

Quick Start Guide:

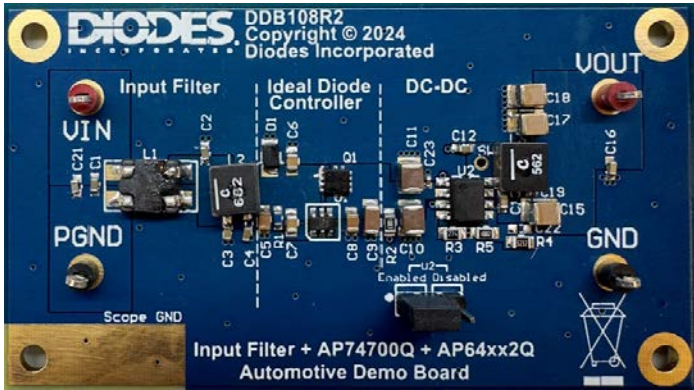


Figure 1: DDB108R2 Demo Board

Pin Description	
Pin	Description
Vin	3.8 V – 40 V Supply In
GND	Common PCB ground
PGND	PCB Input GND
Vout	Output voltage (5V)
J5	Configure internal or external soft start using jumpers
Vin (test point)	Probe to check input voltage to the AP64xx2Q device
SW (test point)	Use an oscilloscope to check the switching stability and frequency of the AP64xx2Q

Table 1: DDB108R2 Demo Board Pin Description

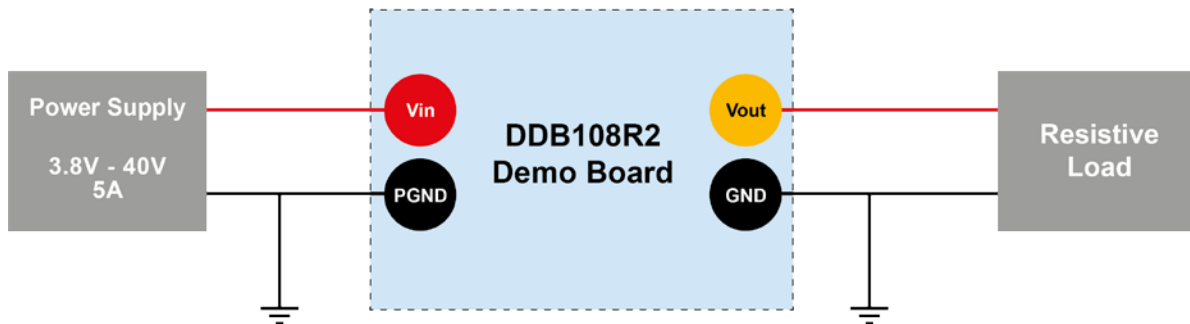



Figure 2: DDB108R2 Demo Board Test Setup

The DDB108R2 demo board has a simple layout and allows access to the appropriate signals through test points. To evaluate the performance of the DDB108R2, follow the procedure below:

Note: The pale-blue row indicates the default position.

	J1	Effect on DDB108R2
	Header on "Enabled" side	Enables the AP64xx2Q device
Header on "Disabled" side	Disables the AP64xx2Q device	
Neither/Both Connected	Not recommended	

- 1) Use jumper J1 to set:
- 2) Connect a DC power supply between the VIN and PGND terminals.
- 3) Connect the load to the VOUT and GND terminals (be sure it does not exceed the current limit of the device).
- 4) Check all connections, then turn on the power supply.
- 5) The EVM board should now power up with a 5V output voltage.

Description:

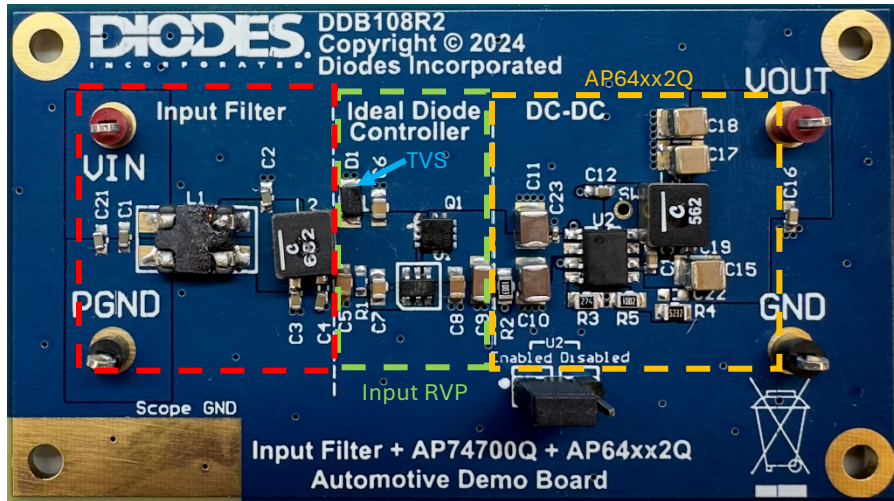


Figure 3: Picture of the DDB108R2 Demo Board

The DDB108R2 Demo Board showcases the [AP64xx2Q](#) DC-DC buck converter family, the [AP74700Q](#) ideal diode controller, as well as the use of an EMI input filter. It demonstrates a system-level solution with reverse voltage protection, ISO 7637-2 transient pulse protection (using a suitable TVS), EMI filtering that passes CISPR 25 Class 4, as well as the DC-DC buck converter.

The input filter (as shown in figure 3 within the red square) contains a common mode choke with capacitors on either side of it in a Pi configuration. This is connected in series with an LC low pass filter containing an inductor and a capacitor. This combination makes the board CISPR 25 class 4 compliant.

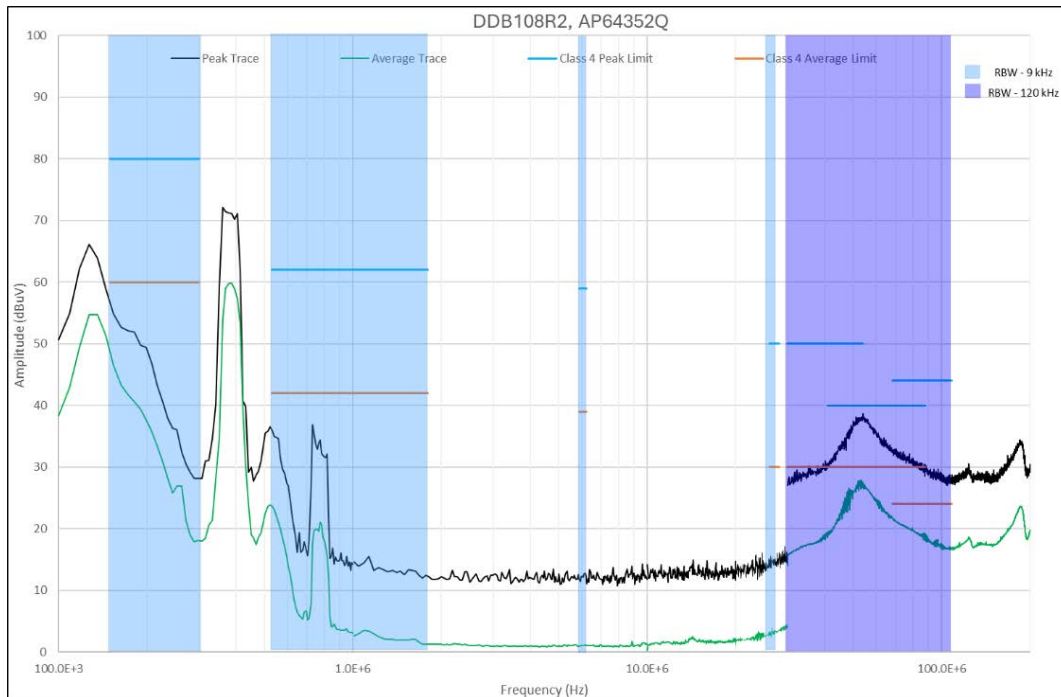


Figure 4: EMC Sweep of DDB108R2, with the AP64352Q installed, from 100 kHz – 200 MHz, 13.5V_{in}, 3.5A load, against CISPR 25 Class 4 limits.

The TVS is highlighted in light blue. This provides the board with ISO7367-2 pulse protection. The SMF4L30CAQ is a suitable choice for the TVS.

Description (continued):

The input RVP section of the board is highlighted in green and consists of the **AP74700Q**. The AP74700Q is a $\pm 65V$ ideal diode MOSFET controller which provides reverse voltage protection and has a low-loss 20mV forward voltage drop rectifier in unidirectional power paths. The AP74700Q supports wide input operation range from 3.2V to 65V, allowing control of many popular DC rail voltage such as 12V, 24V, or higher automotive battery systems. The 3.2V input voltage support is suitable for severe cold crank requirements in automotive systems. The AP74700Q can withstand and protect loads from reverse voltages down to -65V.

The MOSFET design requirements of the AP74700Q are:

- $60V V_{DS(MAX)}$ and $\pm 20V V_{GS(MAX)}$
- $R_{DS(ON)} @ I_{Load(Nominal)}: (20\text{ mV} / I_{Load(Nominal)}) \leq R_{DS(ON)}$
- MOSFET gate threshold voltage V_{TH} : 2V maximum

Due to the PowerDI3333-8 footprint on the DDB108R2 and the AP74700Q's design requirements, the DMTH6016LFVWQ is recommended as the MOSFET.

The **AP64xx2Q** family, highlighted in yellow, is a series of automotive-compliant, 1A/2A/3.5A/5A, synchronous buck converters with an input voltage of up to 40V. The devices fully integrate a high-side power MOSFET and a low-side power MOSFET to provide high-efficiency step-down DC-DC conversion.

The AP6xx2Q devices adopt peak current-mode control and have an integrated loop compensation network making them easy to use. The device range is available in the SO-8EP package.

Schematic Diagram:

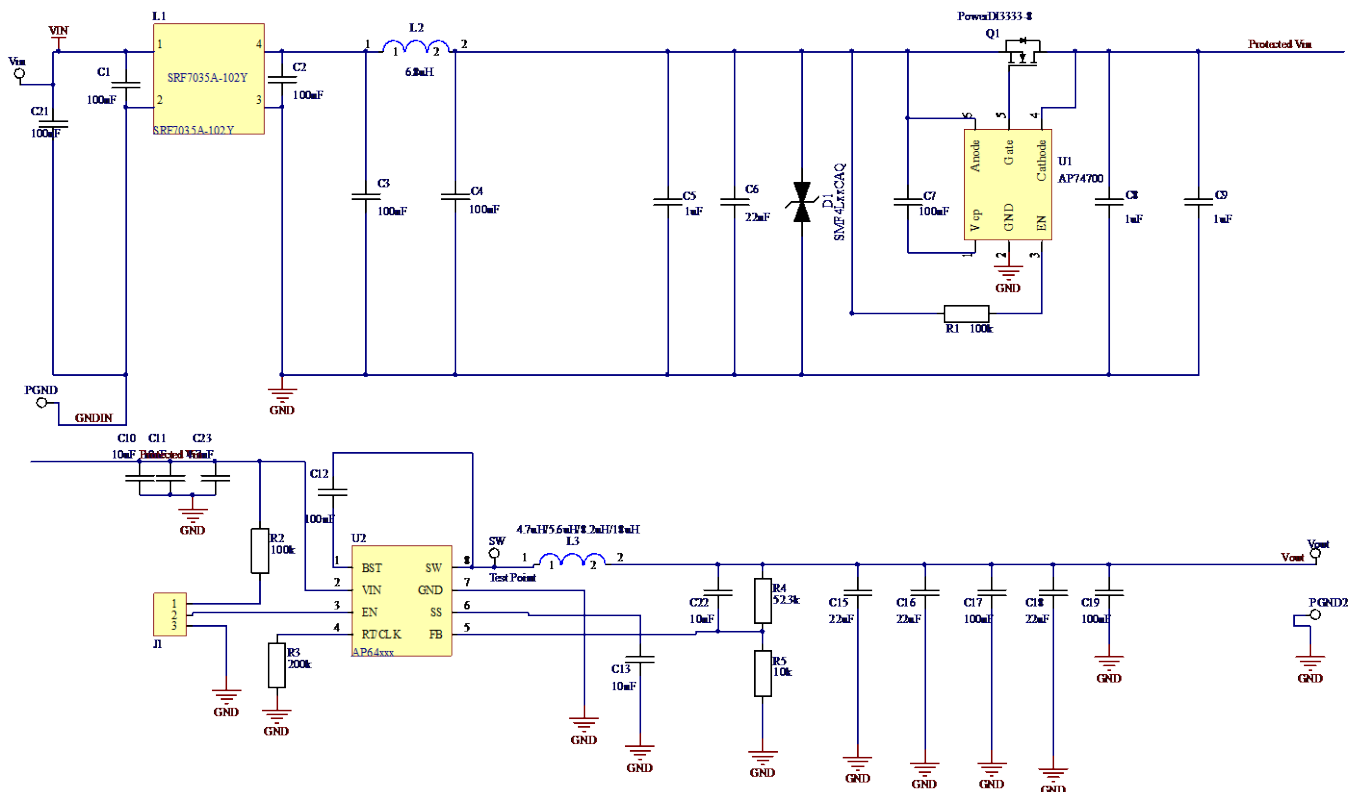
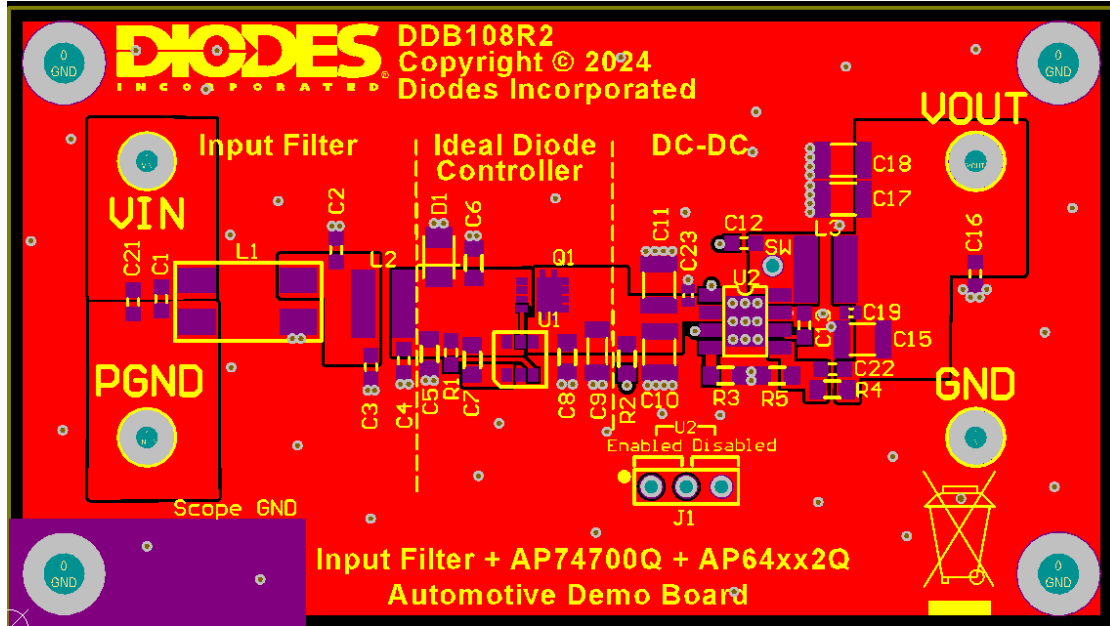


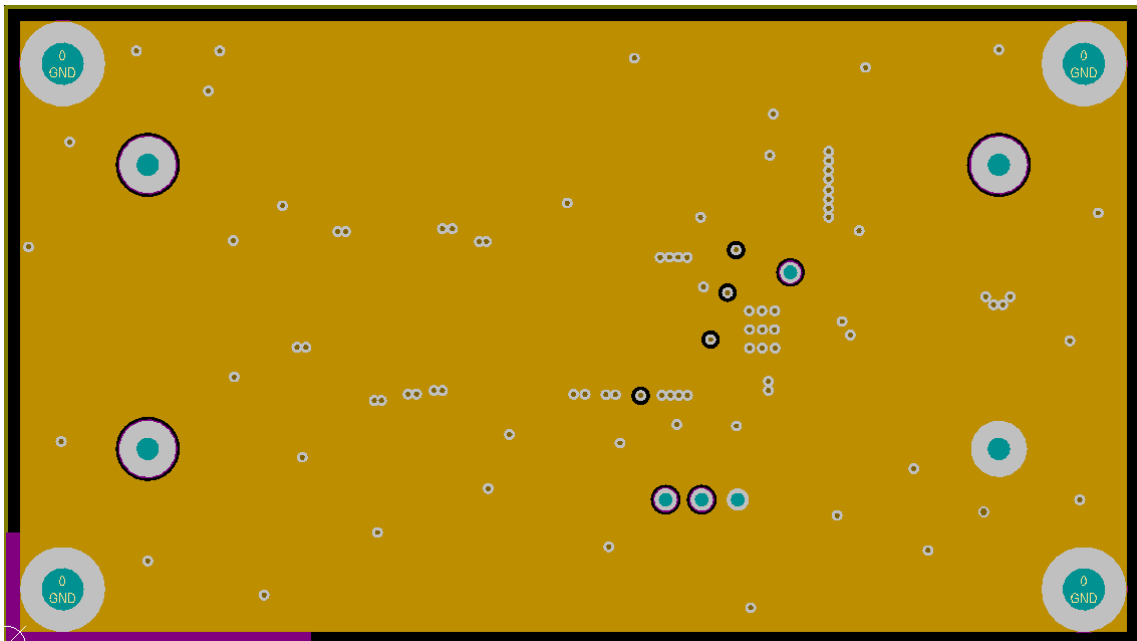
Figure 5: Schematic Diagram of the DDB108R2 Demo Board

Board Layers (Top View):

Top Layer:

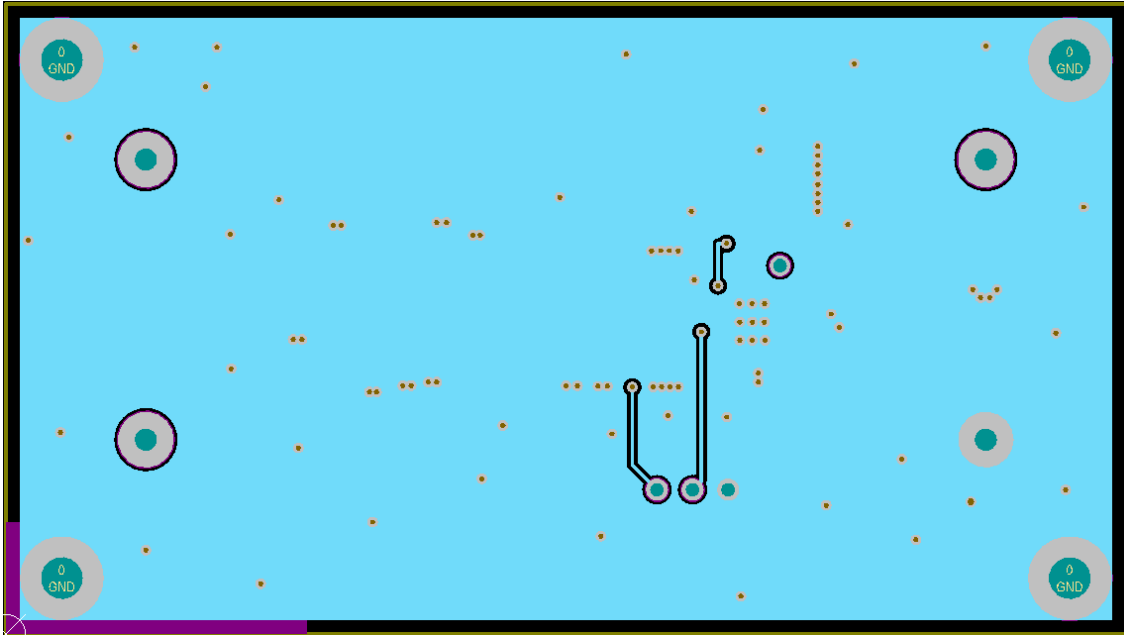


Mid Layer 1:

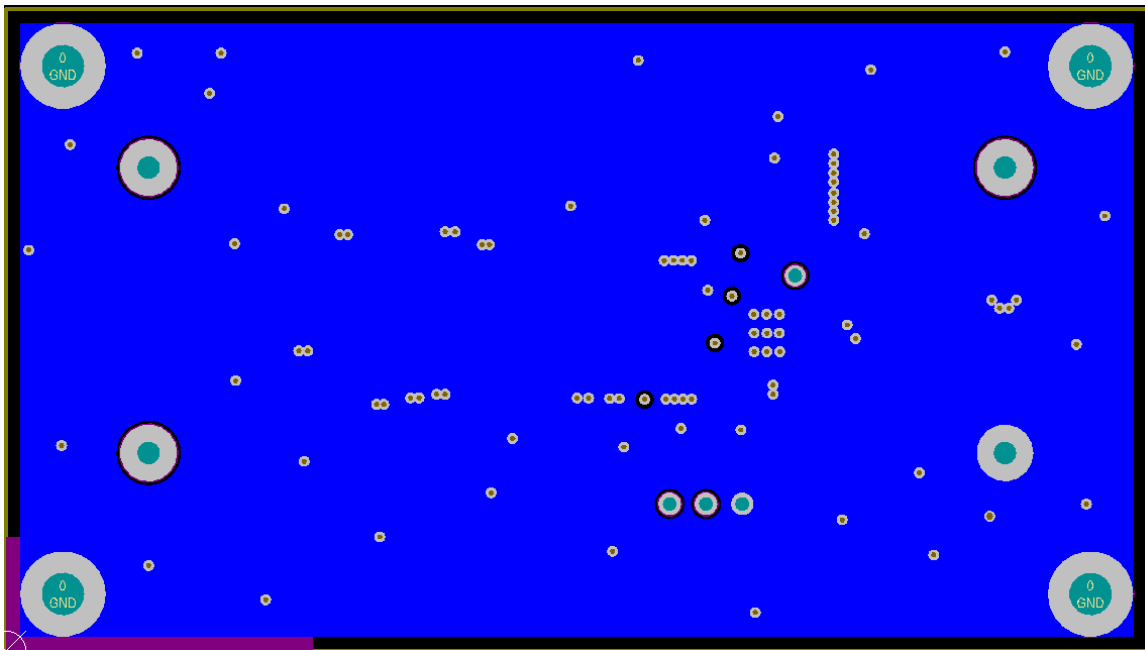


Board Layers (Top View) (continued):

Mid Layer 2:



Bottom Layer:



Bill Of Materials:

Quantity	Idents	Description	Footprint
1	U2	AP64xx2Q	SO8-EP
1	U1	AP74700Q	SOT26
1	Q1	DMTH6016LFVWQ	PowerDI3333-8
1	D1	SMF4LxxxAQ	DO219-AA
1	C10	10uF X7R Capacitor	1210
1	C11	1uF X7R Capacitor	1210
2	C15, C16, C18	22uF X7R Capacitor	1210
1	C7	100nF X7R Capacitor	0805
1	C4	10pF X7R Capacitor	0805
1	C6	22nF X7R Capacitor	0805
2	C3, C4	47nF X7R Capacitor	0603
1	C6	2.2uF X7R Capacitor	0805
2	C5, C8	1uF X7R Ceramic SMD Capacitor	0805
3	C1, C2	1uF X7R Ceramic SMD Capacitor	0603C
5	C17, C19, C20, C21	100nF X7R Ceramic SMD Capacitor	0603C
1	C22	10nF X7R Ceramic SMD Capacitor (optional)	0603C
4	ExtClk, ExtSupply, ExtSupply1	1 pin header	Test pin_1
1	J5	2W header	0.1" 2W
1	L1	Common-mode Choke, BOURNS SRF7035A-102Y	7mm x 6mm x 3.5mm
1	L2	Coilcraft XGL5050-682MEC, 6.8uH, 6.2A	5050
1	L3	Coilcraft XGL5030-183MEC, 18uH, 3.3A (AP64102Q) Coilcraft XGL4030-822MEC, 8.2uH, 3.5A (AP64202Q) Coilcraft XGL5030-562MEC, 5.6uH, 6A (AP64352Q) Coilcraft XGL5030-472MEC, 4.7uH, 6.7A (AP64502Q)	5030/4030
5	R1, R2, R3, R4, R5	SMD Thick Film Resistor	0805
4	Vin, Vout, PGND, GND	Test eyelets	1.6mm test eyelets

IMPORTANT NOTICE

1. DIODES INCORPORATED (Diodes) AND ITS SUBSIDIARIES MAKE NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).
2. The Information contained herein is for informational purpose only and is provided only to illustrate the operation of Diodes' products described herein and application examples. Diodes does not assume any liability arising out of the application or use of this document or any product described herein. This document is intended for skilled and technically trained engineering customers and users who design with Diodes' products. Diodes' products may be used to facilitate safety-related applications; however, in all instances customers and users are responsible for (a) selecting the appropriate Diodes products for their applications, (b) evaluating the suitability of Diodes' products for their intended applications, (c) ensuring their applications, which incorporate Diodes' products, comply the applicable legal and regulatory requirements as well as safety and functional-safety related standards, and (d) ensuring they design with appropriate safeguards (including testing, validation, quality control techniques, redundancy, malfunction prevention, and appropriate treatment for aging degradation) to minimize the risks associated with their applications.
3. Diodes assumes no liability for any application-related information, support, assistance or feedback that may be provided by Diodes from time to time. Any customer or user of this document or products described herein will assume all risks and liabilities associated with such use, and will hold Diodes and all companies whose products are represented herein or on Diodes' websites, harmless against all damages and liabilities.
4. Products described herein may be covered by one or more United States, international or foreign patents and pending patent applications. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks and trademark applications. Diodes does not convey any license under any of its intellectual property rights or the rights of any third parties (including third parties whose products and services may be described in this document or on Diodes' website) under this document.
5. Diodes' products are provided subject to Diodes' Standard Terms and Conditions of Sale (<https://www.diodes.com/about/company/terms-and-conditions/terms-and-conditions-of-sales/>) or other applicable terms. This document does not alter or expand the applicable warranties provided by Diodes. Diodes does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.
6. Diodes' products and technology may not be used for or incorporated into any products or systems whose manufacture, use or sale is prohibited under any applicable laws and regulations. Should customers or users use Diodes' products in contravention of any applicable laws or regulations, or for any unintended or unauthorized application, customers and users will (a) be solely responsible for any damages, losses or penalties arising in connection therewith or as a result thereof, and (b) indemnify and hold Diodes and its representatives and agents harmless against any and all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim relating to any noncompliance with the applicable laws and regulations, as well as any unintended or unauthorized application.
7. While efforts have been made to ensure the information contained in this document is accurate, complete and current, it may contain technical inaccuracies, omissions and typographical errors. Diodes does not warrant that information contained in this document is error-free and Diodes is under no obligation to update or otherwise correct this information. Notwithstanding the foregoing, Diodes reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes.
8. Any unauthorized copying, modification, distribution, transmission, display or other use of this document (or any portion hereof) is prohibited. Diodes assumes no responsibility for any losses incurred by the customers or users or any third parties arising from any such unauthorized use.
9. This Notice may be periodically updated with the most recent version available at <https://www.diodes.com/about/company/terms-and-conditions/important-notice>

The Diodes logo is a registered trademark of Diodes Incorporated in the United States and other countries.
All other trademarks are the property of their respective owners.
© 2024 Diodes Incorporated. All Rights Reserved.

www.diodes.com