NXP system solutions for intelligent automotive exterior lighting

NXP provides a new level of flexibility and scalability

NXP offers a broad portfolio of lighting drivers and controllers to address the increasing demands of advanced automotive lighting applications. This solution provides a cost-effective, flexible and scalable architecture allowing platform designs to be quickly developed.

Overview

LED technology has evolved to enable advanced automotive lighting applications by providing small form factors, higher power levels, longer lifetime and lower power consumption. Intelligent LED applications such as Glare Free High Beam, Adaptive Driving Beam, Dynamic Signaling and Rear Lighting, make driving safer.

These LED lighting systems require efficient, robust, flexible & scalable cost effective electronics to enable the full benefits of LEDs in automotive applications.

The Matrix LED Controller (MLC) controls each individual LED, bypassing the current, thereby enabling dynamic control and functionality of the light. NXPs highly integrated LED Drivers and Controllers are specifically designed to maximize the performance and efficiency of lighting electronics. The ICs combine our deep understanding of LED performance with our world-class automotive A-BCD mixed-signal high voltage technology.

NXP featured products

- ASLx500/7 Boost converters
- ASLx416/7 Buck drivers
- ASL5xxx Matrix LED controller
- ASL61xx Matrix LED controller
- UJA116x System Basis Chip
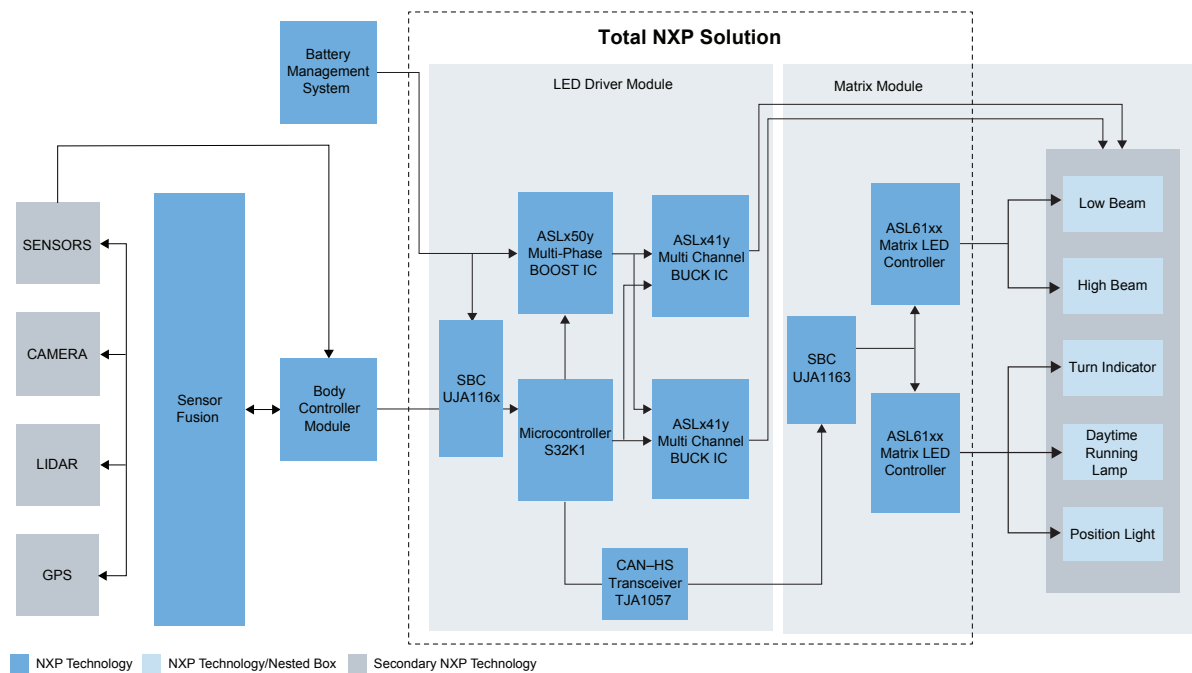- TJA1057 CAN Transceiver
- S32K Microcontroller

Target applications

- Automotive advanced exterior lighting
- Matrix/pixel high/low beam (ADB/GFHB)
- Dynamic signaling (Front/Rear)
- Dynamic daytime running lights
- Welcoming scenarios

Matrix LED controllers family

ASL5xxx Matrix LED controller	ASL61xx Matrix LED controller
12 switches, 4 floating blocks of 3 switches each	16 switches, 4 floating blocks of 4 switches (individual or segments) • Increase switch voltage capability to 20 V
Max current up to 0.8 A or 1.5 A per switch (in parallel up to 6 A)	Max current up to 0.8 A or 1.2 A per switch (in parallel up to 4.8 A)
12-bit resolution PWM & SMART PWM	12-bit resolution PWM flexibly tunable up to 600 Hz
Built in non-volatile memory	Built in non-volatile memory
Single smart charge pump	Single smart charge pump
Integrated 200 MHz oscillator	Integrated 200 MHz oscillator
Support on-board / off-board architectures	Support on-board / off-board architectures
Possible serial and parallel configuration of the switches	Possible serial and parallel configuration of the switches
CAN/CAN FD communication protocol	CAN/CAN FD communication protocol with Baud Rate Switching up to 2 MBps.
Direct NTC & ID resistor input	Direct NTC & ID resistor input
QM(B) - Safety documentation to support up to ASIL B system level	ASIL B compliant product
Small package outline HVQFN36 (6 x 6 mm^2) and HLQFP48 (7 x 7 mm^2) with wettable flanks	Small package outline HVQFN48 & HLQFP48 (7 x 7 mm^2) with wettable flanks
Limp home mode with configurable lighting pattern	Limp home mode with configurable lighting pattern
Available MTP free usage space for customer (~400 bits)	Available MTP free usage space for customer (~1K bits)
5 address pins enabling up to 32 MLCs	5 address pins enabling up to 32 MLCs
Full IC and external components diagnostic • Single LED open/short detection & diagnostics with bypass feature • Junction temperature and LED voltage available in register • Direct NTC resistor • Power on reset (POR) monitoring	**Advanced diagnostic** • Single LED open/short detection in a segment and diagnostics with bypass feature • Junction temperature and LED voltage available in register • Direct NTC resistor input with Temp reading covering entire operating Temp range • Power on reset (POR) monitoring • High open circuit (OC) threshold detection to allow 4 LEDs / switch • Smart open circuit detection when paralleling LED blocks • Detection of individual non-functional switch • Detection of VMAX to ground short to diagnose external capacitor fail
Programmable PWM duty cycle and fixed phase shifting to: • Avoid large peak currents when switching	**Programmable PWM duty cycle and phase shifting (also in LHM) to:** • Avoid large peak currents when switching • Avoid max string voltage being exceeded • Allow higher LED count in strings • Synchronize of PWM across multiple MLCs

Lighting application diagram

Total NXP Solution

LED Driver Module — Matrix Module

- Battery Management System
- SENSORS
- CAMERA
- LIDAR
- GPS
- Sensor Fusion
- Body Controller Module
- SBC UJA116x
- ASLx50y Multi-Phase BOOST IC
- ASLx41y Multi Channel BUCK IC
- Microcontroller S32K1
- ASLx41y Multi Channel BUCK IC
- CAN–HS Transceiver TJA1057
- SBC UJA1163
- ASL61xx Matrix LED Controller
- ASL61xx Matrix LED Controller
- Low Beam
- High Beam
- Turn Indicator
- Daytime Running Lamp
- Position Light

Legend: NXP Technology | NXP Technology/Nested Box | Secondary NXP Technology

Matrix LED controller base part and package variants

Part number	Description	Package
ASL5008	0.8 A maximum current smart PWM matrix led controller	HVQFN36 HLQFP48
ASL5015	1.5 A maximum current smart PWM matrix led controller	
ASL5108	0.8 A maximum current direct PWM matrix led controller	
ASL5115	1.5 A maximum current direct PWM matrix led controller	
ASL6108	0.8 A maximum current direct PWM matrix led controller	HVQFN48 HLQFP48
ASL6112	1.2 A maximum current direct PWM matrix led controller	

Evaluation board overview

Board	Description
ASL5115EVBMST	Master evaluation board matrix IC direct
ASL5115EVBSLAV	Slave evaluation board matrix IC direct
ASL5015EVBMST	Master evaluation board matrix IC smart
ASL5015EVBSLAV	Slave evaluation board matrix IC smart
S32K144EVB-Q100	S32K144 microcontroller evaluation board
EVBMLC2HOST	Host evaluation board matrix controller ASL61xx
EVBMLC2PER	Peripheral evaluation board matrix controller ASL61xx

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