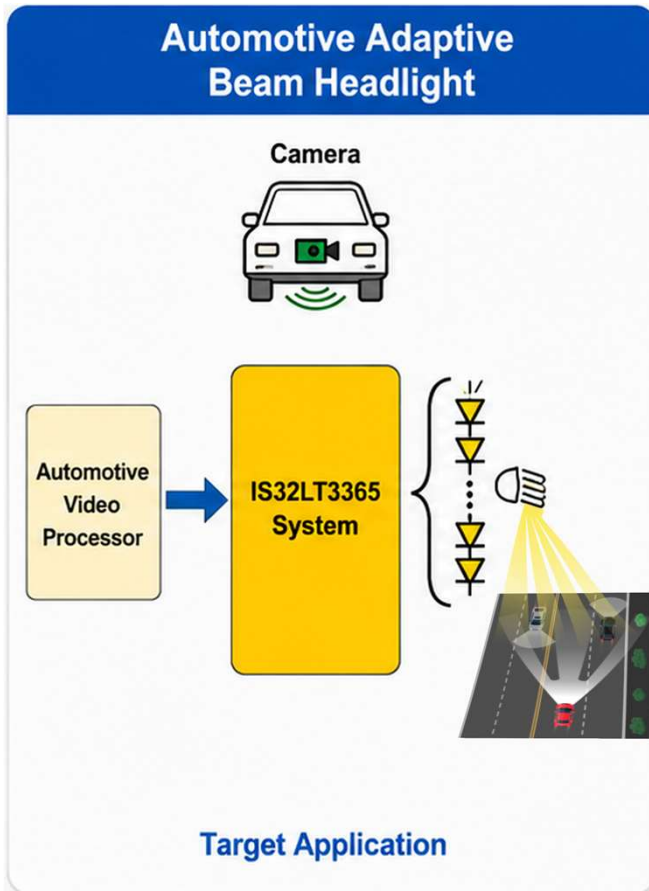


- ## Lumissil ADB Matrix Headlight System

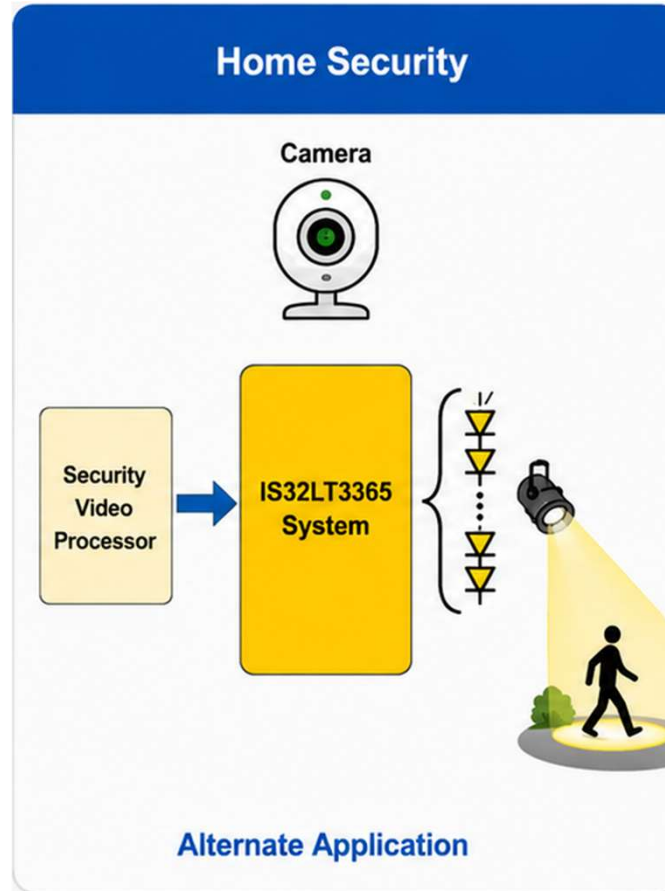


Power Module with 9pcs LT3365(Dimmer)

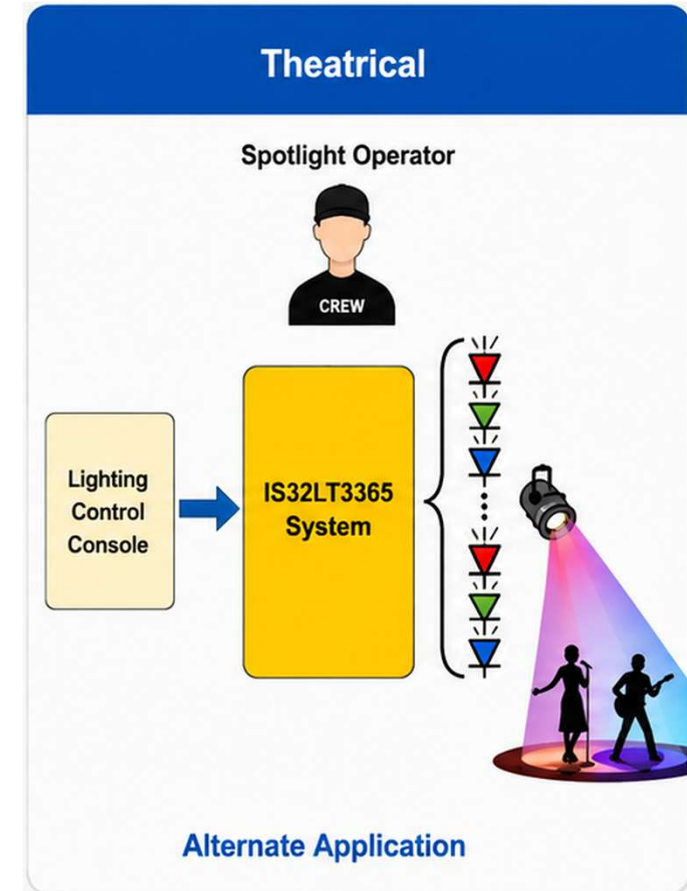
Other Uses for Matrix Manager IS32LT3365



Minimize glare from the cars ahead



Apply light beam on target suspect



Apply RGB light beam on actors

Key Takeaways and Device-Selection Checklist



1. Define the lighting requirement

- Establish the VIN range, LED-string voltage, regulated current, and output power
- Identify the lighting function: fog lamp, high/low beam, DRL, turn, position, or ADB
- Define required brightness levels, fade behavior, PWM performance, and optical stability

2. Select the appropriate power architecture

- Buck: VIN remains above VLED
- Boost: VIN remains below VLED
- Buck-boost or SEPIC: VIN can move above and below VLED
- Choose an integrated-switch driver for compact implementations or an external-MOSFET controller when higher power and greater thermal flexibility are required

3. Design for automotive system requirements

- Minimize critical switching-current loops and optimize filtering, grounding, PCB layout, and thermal spreading
- Use features such as spread spectrum, synchronization, phase management, and interleaving to improve EMI margin
- Confirm analog/PWM dimming, diagnostics, fault response, communication interface, and functional-safety support

4. Match the Lumissil solution to the application

- Compact fog lamps: IS32LT3965, IS32LT3961, and IS32LT3951–IS32LT3954 family
- High- and low-beam headlamps: IS32LT3958B, IS32LT3962, and IS32LT3967A/B
- ADB headlamps: IS32LT3960 CV pre-regulator, IS32LT3964 buck stages, and IS32LT3365 matrix managers

Lumissil has solutions for the complete front-lighting design: compact fog lamps, high-power headlamps, combination lamps, and scalable ADB matrix systems.

Thank You!

Questions or comments?
Our contacts are below.



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Sense the power of light

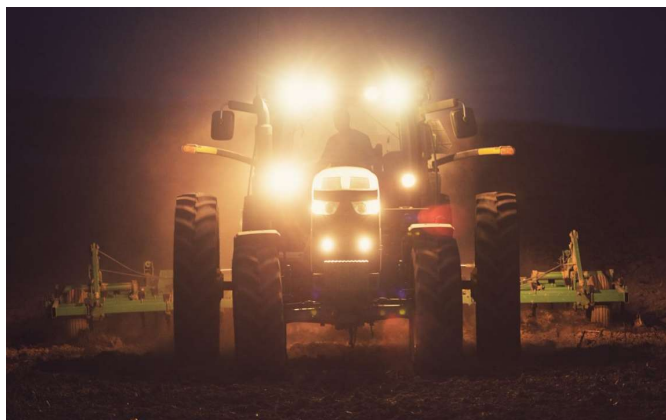
ams OSRAM Automotive Forward Lighting

EMBARCADOS Presentation – ILUMINAÇÃO AUTOMOTIVA DE ALTA EFICIÊNCIA

ams-OSRAM International GmbH

ams OSRAM: Automotive & Transportation

Today's focus: Forward lighting



Forward Lighting Applications

Forward lighting includes Daytime Running Lights; Fog Lamp; High/low beam and Adaptive Driving Beam systems enhancing vehicle safety and visibility.

LED Performance Requirements

Different LED families meet diverse needs for luminous flux, luminance, thermal management, and optical efficiency.

Thermal and System Integration

Thermal resistance and heat dissipation are critical for LED reliability and system integration in automotive lighting.

Lighting as Safety and Styling

Modern exterior lighting is vital for vehicle safety and aesthetics, combining advanced LED technology and design.

Sense the power of light

OSRAM

Product presentation:

OSLON Black Flat

OSLON Black Flat S

OSLON Black Flat X

OSLON® Black Flat

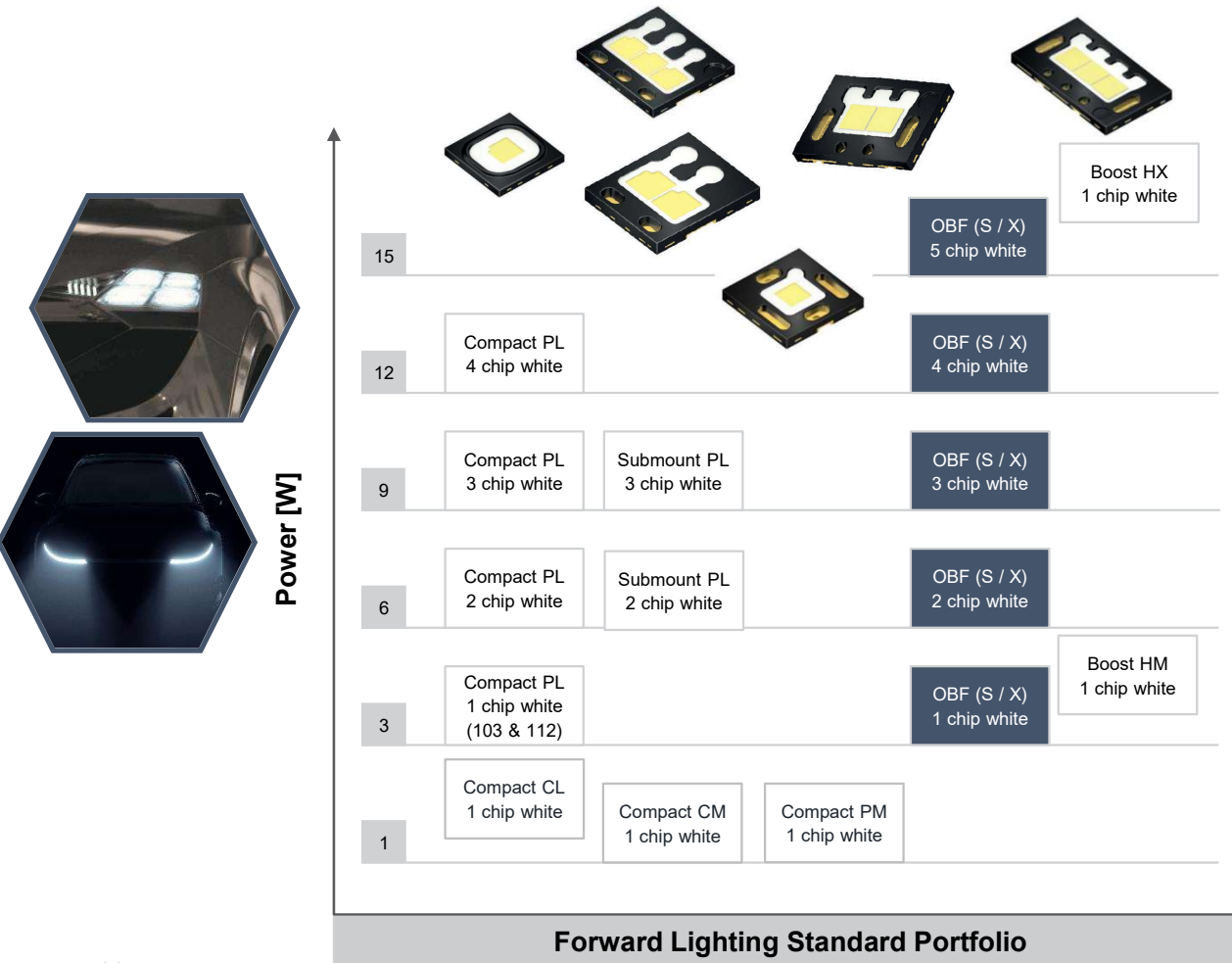
am **OSRAM**



OSLON® Black Flat

Offers high luminous flux and cost-effective solutions for standard forward lighting in vehicles

OSLON® Black Flat Portfolio



Outstanding Features

- **Black epoxy LF-based package**, full portfolio range from 1-5 chip available
- **Low thermal resistance** with chip on copper
- CTE matching PCBs and IMS → **Excellent 2nd board reliability** in combination with **Al-metal core boards**, also given for multichip products
- **High luminous flux performance and high efficiency** levels enables low system cost
- **High package contrast: >>250:1** being beneficial for reflector designs
- **Single addressability of each chip (OBF S, OBF X)**
- **Light output: typ. 460lm per chip @ 1A**
- **AEC-Q102 Qualified, Corrosion Robustness Class: 3B, 8 kV ESD**

OSLON® Black Flat

2. Fields of Application

Design-in focus products:
OBF S gen3

1-chip



OBF
LUW HWQP



OBF S gen3
KW HHL533.TK



OBF X
KW HHL631.TK

2-chip



OBF
KW H2L531.TE



OBF S gen3
KW2 HIL533.TK



OBF X
KW2 HML631.TK

3-chip



OBF
KW H3L531.TE



OBF S gen3
KW3 HJL533.TK



OBF X
KW3 HNL631.TK

4-chip



OBF
KW H4L531.TE



OBF S gen3
KW4 HKL533.TK



OBF X
KW4 HPL631.TK

5-chip

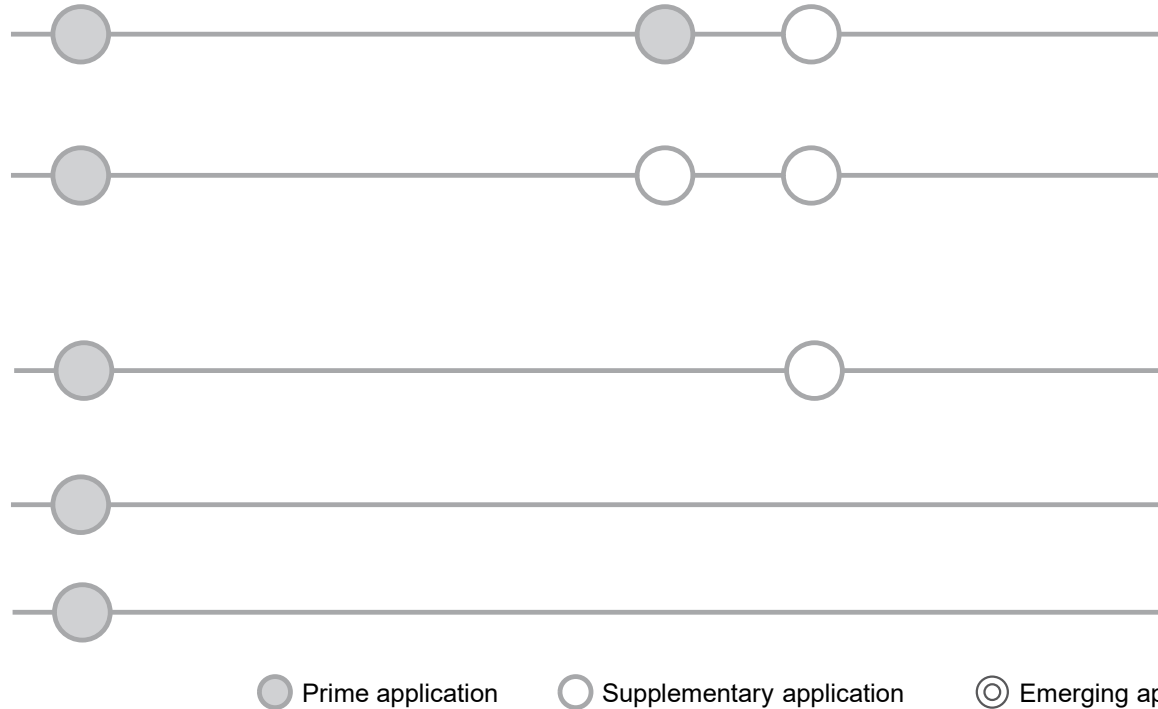


OBF
KW H5L531.TE
25



OBF X
KW5 HQL631.TK

Halogen Replacement HB/LB	Matrix Beam ADB-Systems	Slim Head-lamp Designs	High Resolution	DRL	Front Fog	Front Turn Indicator	Special Lighting



Sensing is life

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Product Presentation

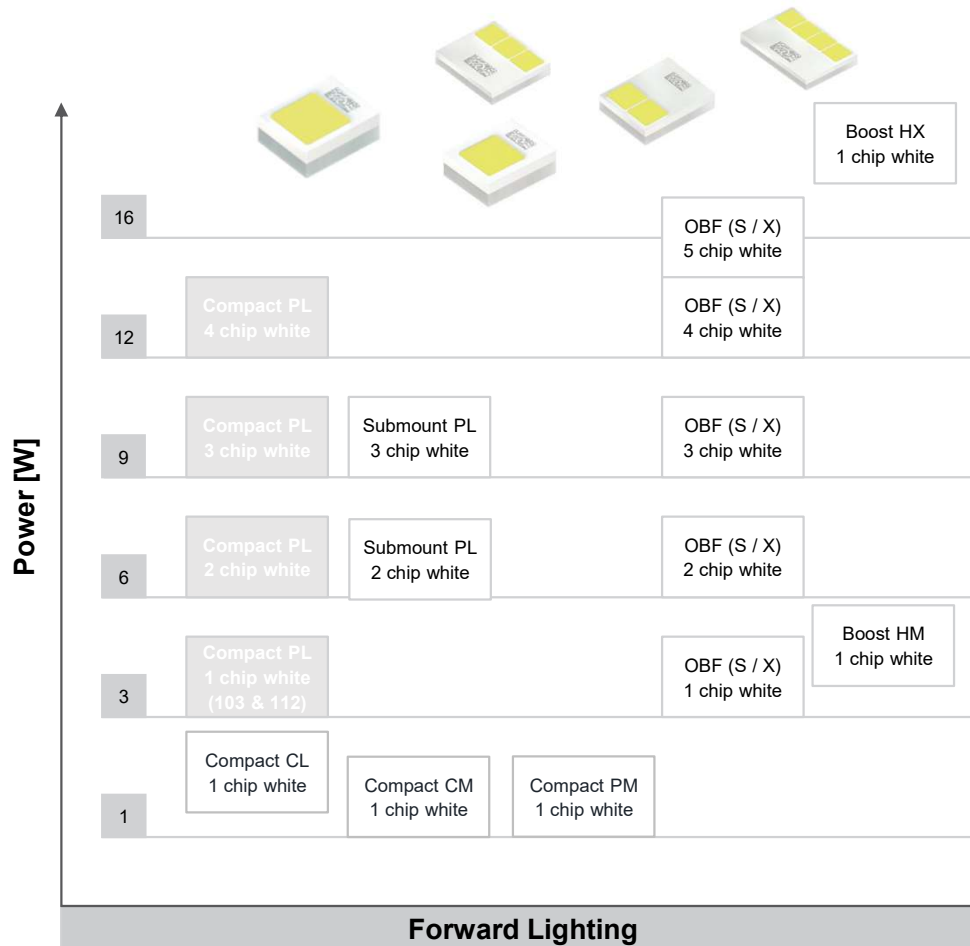
OSLON® Compact PL (white)

am **OSRAM**



OSLON® Compact PL (white)

Delivers high luminance in a compact ceramic package, ideal for matrix and adaptive driving beam systems.



OSLON® Compact PL Portfolio

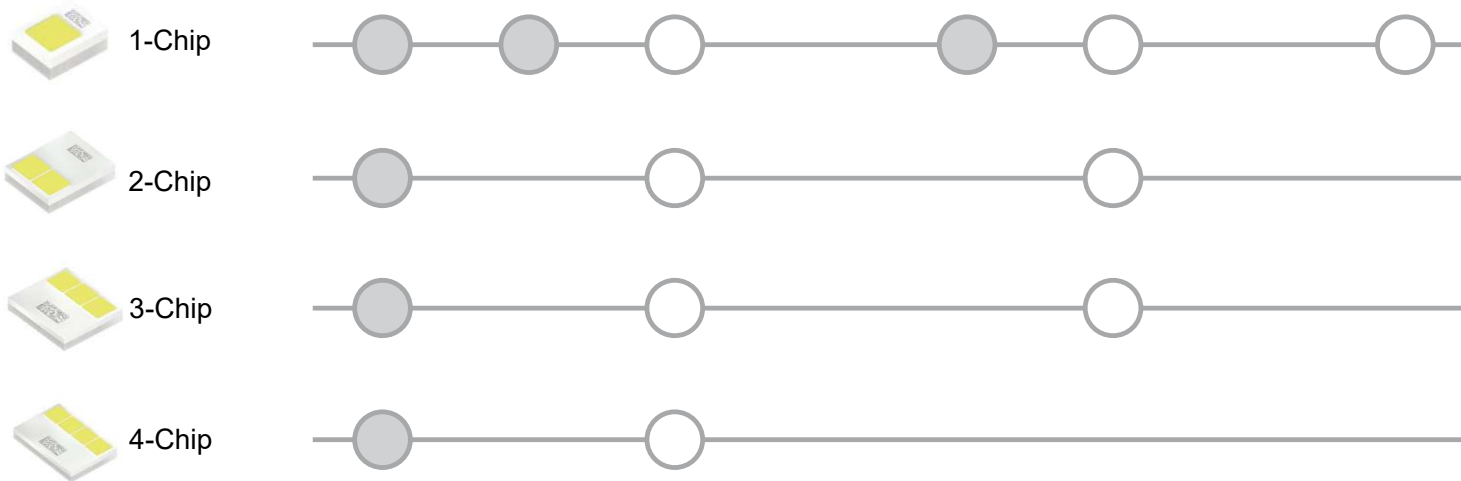
Outstanding Features

- **White ceramic-based package** with 1-4 chip configuration
- **Superior thermal management** due to electrical isolated pad (3-pad design available)
- **Solder stability on AL-boards** due to 2-pad design availability
- **High luminous flux in combination with high luminance** supporting the reduction of headlamp size
- **High portfolio flexibility** by offering two chip size variants available (1150µm + 1030µm)
- **Small package outline** to be used for ADB functions
- **Small z-tolerance (+/-35µm)** to allow proximity of LEA and optical system
- **Light output:** typ. 450lm per chip @ 1A
- **AEC-Q102 Qualified**, Corrosion Robustness Class: 3B, 8 kV ESD
- **Application:** SMT package for High Power FWL applications, especially designed for ADB function, DRL with light guides and headlamp modules

OSLON® Compact PL (white)

Fields of Application

Halogen Replacement HB/LB	Matrix Beam ADB-Systems	Slim Head-lamp Designs	High Resolution	DRL	Front Fog	Front Turn Indicator	Special Lighting



Prime application
 Supplementary application
 Emerging application

Sensing is life

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Product Presentation

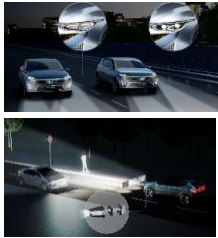
OSLON® Compact RM

am **OSRAM**



Portfolio Overview

Forward Lighting



OSOLON™ Compact RM

- Enlarge luminance driven portfolio by specific rectangular LEA product for trend to slim HL designs
- 0.5mm² 1-chip Rectangular product based on ceramic package concept of OSOLON Compact family
- New aspect ratio in 0.5mm² LEA range:
→ 1:1.5 via 0.9mm x 0.6mm LEA size dimension

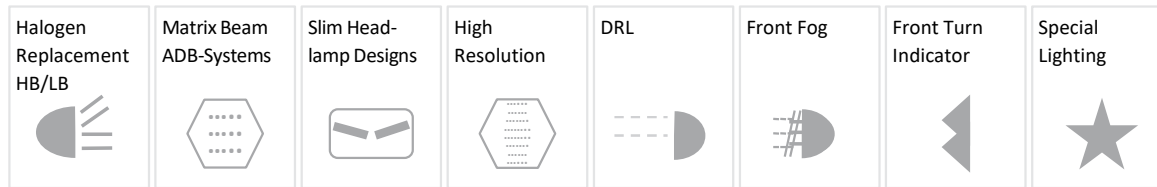
Outstanding Features

- Ceramic based OSOLON Compact package in 1612 footprint with 2-pad design
- High aspect ratio of 1:1.5 via smaller vertical light emitting area dimension enabling improved optic efficacy for slim Headlamp designs
- Homogeneous LEA* surface and high efficacy
- High solder stability on AL-boards due to 2-pad design
- Small package outline to be used for ADB functions

* LEA = Light Emitting Area

OSLON™ Compact RM

Fields of Application



KW CVLDM1.TK



☒ Prime application
 ☐ Supplementary application
 ☐ Emerging application

Slim HL designs

Classification within HL optic solution acc. optic heights



- Slim HL designs enabling differentiation of car styling via diversified HL design features → design identity via long and thin line and slim signature
- Miniaturization of HL module size for LB/ HB as a general trend

Small optical systems demanding dedicated LED solutions

Sensing is life

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Product Presentation

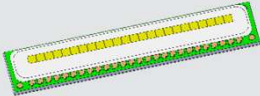
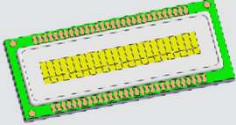
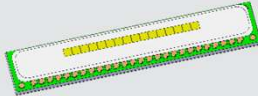


OSLON® PX



OSLON® PX

Emphasizes thermal performance through advanced packaging and direct heat extraction methods.

Color: White			
	KEW M SFS P1 T01 OSLON PX24	KEW M TGT S1 T01 OSLON PX48R	KEW M SFP Q1 T01 OSLON PX16
			
LEA size	24 x 1.03mm ²	24x 625x625 µm ² 24x 625x1695 µm ²	16 x 1.03mm ²
Conversion technology	UX3 chip + PIXOG conversion layer glued on ceramic submount, glued on MCB		

Chip Footprint and Size Counter

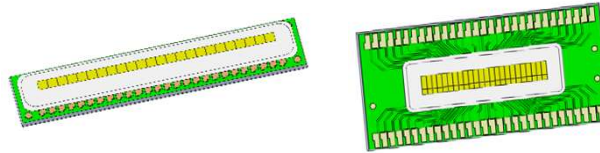
KEW M **x x x** **P1** **T** **x x**

P = PX24
Q = PX16
S = PX48

OSLON® PX

Values

KEW M x x x P1 T x x



Features

- Top Contact multipixel array
- narrow gap between LEDs (50µm typ.)
- all pixels individually addressable
- low R_{TH} for high systems efficiency
- Tape & Reel packaging

Customer Benefits/USPs

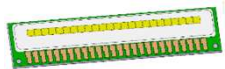
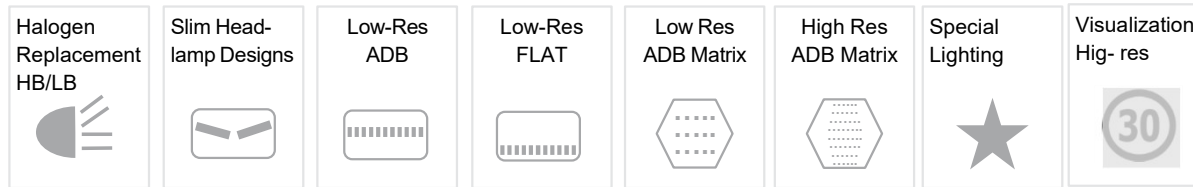
- Same chip as Compact PL, with comparable Optical/Thermal behavior
- Generate ADB / FLAT beam pattern with direct projection optics - no need of primary lenses
- Compatibility with both 12 and 16 channels LMM (LED Matrix Manager)
- Flexibility on product customization (pixel footprint: quantity, larger gaps, combination of different sizes, etc.)

Decision Criteria

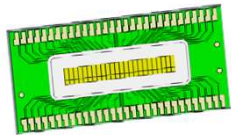
- Suitable with more compact headlamp design
- Cost reduction when swapping from modules to light source
- Bundle with High Resolution light sources to increase the brightness and limit the costs at system level

OSLON® PX

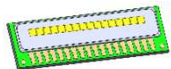
Fields of Application



KEW M SFS P1 T01



KEW M TGT S1 T01

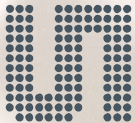


KEW M SFP Q1 T01



☒ Prime application
 ☐ Supplementary application
 ☐ Emerging application

Sensing is life

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