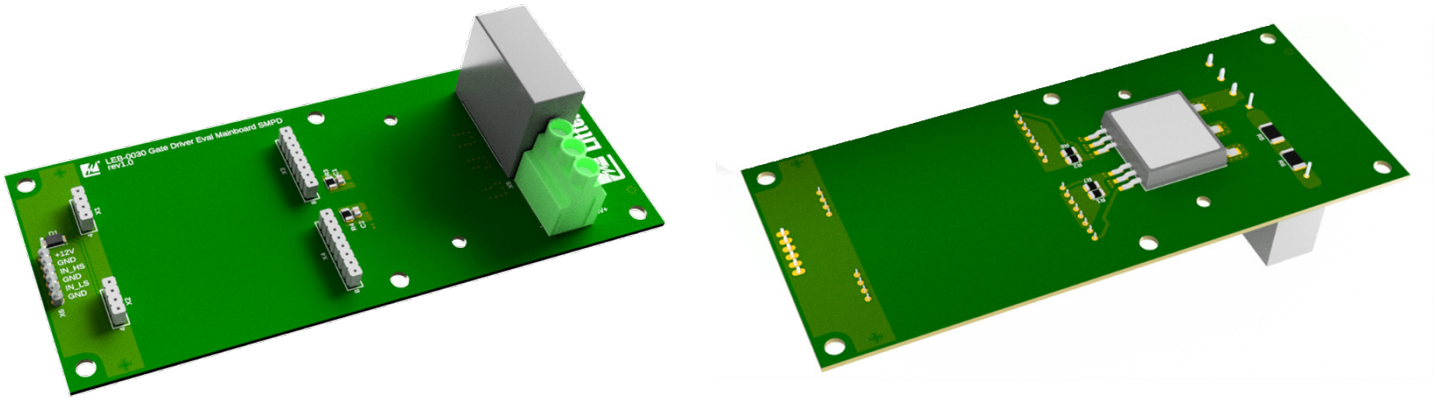
LEB-0030
Gate Driver Evaluation Mainboard for SMPD-B Modules

Introduction

Littelfuse offers a broad range of power semiconductor gate drivers with various features. These include both isolated and non-isolated drivers of different current classes, as well as drivers that incorporate safety features like desaturation detection, soft turn-off, and fault state feedback. A gate driver evaluation platform has been introduced to enable customers to evaluate the gate driver portfolio under comparable conditions. This platform includes multiple gate driver boards that are compatible with mainboards designed for different power semiconductor packages. This manual describes the platform's mainboard for SMPD-B power modules. It allows testing of various combinations of gate drivers and power transistors within the same setup. The mainboard can be equipped with different gate driver evaluation boards and various power transistors in SMPD-B packages.



Top view Bottom view

Figure 1. Littelfuse gate driver evaluation platform mainboard for SMPD-B power modules

Features

- Ability to test and compare different Littelfuse gate driver solutions with power semiconductors in SMPD-B packages
- Maximum operating voltage: 800 V
- Suitable for double pulse and application-related testing

Target Audience

This manual is intended for engineers working on power electronics hardware design and investigating optimal gate driver and power semiconductor solutions for their applications.

Contact Information

For more information on the evaluation board and application support, contact the Littelfuse Power Semiconductor team of product and applications experts: PowerSemiSupport@Littelfuse.com

© 2025 Littelfuse, Inc.

Important Notes

Disclaimer Notice – The Customer (individually or, if you are acting on behalf of a company, the company) agrees to use the Evaluation Board solely for this purpose and subject to the terms of this Notice.

The design of the Evaluation Board has been tested by Littelfuse only as described in this document. The design is not qualified in terms of safety requirements, manufacturing and operation over the entire operating temperature range or lifetime.

The Evaluation Board is an engineering tool intended solely for laboratory use by qualified and experienced electrical engineers to evaluate the performance of Littelfuse power semiconductors and integrated circuit products according to the terms and conditions set forth in this document or other related documents supplied with the respective Evaluation Board. The Evaluation Board should not be used at all or as part of a finished product.

The Evaluation Board provided by Littelfuse is subject to functional testing only under typical load conditions. Evaluation Board is not subject to the same procedures as regular products regarding returned material analysis (RMA), process change notification (PCN) and product discontinuation (PD). Applications described are for illustrative purposes only and Littelfuse makes no representation that such applications will be suitable for the customer's specific use without further testing or modification.

Evaluation Boards are not commercial products and are intended solely for testing and evaluation purposes. They should not be used for reliability testing or production. As a result, the Evaluation Board may not comply with product-specific standards. The Customer must ensure that the Evaluation Board is handled in compliance with relevant requirements and standards of the country in which they are operated.

It is the responsibility of the Customer's technical departments to evaluate the suitability of the Evaluation Board for the intended application, based on their own performance criteria, conditions, specific application, compatibility with other components, and environmental conditions further to evaluate the completeness and correctness of the information provided in this document with respect to such application. The Customer is obliged to ensure that the use of the Evaluation Board does not cause any harm to persons or third-party property. The Evaluation Board and any information in this document is provided "as is" and Littelfuse disclaims any warranties, express or implied, including but not limited to warranties of non-infringement of third-party rights and implied warranties of fitness for any purpose, or for merchantability. There is no representation that operation of the Evaluation Board will be uninterrupted or error free.

Littelfuse shall not be responsible for any damages resulting from the use of the Evaluation Board and/or from any information provided in this document. The Customer is obliged to defend, indemnify and hold Littelfuse harmless from and against any claims or damages arising out of or resulting from any use thereof. Littelfuse reserves the right to modify this document and/or any information provided herein at any time without further notice.

The Evaluation Board is not a standard consumer or commercial product. As a result, any indemnification obligations imposed upon Littelfuse by contract with respect to product safety, product liability, or intellectual property infringement do not apply to the Evaluation Board.

© 2025 Littelfuse, Inc.

Table of Contents

List of Figures

© 2025 Littelfuse, Inc.

1. Overview

Figure 2 displays the block diagram of the gate driver evaluation mainboard for SMPD-B packages. This board comes without pre-mounted SMPD-B modules, allowing customers to test power semiconductors according to their preferences. The board can be used for standard double pulse tests if the SMPD-B package is not attached to a heatsink. For continuous operation, the SMPD-B package should be attached to a heatsink. The desired driver evaluation boards are plugged onto the connectors X1 and X3 for high side connection, and connectors X2 and X4 for low side connection, for testing purposes. The supply voltage and the control signals are provided through connector X6. Terminal block X5 is used for connecting the DC-Link-voltage and auxiliary components, such as a choke or a resistor for double-pulse tests.

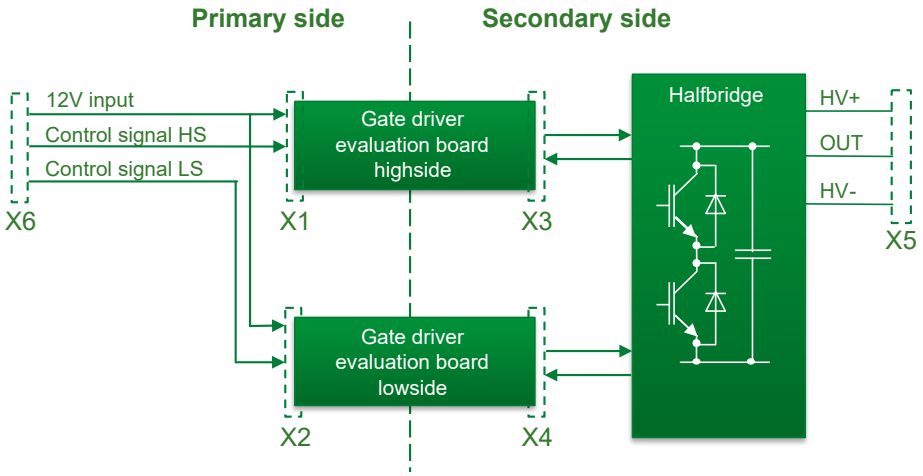


Figure 2. Gate driver evaluation mainboard block diagram

Table 1 contains the operating conditions of the driver evaluation mainboard.

Table 1. Operating conditions of the gate driver evaluation mainboard

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
V_{CC}	Board primary side supply voltage	11	12	13	V
$U_{control}$	Primary side control signal input voltage	–	5	5.5	V
U_{HV}	Secondary side operating voltage(1)	–	–	800	V
I_{HV}	Secondary side load current(2)	–	–	50	A
T_{amb}	Operating ambient temperature	0	25	50	°C

Notes:
(1) See Section 5 for further details on isolation ratings.
(2) Operation in double pulse test. Not for continuous operation.

Please be aware that depending on the power semiconductor in use, the gate driver voltages on the driver evaluation boards must be adjusted accordingly. In standard configuration, the driver evaluation boards are equipped with power supply of +15/-9 V.

© 2025 Littelfuse, Inc.
Revised: TK.05/01/2025

2. Pin Assignments

Table 2 describes the electrical connections of the mainboard. A 4-terminal socket strip is used to connect the gate driver evaluation boards on the primary side. On the secondary side, the evaluation boards are connected via an 8-terminal socket strip. The power circuit is connected via a 3-pole terminal block.

Table 2. LEB-0030 pin assignments

Connector Name	Pin Number	Pin Name	Description
X1	1	12 V	+12 V supply high-side gate driver
X1	2	GND	Primary-side GND
X1	3	IN+	PWM input high-side gate driver
X1	4	GND	Primary-side GND
X2	1	12 V	+12 V supply low-side gate driver
X2	2	GND	Primary-side GND
X2	3	IN+	PWM input low-side gate driver
X2	4	GND	Primary-side GND
X3	1	DESAT_FB	High-side desaturation detection feedback pin (reserved for IX4352NE)
X3	2	SOURCE_EMITTER	High-side power transistor source/emitter connection
X3	3	DRIV_OUT	High-side gate driver evaluation board gate output
X3	4	SOURCE_EMITTER	High-side power transistor source/emitter connection
X3	5	DRIV_OUT	High-side gate driver evaluation board gate output
X3	6	SOURCE_EMITTER	High-side power transistor source/emitter connection
X3	7	DRIV_OUT	High-side gate driver evaluation board gate output
X3	8	GATE_FB	High-side gate feedback pin (reserved for IX4352NE)
X4	1	DESAT_FB	Low-side desaturation detection feedback pin (reserved for IX4352NE)
X4	2	SOURCE_EMITTER	Low-side power transistor source/emitter connection
X4	3	DRIV_OUT	Low-side gate driver evaluation board gate output
X4	4	SOURCE_EMITTER	Low-side power transistor source/emitter connection
X4	5	DRIV_OUT	Low-side gate driver evaluation board gate output
X4	6	SOURCE_EMITTER	Low-side power transistor source/emitter connection
X4	7	DRIV_OUT	Low-side gate driver evaluation board gate output
X4	8	GATE_FB	Low-side gate feedback pin (reserved for IX4352NE)
X5	1	HV+	Load circuit positive terminal
X5	2	HV-	Load circuit negative terminal
X5	3	OUT	Half-bridge output terminal
X6	1	+12V_LV	+12 V board supply
X6	2	GND_LV	Primary-side GND
X6	3	IN+_HS	High-side driver PWM input
X6	4	GND_LV	Primary-side GND
X6	5	IN+_LS	Low-side driver PWM input
X6	6	GND_LV	Primary-side GND

© 2025 Littelfuse, Inc.
Revised: TK.05/01/2025

3. Schematics

The mainboard's schematic is depicted in Figure 3. On the left side, the driver control signals and the 12 V power supply are routed directly from connector X6 to the connectors X1 and X2 of the evaluation boards. The 12 V power supply line is equipped with reverse polarity protection. The right side of the schematic shows the power semiconductor circuitry on the mainboard. The Littelfuse SMPD-B module in half-bridge configuration is connected to a DC-Link with passive discharge resistors.

For using the LEB-0023 IX4352NE driver evaluation board, the desaturation detection feature of the gate driver can be evaluated using SMPD-B-devices like the IXAxxPG1200DHGLB series with integrated DESAT-diodes. For other SMPD-B devices, these pins are left open. For other driver evaluation boards, the DESAT-Pins on X3 and X4 are left open.

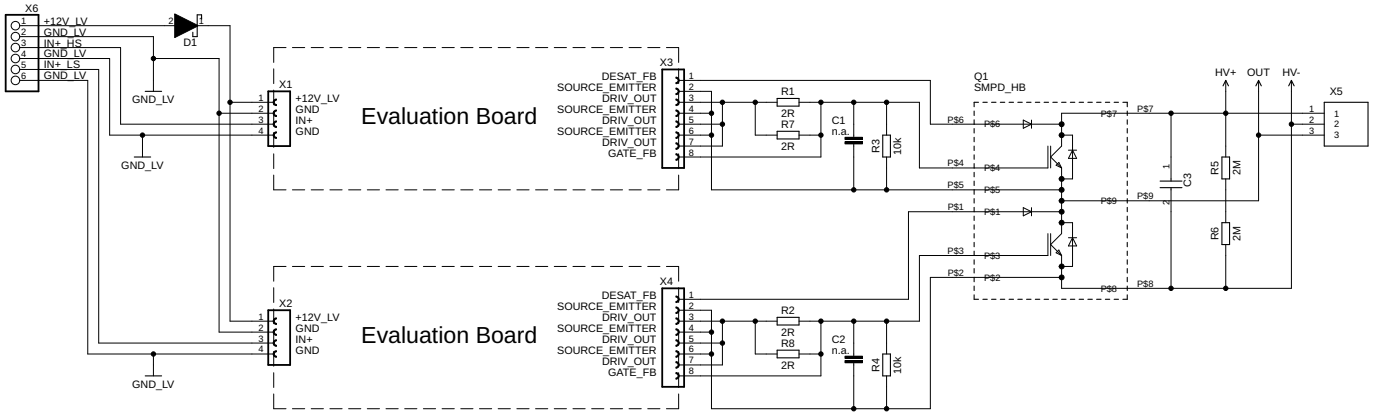


Figure 3. SMPD-B mainboard schematics

4. Bill of Materials

Table 3 contains the evaluation board's bill of materials.

Table 3. Bill of materials for the gate driver evaluation mainboard

Item	Quantity	Reference	Value	Description	Manufacturer	MPN
1	1	C3	2.2 µF	Film Cap 1200 V 2.2 µF 5 %	Kemet	C4AQPBU4220M1YJ
2	2	R1, R2, R7, R8	2 Ω	Res 2 Ω 1 % 1206	- generic -	–
3	2	R3, R4	10 kΩ	Res 10 kΩ 10 % 1206	- generic -	–
4	2	R5, R6	1 MΩ	Res 2 MΩ 500 V 1 % 2512	- generic -	–
5	1	D1	–	1 A low V_F Schottky barrier rectifier	Nexperia	PMEG6010EP,115
6	1	Q1	–	SMPD-B in phase-leg configuration	Littelfuse	–
7	2	X1, X2	–	.100" Closed Entry Low Profile Socket Strip	SAMTEC	CES-104-01-T-S
8	2	X3, X4	–	.100" Closed Entry Low Profile Socket Strip	SAMTEC	CES-108-01-T-S
9	1	X5	–	Fixed Terminal Block 3P 6.35 mm 90°	Phoenix Contact	1714968
10	1	X6	–	Pin header 0.1" pitch 6-pin	SAMTEC	TSW-106-23-H-S

© 2025 Littelfuse, Inc.
Revised: TK.05/01/2025

5. Isolation Ratings

The creepage distances between primary and secondary side on the mainboard are 51.5 mm. The isolation capability between primary and secondary side of the overall setup is given by the isolation capability of the gate driver evaluation board, which is mounted on the mainboard. Refer to the user manual of the respective driver evaluation board for more information.

The board is specified for a maximum operating voltage of 800 V. In accordance with the IEC 60664-1 standard, the assumption of pollution degree 1 and material group 1 of the PCB-material, the required creepage distance for 800 V operating voltage is 2.4 mm.

6. PCB Layout

Figures 4 to 7 display the four copper layers of the PCB.

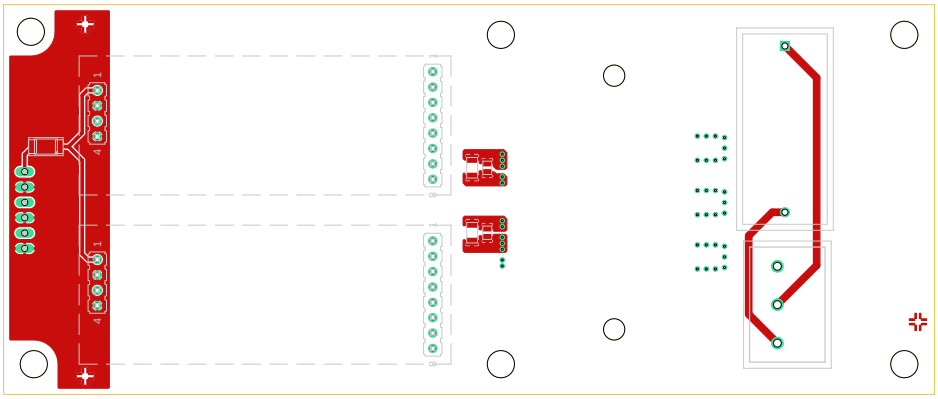


Figure 4. PCB top layer

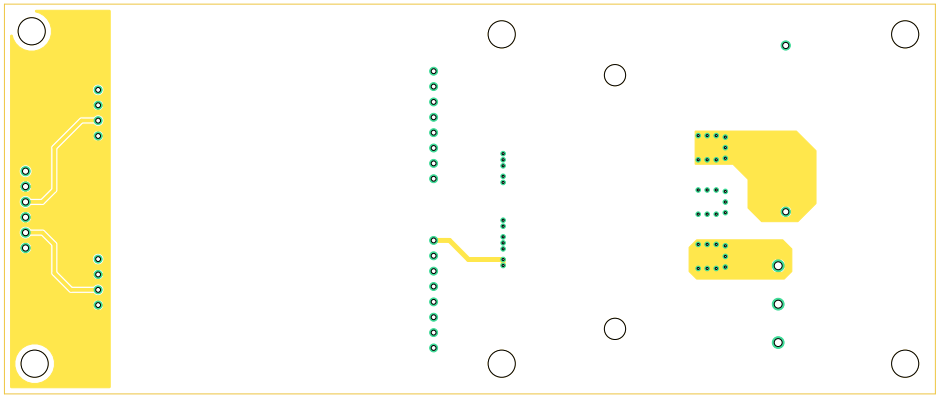


Figure 5. PCB layer 2

© 2025 Littelfuse, Inc.
Revised: TK.05/01/2025

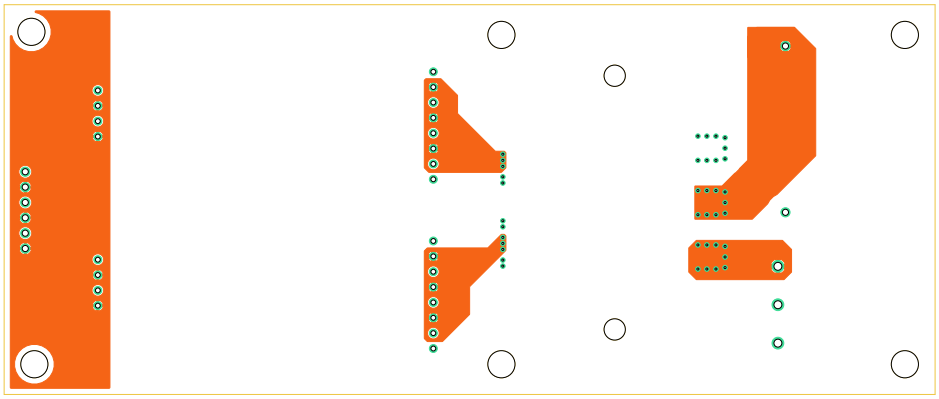


Figure 6. PCB layer 3

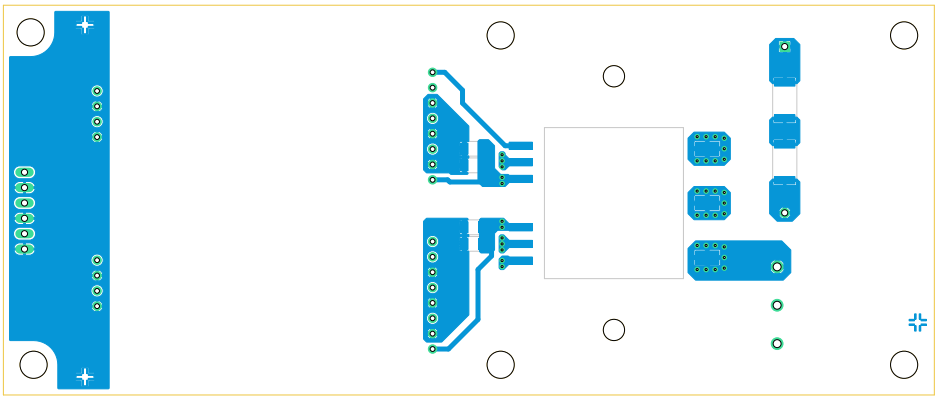


Figure 7. PCB bottom layer

© 2025 Littelfuse, Inc.
Revised: TK.05/01/2025

7. PCB Assembly Data

Figure 8 and Figure 9 depict the PCB assembly, including the mechanical dimensions of the mainboard.

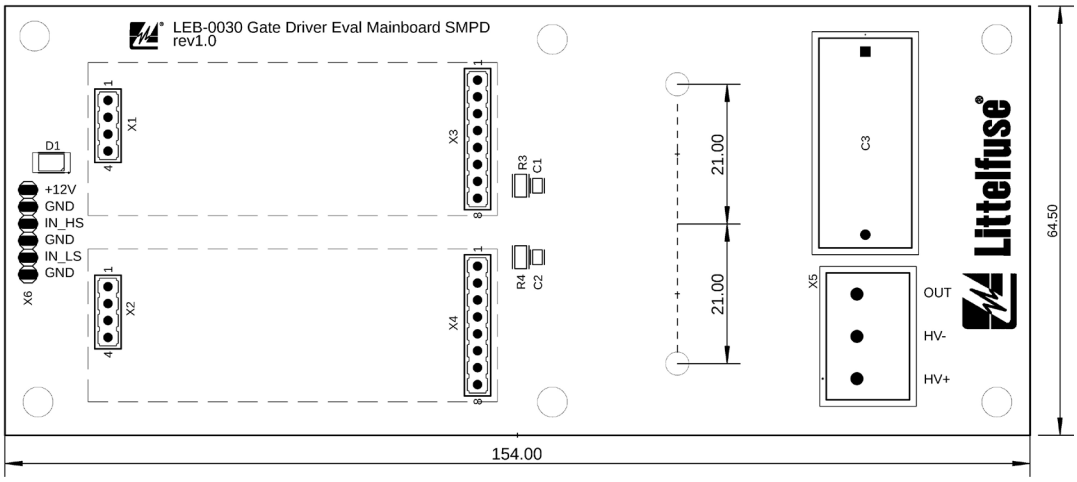


Figure 8. PCB top assembly and dimensions

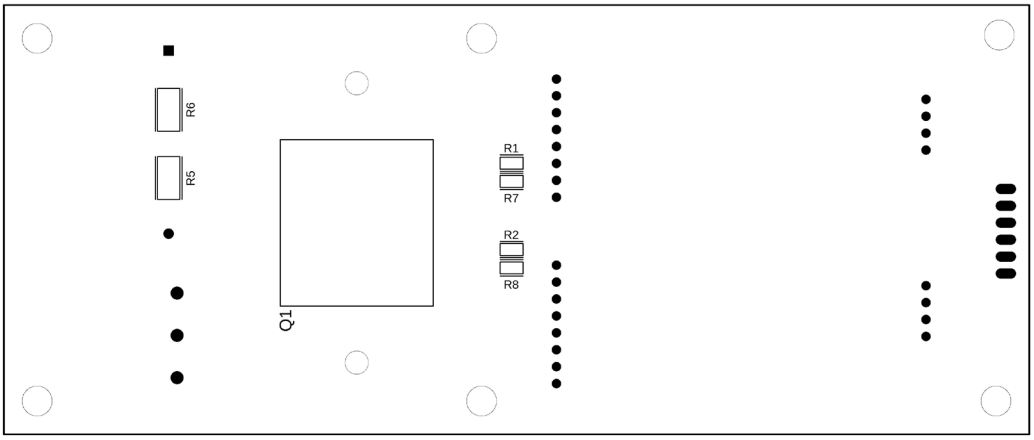


Figure 9. PCB bottom assembly

Revision History

Date	Revision	Changes
April 2025	1.0	Initial Release

Disclaimer Notice: Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at http://www.littelfuse.com/disclaimer-electronics.

© 2025 Littelfuse, Inc.
Revised: TK.05/01/2025