Design Guide: TIDA-050041
Bulk Current Injection (BCI) Compliant Automotive Rear Light Reference Design

Description

This reference design for TPS92611-Q1 is an automotive rear light EMC compliant design. This is a direct connection to battery application with multiple single channel device and the fault pins are connected together to realize One-Fails-All-Fail function. TIDA-050041 provides some recommendations to pass the Bulk Current Injection (BCI) test based on ISO11452-4 test 200mA substitution method and HKMC ES96200 Standard.

Resources

TIDA-050041	Design Folder
TPS92611-Q1	Product Folder

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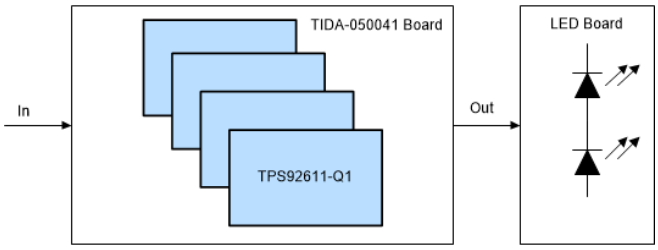
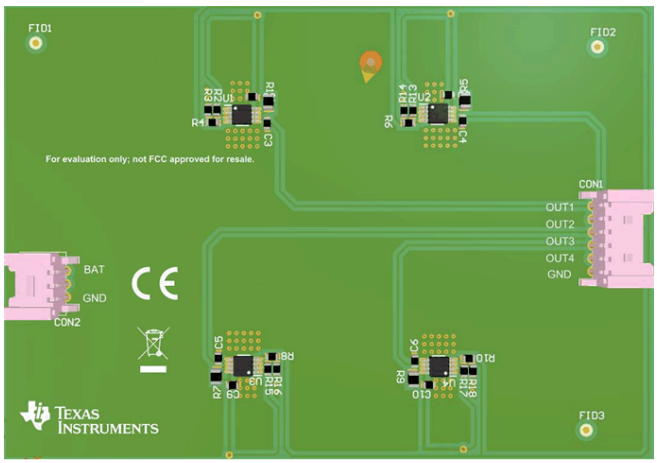
Features

- Pass Bulk Current Injection (BCI) Test:
  - ISO11452-4 200mA standard
  - HKMC ES96200 standard
- Support One-Fails-All-Fail function
- Suit off-board driving application

Applications

- Rear Light
- Interior Light





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1 System Description

In an automotive rear lamp application, long cables are used to connect the battery to a LED module. The noise generated by RF electromagnetic fields frequently degrades the performance of the electronic device by generating CM currents on cables. The effect of noise on rear lamp system can be simulated well by injecting common mode current to the cables of the equipment. Several automotive standards, such as ISO11452, define methods to evaluate the immunity levels of electronic devices. ISO11452-4 defines procedure and several different levels for conducting immunity testing of wiring harnesses in the frequency range of 1-400MHz.

This reference design incorporates 4 single-channel LED drivers with fault bus. It can pass the ISO11452-4 200mA level substitution method and HKMC ES96200 standard BCI test.

1.1 Key System Specifications

TIDA-050041 reference design provides a template for 8 or 12 LED off-board driving rear light applications with 4pcs TPS92611-Q1.

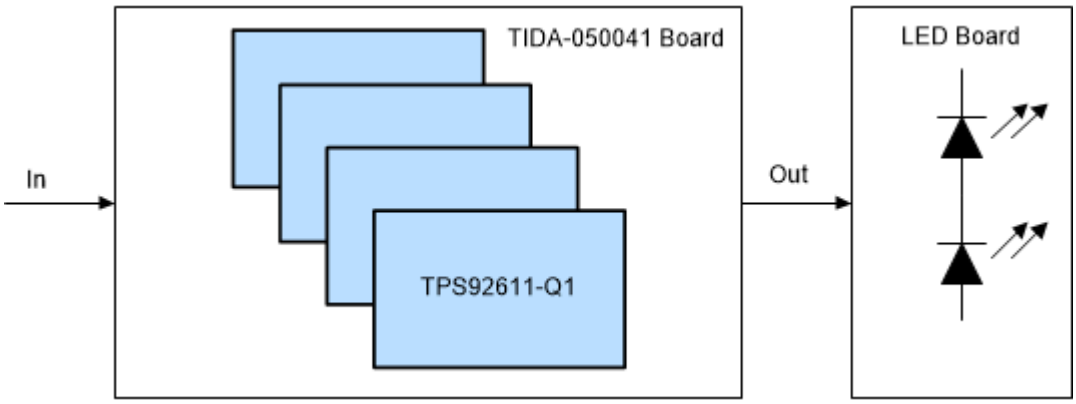
Table 1. Key System Specifications

PARAMETER	SPECIFICATIONS
Input Voltage	9 V-16 V
Output Current	100mA
Input capacitor	4.7uF + 100nF
Output capacitor	100nF
System level protection	One-Fails-All-Fail

2 System Overview

2.1 Block Diagram

Figure 1. TIDA-050041 Block Diagram



2.2 Design Considerations

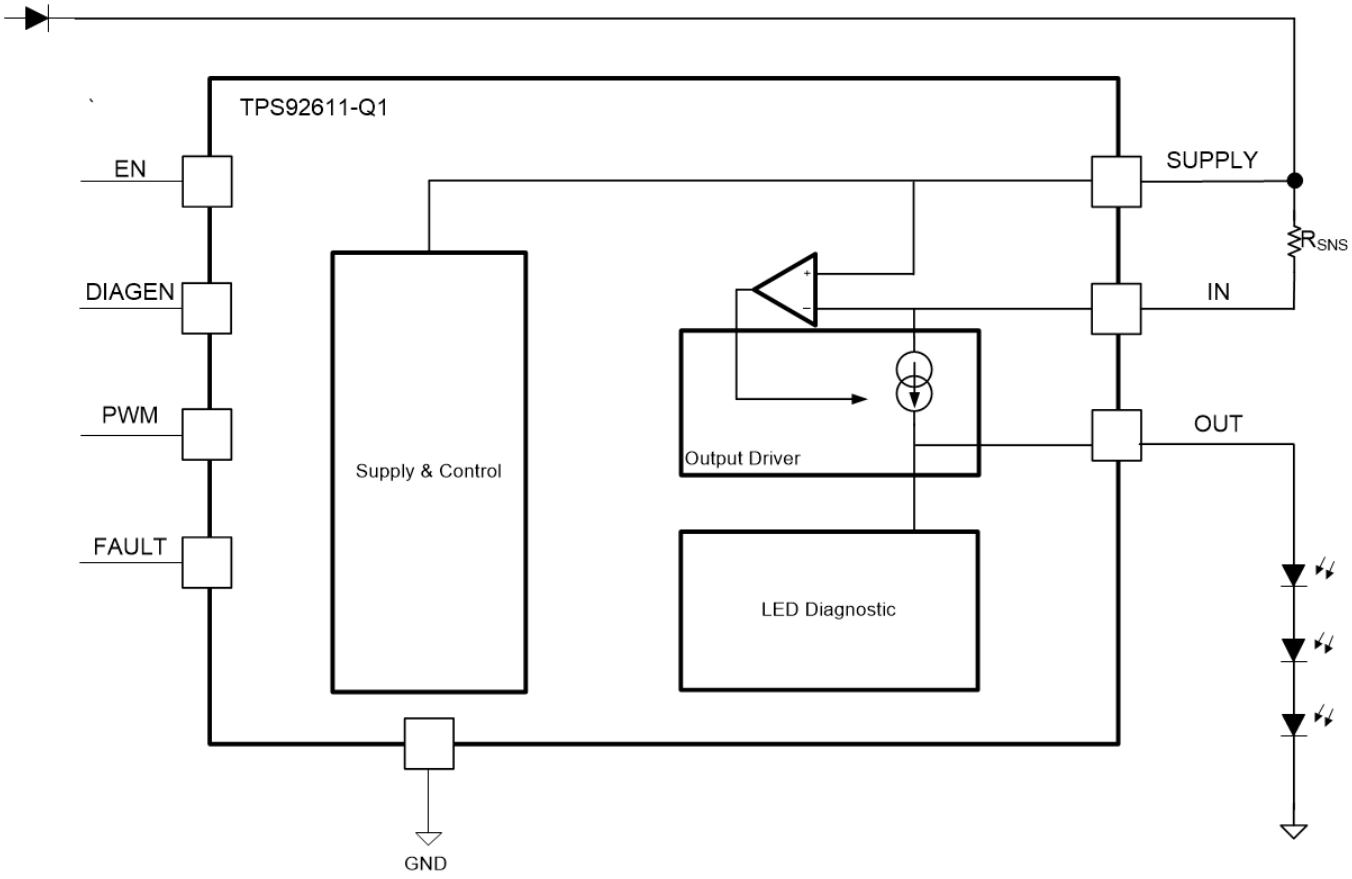
To pass BCI test, it is important to follow the three items:

- Good input filter circuit can suppress the BCI noise, TI recommends to place input capacitors as close to device pins as possible.
- Vias will introduce parasitic noise, TI recommends to use as less vias as possible especially on power traces.
- Large GND polygon can provide a good noise path and thermal performance, TI recommends to merge GND together and keep it as large as possible.

2.3 Highlighted Products

TPS92611-Q1 is a simple single-channel high-side LED driver operating from an automotive car battery. It is a simple and elegant solution, with LED diagnostics, to deliver constant current for a single LED string. It is a one-fails–all-fail feature able to work together with other LED drivers, such as the TPS9261x-Q1, TPS9263x-Q1, and TPS9283x-Q1 devices, to address different requirements.

Figure 2. TPS92611-Q1 Block Diagram



3 Hardware, Testing Requirements, and Test Results

3.1 Required Hardware

This test is based on the qualified test agency, so the required hardware customer needs include:

- TIDA-050041 board
- LED board with 8 LED (2 LED per string) or 12 LED (3 LED per string)
- Test wires referencing the ISO 11452-4 request

3.2 Testing and Results

3.2.1 Test Setup

Reference the standard of ISO11452-4.

3.2.2 Test Results

Pass the ISO11452-4 200mA level substitution method and HKMC ES96200 standard BCI test. The formal reports are provided using the following links:

- ISO11452-4 200mA level substitution method test report
- HKMC ES96200 standard test report

4 Design Files

4.1 Schematics

To download the schematics, see the design files at TIDA-050041.

4.2 Bill of Materials

To download the bill of materials (BOM), see the design files at TIDA-050041.

4.3 PCB Layout print

To download the layer plots, see the design files at TIDA-050041.

4.4 Altium Project

To download the Altium Designer® project files, see the design files at TIDA-050041.

4.5 Gerber Files

To download the Gerber files, see the design files at TIDA-050041.

4.6 Assembly Drawings

To download the assembly drawings, see the design files at TIDA-050041.

5 Related Documentation

1. *Automotive Rear Light EMC Reference Design*
2. ISO11452-4

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