FTF 2016
TECHNOLOGY FORUM

LED DRIVER SOLUTIONS FOR ADVANCED LIGHTING ADAS

FTF-AUT-N1831

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FTF-AUT-N1831
May 17, 2016

Why Automotive LED Lighting?

New Launching Market for Automotive

“Car Jewelry”

Driver Assistance (ADB)

Efficiency

CO^2 -1.6 g/mile

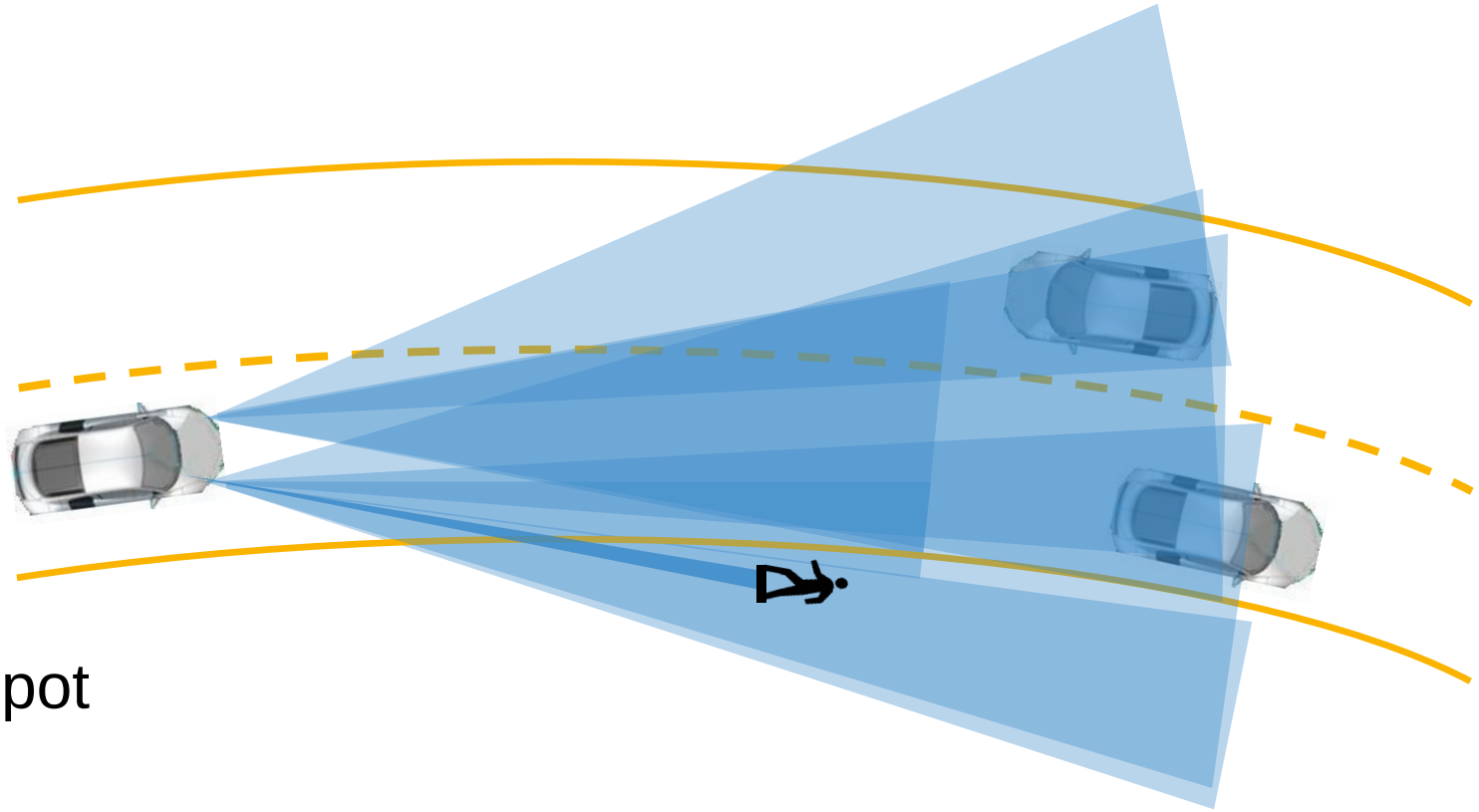
Range +6 miles

Automotive Lighting Applications

Advanced Exterior Lighting Supports ADAS

ADAS Functions:

- Dynamic front lighting
- Glare-free high beam
- Pedestrian marker
- Lane marker
- HMI in autonomous drive
- Dynamic rear lighting
- Laser and high current LED spot
- Dynamic (sweeping)
  Turn indicator



Automotive LED Lighting

Driven by Design, Efficiency and Innovation

Growth Drivers

Styling

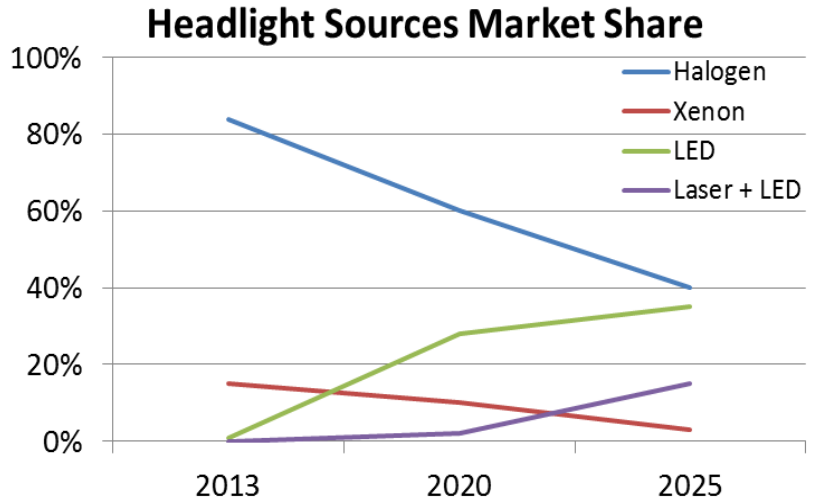
Improved energy efficiency

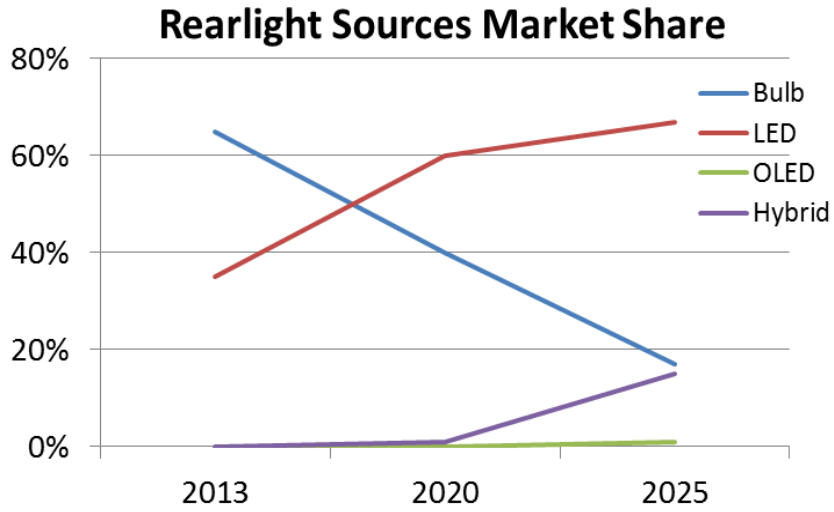
Energy Consumption*	DRL – LED	DRL – Bulb
Energy Consumption	2 x 11.4 W	45.8 W
CO2 – emission	**0.58g** CO2/km	**1.2g** CO2/km

50% reduction in CO_2 emissions by using LEDs*

Advanced lighting options (ADAS-ADB)

* Source: University Of Michigan Transportation Res. Inst.





Source: Driving Vision News 2014

Automotive LED Lighting

Single Function Applications Driven by Low Cost

- Daytime running light, fog, signaling or basic headlights
  - Maturing functionality but still growing application. DRL, RCL –driven by style

- Challenges:
  - High/low beam needs to achieve cost breakthrough to increase penetration rate
  - Requirements are wide – light guide to LED string
  - Driver electronics: key is low cost solution, wide operating range & core functionality

1 – 5 W

5 – 10 W

Few LEDs driven at high current
Low Vf, high I_{LED}

Many LEDs driven at low current
High Vf, low I_{LED}

Automotive LED Lighting

Differentiated Headlights Demand Flexibility & Scalability

- Headlights and advanced tail lights
  - Emerging application, exploiting design freedom → many individual designs
- Challenges:
  - Multiple projects with high development costs and long throughput times
  - Low number of channels, with increased level of functionality & diagnostics
  - Driver electronics: Key is a single flexible & scalable system solution

3 – 5 Channels

Dimming, thermal management, LED control & diagnostics, configurability

Common scalable PCB design for re-use on multiple projects

Flexible architecture for different LED configurations

10 – 50 W LED Power

Automotive LED Lighting

Advanced Front Lighting Systems Pushing the Boundary

- Advanced dynamic beam, dynamic turn indicator, matrix lighting
  - Emerging applications – part of Advanced Driver Assistance Systems
- Challenges:
  - High number of channels and increased signal processing & functionality
  - Increased focus on network interface, thermal management and system efficiency
  - Driver electronics: Key is an efficient flexible system with advanced functionality

3 – 5 Channels

Dynamic switching of individual LEDs or segment LED control.

Large real time information exchange with body control module

High system efficiency

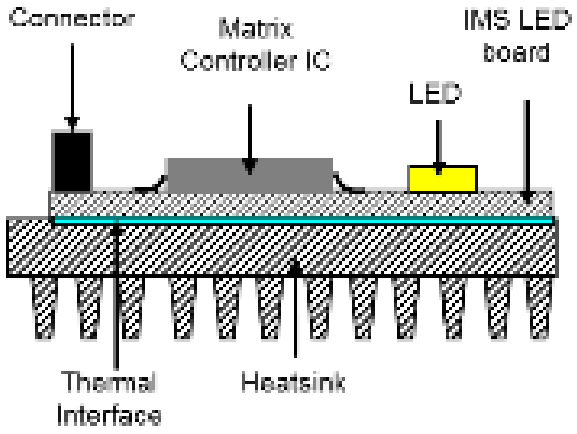
50 – 120+ W LED Power

Emerging ADAS Function – Advance Drive Beam

(Matrix Pixel Light) Boosted by Driver Assistance

Safety gain through glare-free high beam

- Increase of 30 m detection distance, +1.3s reaction time (80 km/h)
- Also used in wiping blinker and premium low beam
- In combination with Laser Booster and Laser Spotlight for seamless driver assistance
- Penetration with ADAS (camera systems) with low incremental cost
- Option for all German cars from 2018 (expect 1/3 fit rate)

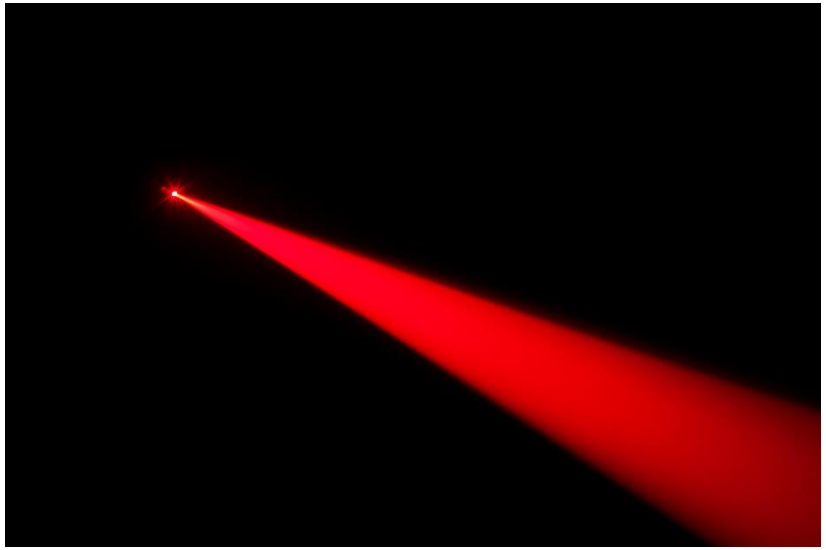


Automotive LED Lighting

Laser Front Lighting Systems – Emerging Technology

- Advanced Laser Front lighting
  - Emerging Technology – Application with long narrow beam for distance visibility

- Challenges:
  - Laser Diodes are not like LEDs - Lasing is based on ‘stimulated emission’
  - High Ripple/transients/current spikes can kill the Laser Diode instantly
  - Driver electronics: Key is low noise drivers with advanced diagnostics



Highly efficient lighting system

Suited to produce a narrow beam for motorway light or spot beam.

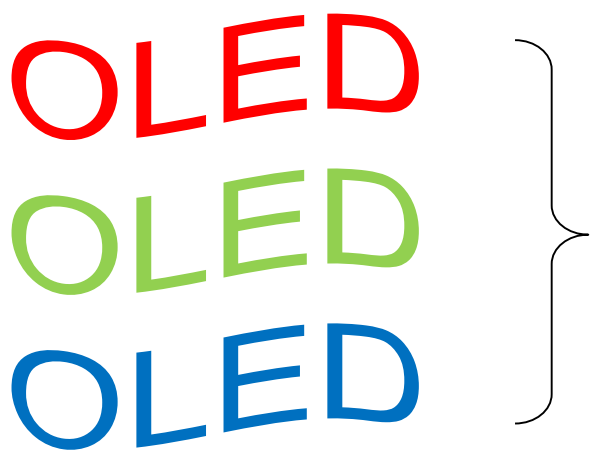
Highly regulated drivers needed for optimum performance

Diagnostics required to monitor light levels and Laser temperature

Automotive LED Lighting

OLED – Emerging Technology

- Signaling functions, turn indicator, tail light
  - Emerging application, exploiting design freedom → many individual designs
- Challenges:
  - Styling driven design, system needs flexibility to adapt to different style
  - More intelligence in the signalling functions require more control of the light output
  - Driver electronics: Key is an efficient flexible system with advanced functionality



Dimming, thermal management, LED control & diagnostics, configurability

Common scalable PCB design for re-use on multiple projects

Flexible architecture for different LED configurations

Automotive Lighting Light Sources

New Light Sources for Exterior Lighting

Light sources of automotive exterior lighting

Solid-state

Laser

OLED

LED

Non-solid-state

HID & Halogen

Bulbs

Future

Now

History

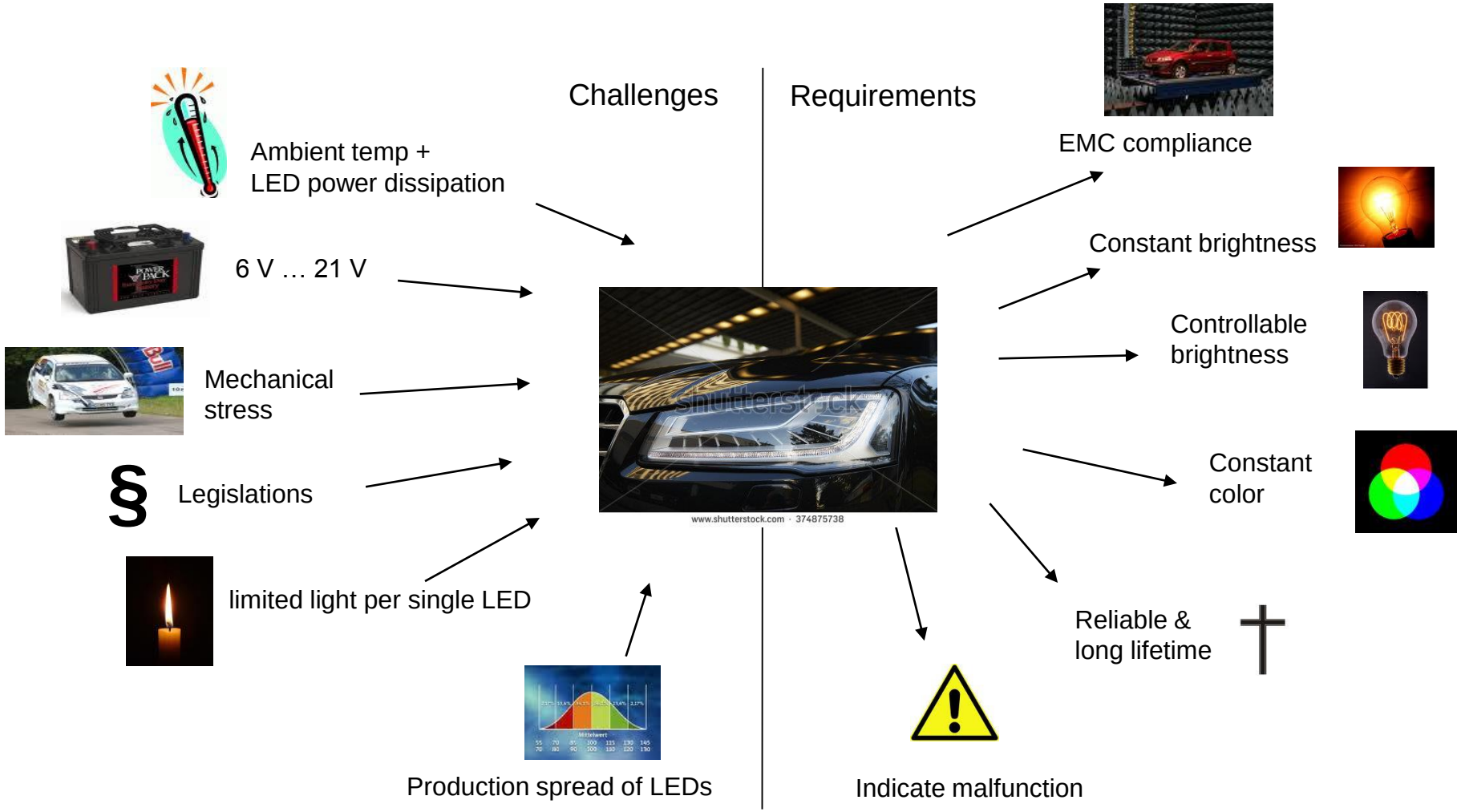
Applications of Solid State Light Sources

SSL Light Sources Have Become Capable of Supporting All Automotive Lighting Applications

- Traditional applications
  - Low beam, high beam
  - Daytime running lights
  - Fog light
  - Position or park light
  - Turn indicator
  - Cornering light
  - Reversing light
- Advanced applications
  - Matrix beam
  - Adaptive driving beam (ADB)
  - Advanced front lighting (AFL)
  - Autonomous driving
  - …

Requirements for Automotive SSL Application

Driver & Controller Circuits are Necessary



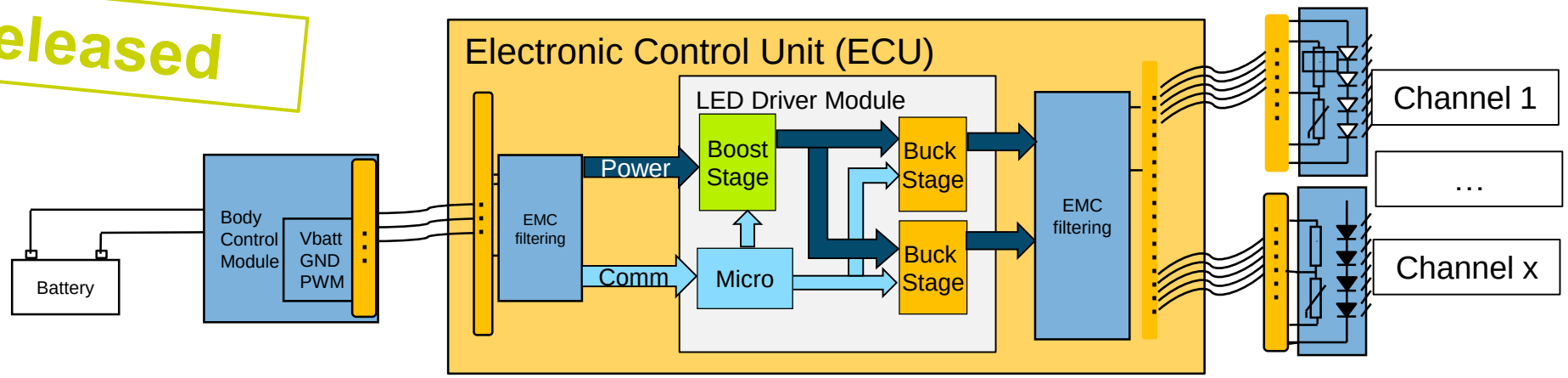
NXP Multi-channel LED Driver Circuit Architecture

PL DES Focuses on Multi-Channel LED Driver Circuit

- Multi-channel circuit for multi-function applications
- Emerging market requires platform-solutions with minimum system cost
- Multi-channel boost-buck LED driver System

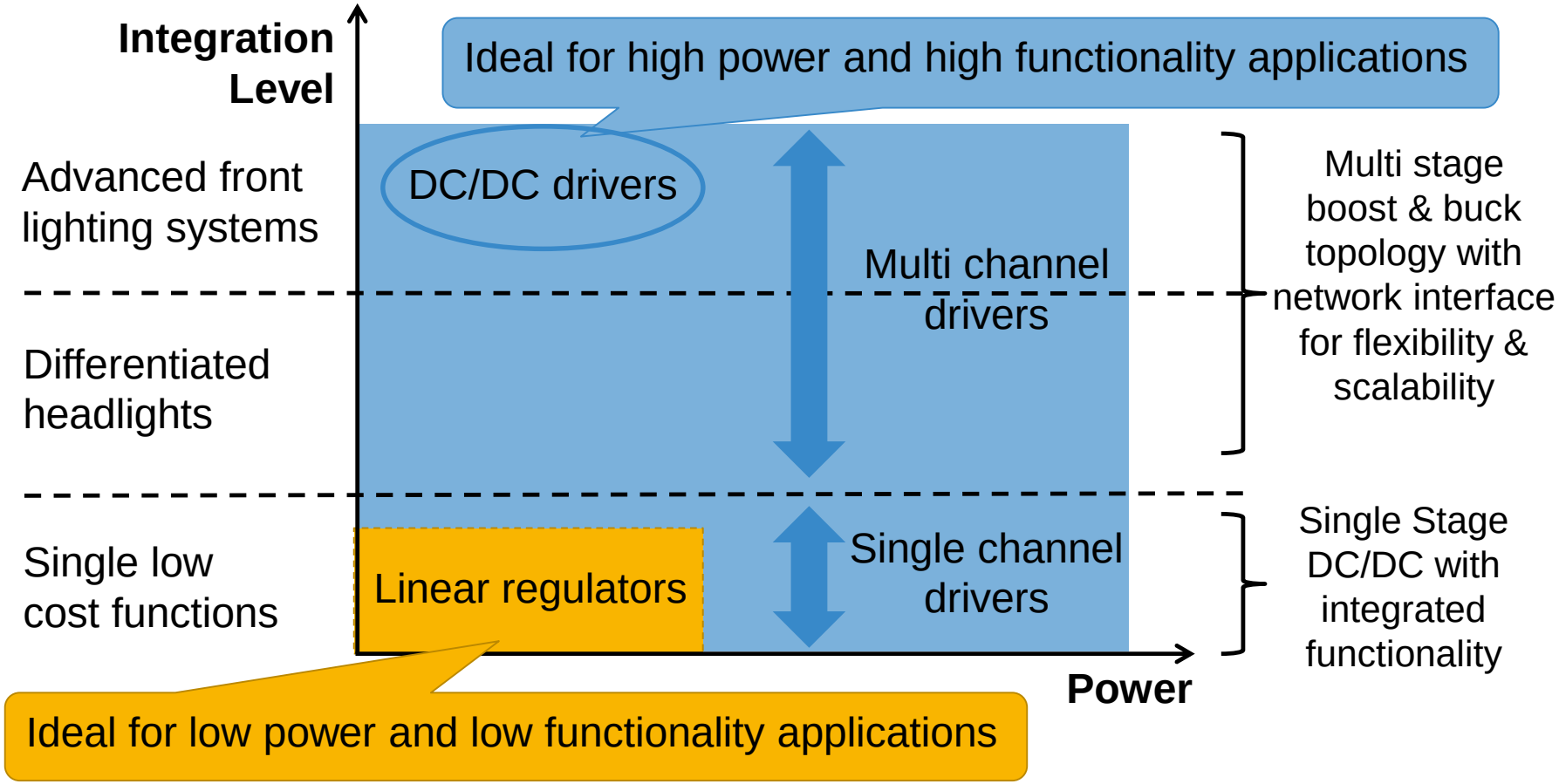
6-channel headlamp

Released



LED Driver Options & Suitability

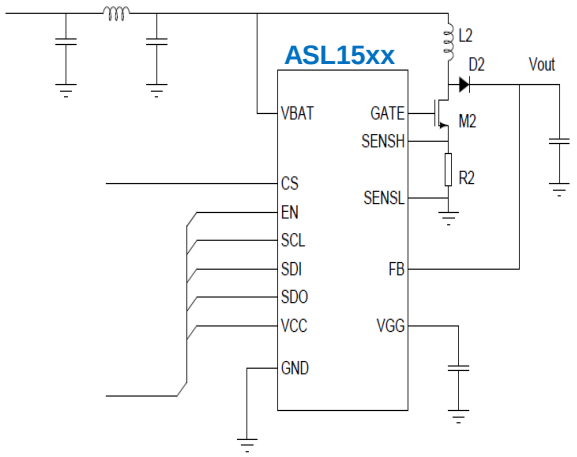
Suitability of Linear Vs. DC/DC Topology



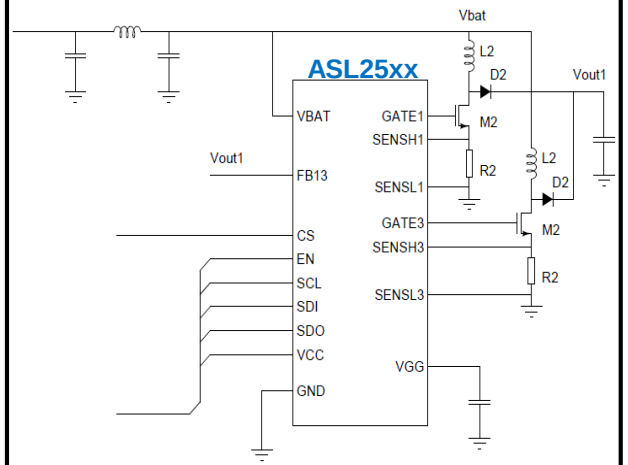
ASL15xx/25xx/45xx – Boost Converter

Multiphase Boost Converter IC with Integrated SPI

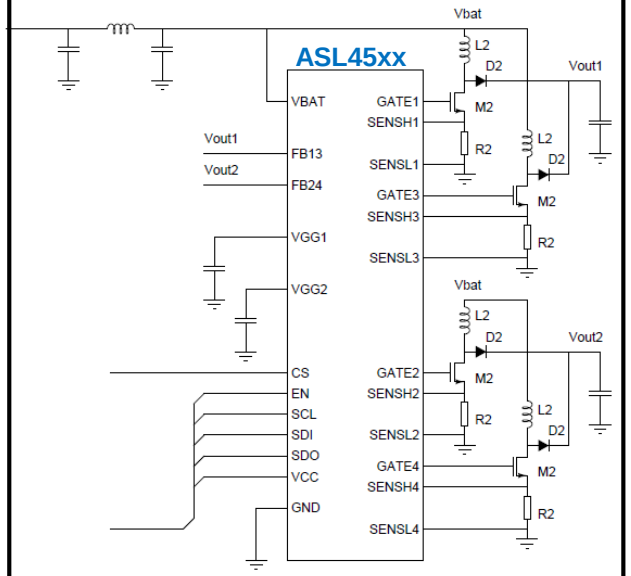
ASL15xx is a 1 phase Boost converter IC.



ASL25xx is a 2 phase Boost converter IC.



ASL45xx is a 4 phase Boost converter IC.

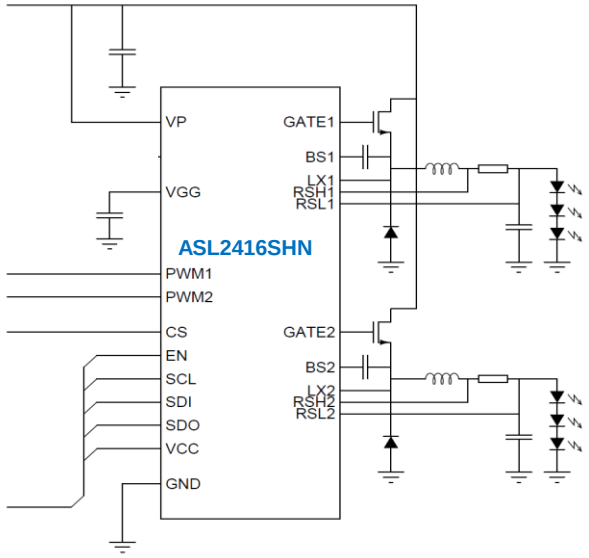


- Highly integrated boost converter
- 2 independent output voltages for 2-phase and 4-phase versions
- Output power per phase is determined by the external components

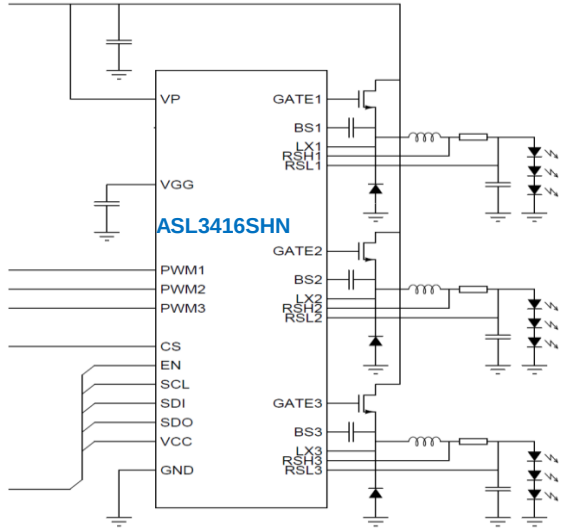
ASL2416SHN/3416SHN – Buck Converter

Multi-Channel Buck Mode LED Drivers With Integrated SPI

ASL2416SHN is a 2 channel buck mode LED driver IC.



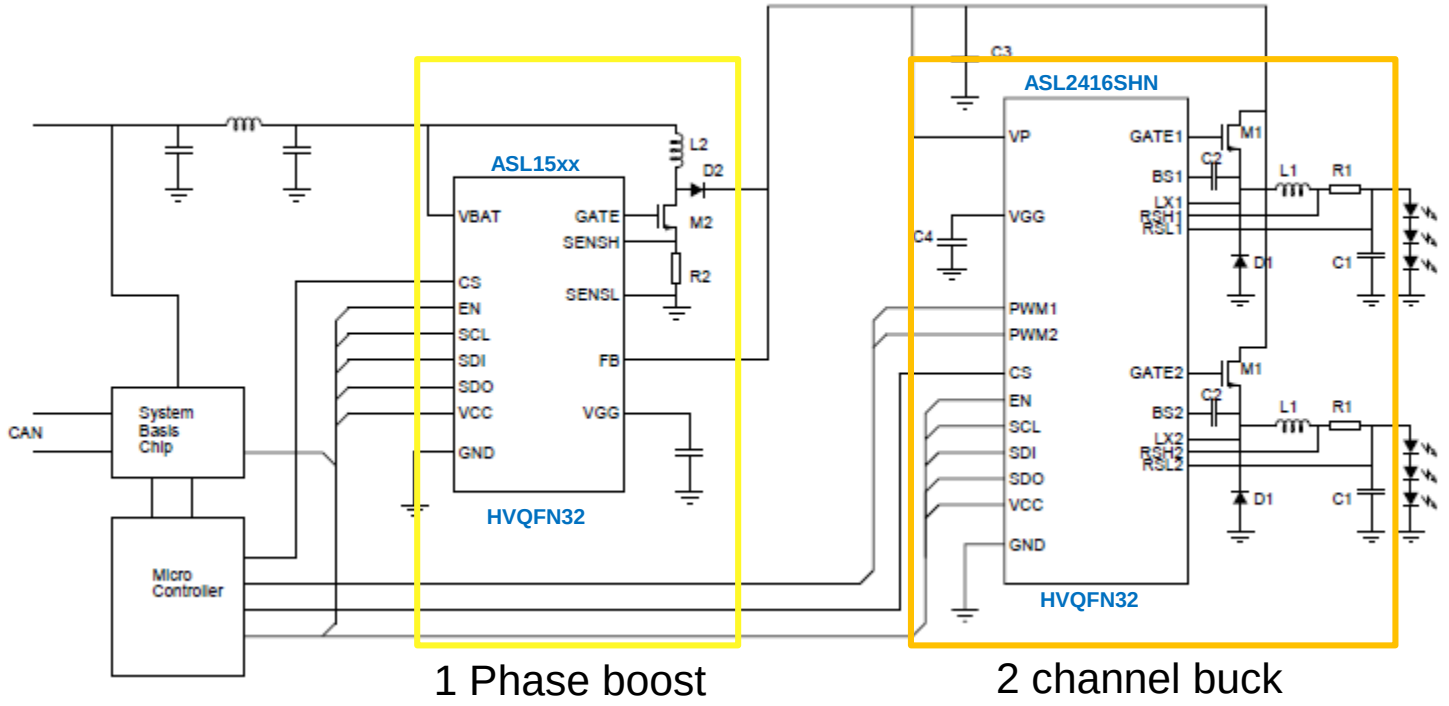
ASL3416SHN is a 3 channel buck mode LED driver IC.



- A highly integrated multi channel programmable hysteretic constant current buck converter
- Programmable LED current from 120 mA to larger than 1.5 A with 5% accuracy
- PWM dimming from 0 to 100%, 0.1% resolution
- LED open and short-to-ground fault detection

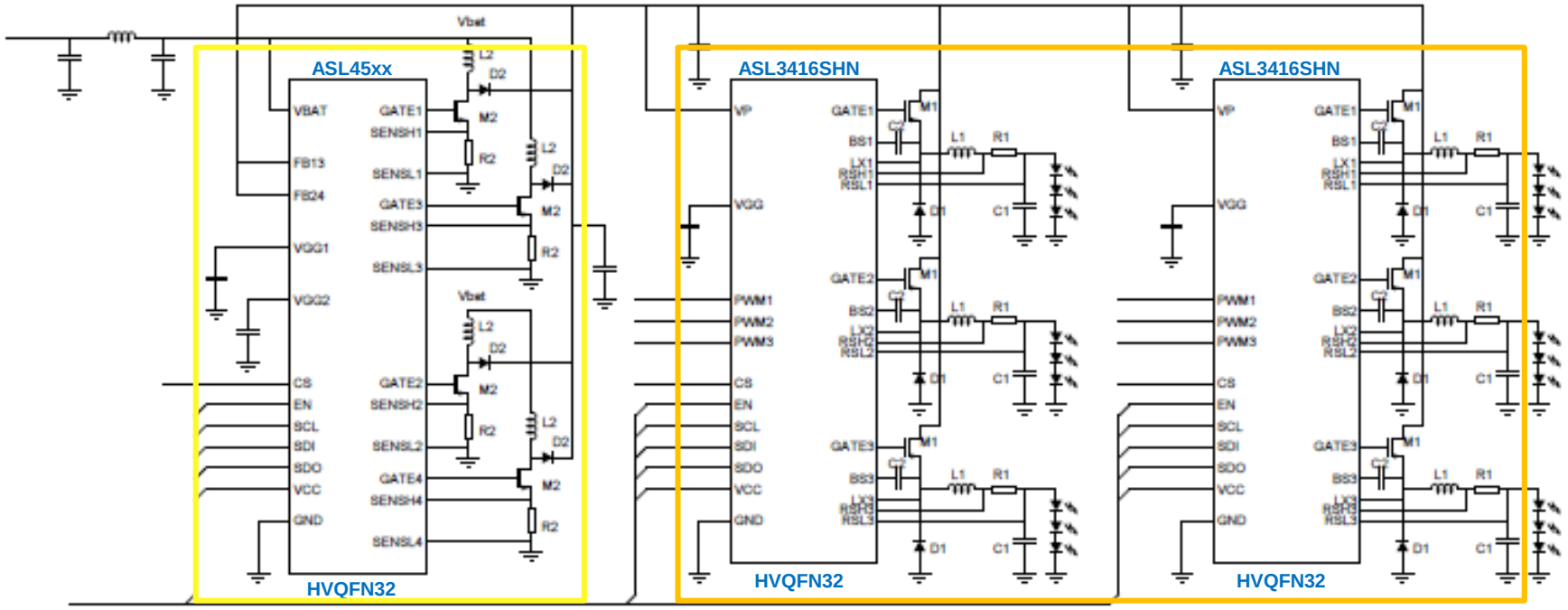
NXP’s Scalable Multi-channel Architecture

Typical Schematic for 2 Channel System



NXP’s Scalable Multi-channel Architecture

Easily Scalable to 6 Channel System

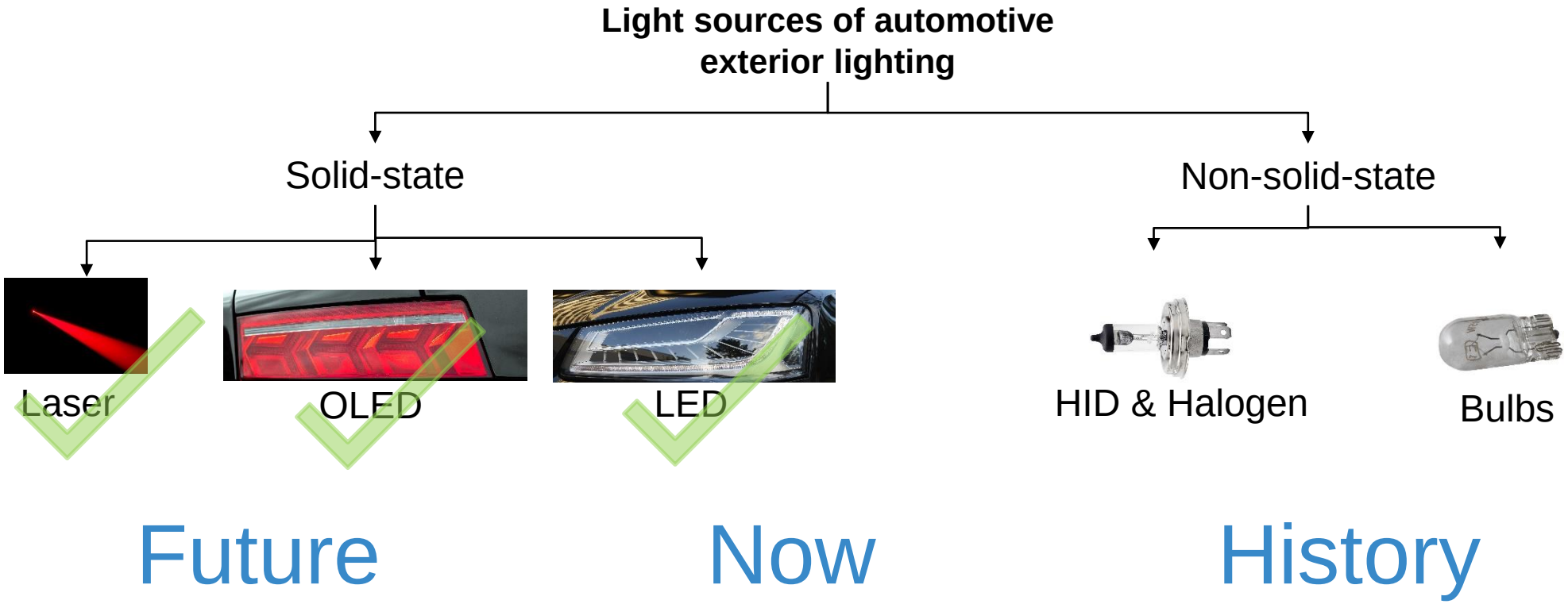


4 Phase boost

2 x 3 channel buck

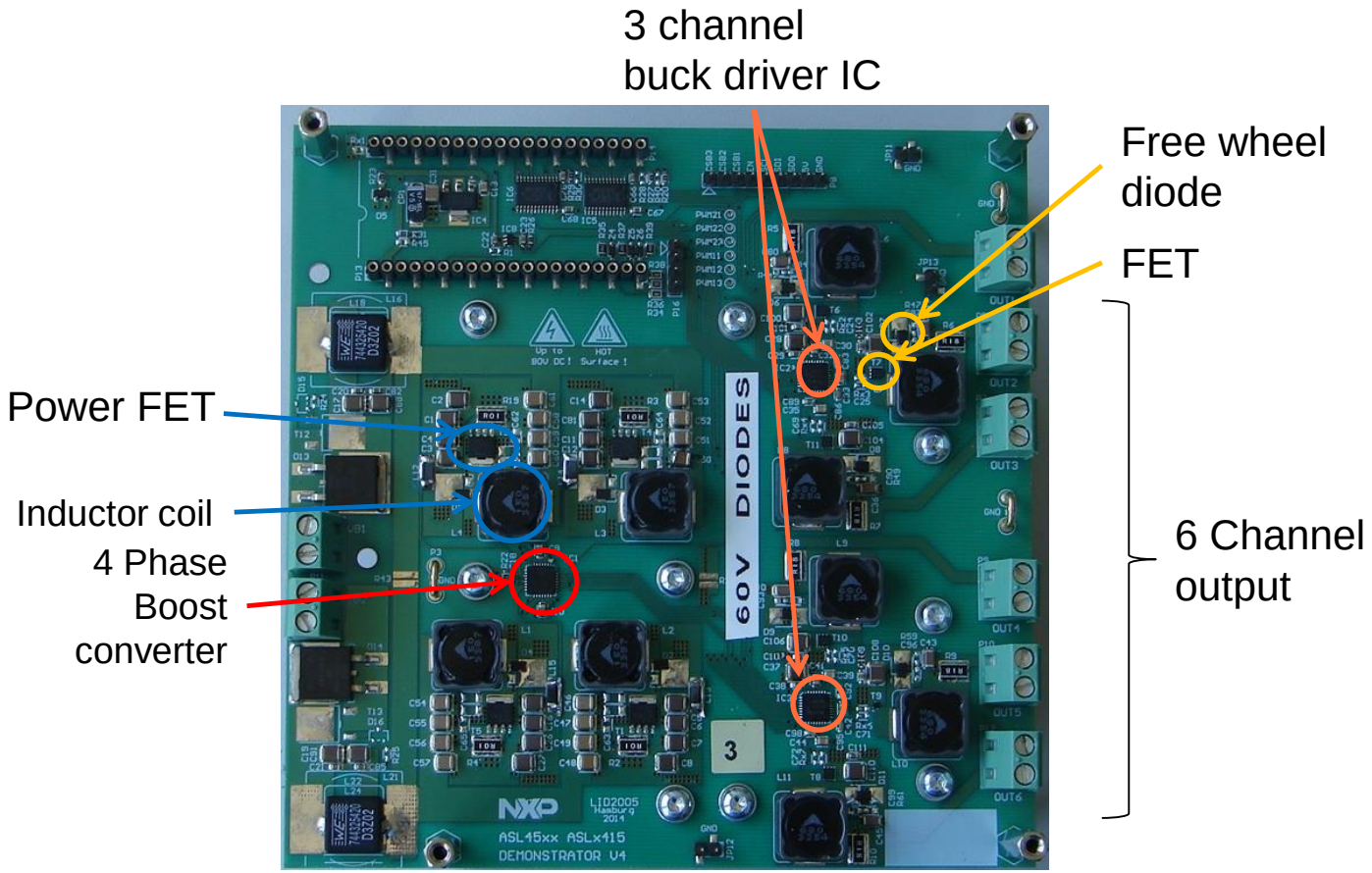
Automotive Lighting Light Sources

New Light Sources for Exterior Lighting



NXP Multi-Channel Driver Evaluation Board

Complete System Solution From NXP



Questions

- See you at our demo

- Adjacent speech
- FTF-INS-N1830
- Thursday - May 19 from 9:00 AM - 10:00 AM
- Lone Star Ballroom F - Level 3 (122)

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