



# AN90068

Rev. 1 — 25 August 2025

Application note

## A design guide for mixing Nexperia's 12/16/24-channel LED drivers in combined systems



**Abstract:** This document is a design guide for mixing NEX13120-Q100, NEX1316X-Q100, and NEX1324X-Q100 LED driver ICs on one LED board, enabling flexible channel expansion within complex lighting systems.

**Keywords:** NEX13120-Q100, NEX1316X-Q100, NEX1324X-Q100, LED drivers

## 1. Introduction

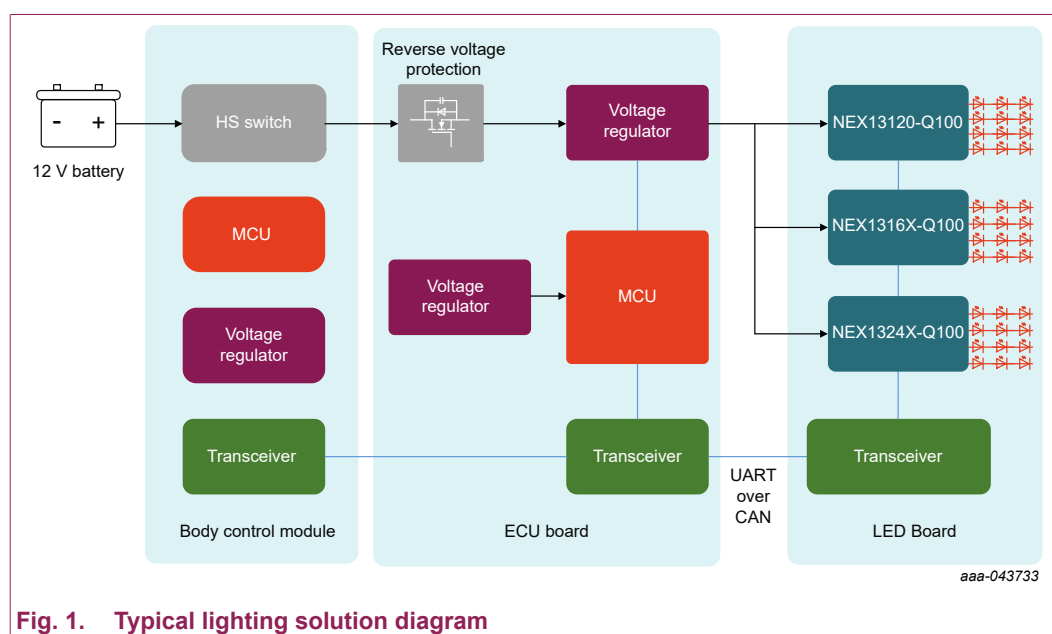
Channel count requirements vary significantly across functional zones in advanced automotive lighting systems such as dynamic taillights.

Integration of multi-channel LED drivers becomes essential to optimize BOM cost by matching channel density to zone requirements, enhance thermal management through distributed power dissipation and enable modular maintenance. It allows independent zone replacement.

## 2. Application and implementation

NEX13120-Q100, NEX1316X-Q100, and NEX1324X-Q100 LED driver ICs are inter-operable and can be combined to enable flexible channel-count configurations. This hybrid architecture achieves an optimal balance of performance, cost efficiency, and reliability in complex LED systems.

As shown in [Fig. 1](#), the transmit (TX) and receive (RX) terminals of the three devices are interconnected via a shared UART bus, allowing individual LED drivers to be addressed through distinct device identifiers. The microcontroller unit (MCU) receives command signals from the body control module (BCM) and transmits response data to the BCM via the controller area network (CAN) bus protocol.



**Fig. 1. Typical lighting solution diagram**

NEX13120-Q100 supports a unique burst mode. By setting CONF\_LENEXT to 0 or 1, users can select different burst mode.

- When CONF\_LENEXT=0, burst mode supports 1 byte, 2 bytes, 4 bytes and 8 bytes.
- When CONF\_LENEXT=1, burst mode supports 1 byte, 4 bytes, 16 bytes and 24 bytes.

If CONF\_LENEXT=1, NEX13120-Q100 supports the same burst mode formats as the NEX1316X-Q100 and NEX1324X-Q100 do.

If burst mode is set to 16 or 24 bytes:

- For write bursts, NEX13120-Q100 processes only the first 12 data bytes and the CRC bytes and ignores any subsequent data within the burst.
- For read bursts, the device reads the full requested length (16 bytes or 24 bytes).

### 3. Hardware connection setup

For rear-lamp animation, use multiple LED drivers with different channel counts to control many LED pixels.

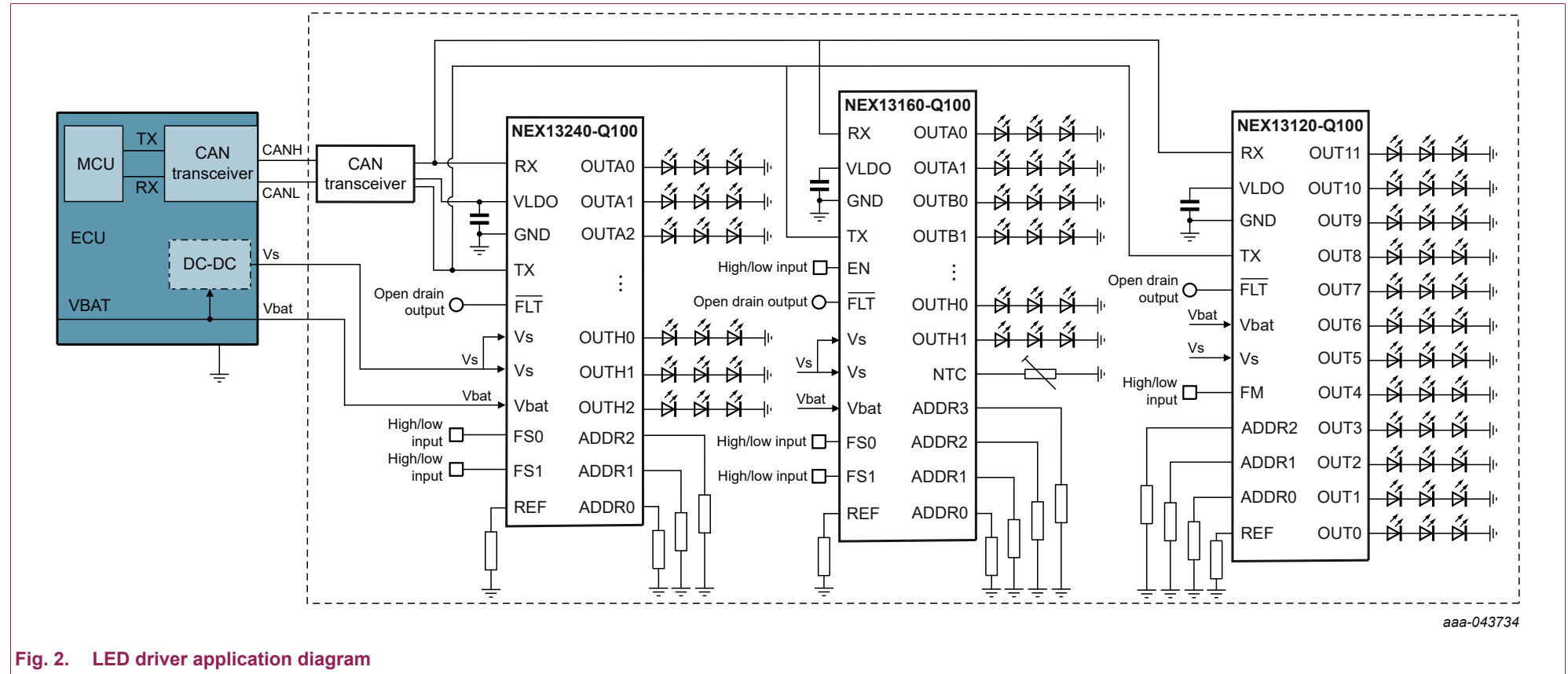


Fig. 2. LED driver application diagram

## 4. Setup steps

### Step 1: Define the system-level architecture

Given the MCU resides on a separate board or off-board, long-distance communication between the LED driver boards and the MCU board utilizes the CAN physical layer. The overall system block diagram is depicted in [Fig. 2](#).

The requirement for RX and TX interface pull-up resistors is transceiver-model-dependent. Typically, these pull-up resistors are specified at approximately 10 kΩ.

For a stable VLDO output voltage, Nexperia recommends adding a 4.7 μF ceramic capacitor. As only one CAN transceiver is implemented per PCB, it must be powered by the LDO output of a single LED driver on that board. The LDO outputs of multiple LED drivers on the same PCB must not be tied together.

### Step 2: Thermal analysis under worst-case conditions

Thermal analysis is essential for linear LED driver applications to ensure that the LED drivers operate within their specified junction temperature ( $T_j$ ) range. The device's total power dissipation is a critical factor in determining its operating junction temperature and can be calculated as follows:

$$P_{(MAX)} = [VS_{(MAX)} - VLED_{(MIN)}] \times I_{OUT} \times N$$

Where:

$VS_{(MAX)}$  is the maximum supply voltage.

$VLED_{(MIN)}$  is the minimum output voltage.

$I_{OUT}$  is the channel output current.

$N$  is the number of output channels.

Based on worst-case analysis for maximum device power consumption, either optimizing the PCB layout for improved thermal dissipation or implementing a DC-DC converter preceding the MCU board are viable solutions.

A DC-DC converter topology such as buck or buck-boost can regulate the battery voltage to provide a stable supply for the LED drivers with sufficient headroom. A properly designed supply voltage minimizes power dissipation within the LED driver itself and across the overall system.

### Step 3: Set up the peripheral address for the individual LED drivers

NEX13120-Q100, NEX1316X-Q100, and NEX1324X-Q100 each supports up to 27 devices. Peripheral addressing is configured through dedicated address pins and an internal register NV\_DEVADDR [3].

- NEX13120-Q100/NEX1324X-Q100: ADDR2, ADDR1 and ADDR0
- NEX1316X-Q100: ADDR3, ADDR2, ADDR1 and ADDR0

Different pin configurations differentiate peripheral addressing for each device. For implementation details, refer to the respective data sheet of the devices.

### Step 4: Initialize different LED drivers

Prior to initialization, device unlocking is required:

- NEX13120-Q100: unlock by writing 0x00 to register 0x61.
- NEX1316X-Q100/NEX1324X-Q100: unlocking sequence requires first writing 0x43, 0x4F, 0x44, 0x45 to register 0x96, followed by 0x00 to register 0x93.

Post-unlock initialization includes:

**A design guide for mixing Nexperia's 12/16/24-channel LED drivers in combined systems**

1. Current configuration for each channel
2. PWM generator configuration
3. Diagnostics configuration

Refer to the respective data sheets for implementation details.

**Step 5: Main loop execution with BCM command handling**

Upon finishing initialization, the system enters its main execution loop and continuously monitors in-vehicle networks for Body Control Module (BCM) command frames. The MCU maintains active listening to the CAN bus, awaiting valid lighting control triggers to transition into animation operation modes.

5. Revision history

Table 1. Revision history

Revision number	Date	Description
AN90068 v. 1	20250825	Initial version

## 6. Legal information

### Definitions

**Draft** — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

### Disclaimers

**Limited warranty and liability** — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of Nexperia.

**Right to make changes** — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

**Suitability for use** — Nexperia products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

**Applications** — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

**Export control** — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

**Translations** — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

### Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

Contents

1. Introduction.....2

2. Application and implementation..... 2

3. Hardware connection setup.....3

4. Setup steps ..... 4

5. Revision history.....6

6. Legal information..... 7

© Nexperia B.V. 2025. All rights reserved

For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)

Date of release: 25 August 2025