

TPS62148 Buck Converter Evaluation Module User's Guide



ABSTRACT

This user's guide describes the characteristics, operation, and use of TI's TPS62148 evaluation module (EVM). These EVMs are designed to help the user easily evaluate and test the operation and functionality of the TPS62148 2-A buck converters. The EVMs convert a 3-V to 17-V input voltage to a regulated 3.3-V output voltage that delivers up to 2 A. This user's guide includes setup instructions for the hardware, a printed-circuit board (PCB) layout, a schematic diagram, a bill of materials (BOM), and test results of the EVMs.

Table of Contents

1 Introduction	2
1.1 Performance Specification	2
1.2 Modifications	2
2 Setup	4
2.1 Connector Descriptions	4
2.2 Hardware Setup	4
3 TPS62148EVM-034 Test Results	4
4 Board Layout	5
5 Schematic and Bill of Materials	8
5.1 Schematic	8
5.2 Bill of Materials	9
6 Revision History	9

List of Figures

Figure 1-1. Loop Response Measurement Modification	3
Figure 4-1. Assembly Layer	5
Figure 4-2. Top Layer	5
Figure 4-3. Internal Layer 1	6
Figure 4-4. Internal Layer 2	6
Figure 4-5. Bottom Layer	7
Figure 5-1. TPS62148EVM-034 Schematic	8

List of Tables

Table 1-1. Performance Specification Summary	2
Table 5-1. TPS62148EVM-034 Bill of Materials	9

Trademarks

All trademarks are the property of their respective owners.

1 Introduction

The TPS62148 is a 2-A, synchronous, step-down converter in 3 mm × 2 mm, 11-pin QFN package. The TPS62148EVM-034 (PWR034) uses the TPS62148 integrated circuit (IC) which operates with a nominal switching frequency of 2.5 MHz.

1.1 Performance Specification

[Table 1-1](#) provides a summary of the TPS62148EVM-034 performance specifications. All specifications are given for an ambient temperature of 25°C.

Table 1-1. Performance Specification Summary

Specification	Test Conditions	MIN	TYP	MAX	Unit
Input voltage		3		17	V
Output current		0		2	A

1.2 Modifications

The printed-circuit board (PCB) for this EVM is designed to accommodate the adjustable voltage version of this integrated circuit (IC). On the EVM, additional input and output capacitors can be added, the soft-start time can be changed, the tracking voltage and the input voltage at which the IC turns on can be adjusted. Finally, the loop response of the IC can be measured.

1.2.1 Input and Output Capacitors

C5 is provided for an additional input capacitor. This capacitor is not required for proper operation but can be used to reduce the input voltage ripple.

C8 and C9 are provided for additional output capacitors. These capacitors are not required for proper operation but can be used to reduce the output voltage ripple and to improve the load transient response. For output voltages higher than 5 V, more output capacitance is necessary. The total output capacitance must remain within the recommended range in [Data sheet title](#) for proper operation.

1.2.2 Soft-Start Time

C3 controls the soft-start time of the output voltage on the TPS62148EVM-034. It can be changed for a shorter or slower ramp up of Vout. Note that as the value of C3 is decreased, the inrush current increases.

1.2.3 Configurable Tracking Voltage

R5 and R6 can be installed to set a user-selectable tracking voltage. See the equations in the data sheet for details of calculating the resistor values.

1.2.4 Configurable Enable Threshold Voltage

With JP1 removed, R7 and R8 can be installed to set a user-selectable input voltage at which the IC turns on. See the equations in the data sheet for details of calculating the resistor values.

1.2.5 Loop Response Measurement

The loop response of the TPS62148EVM-034 can be measured with two simple changes to the circuitry. First, install a 10-Ω resistor across the pads in the middle of the back of the PCB. The pads are spaced to allow installation of 0603-sized resistors. Second, cut the trace between the via on the VOS pin on the top layer and output capacitor. These changes are shown in [Figure 1-1](#). With these changes, an ac signal (10-mV, peak-to-peak amplitude recommended) can be injected into the control loop across the added resistor.

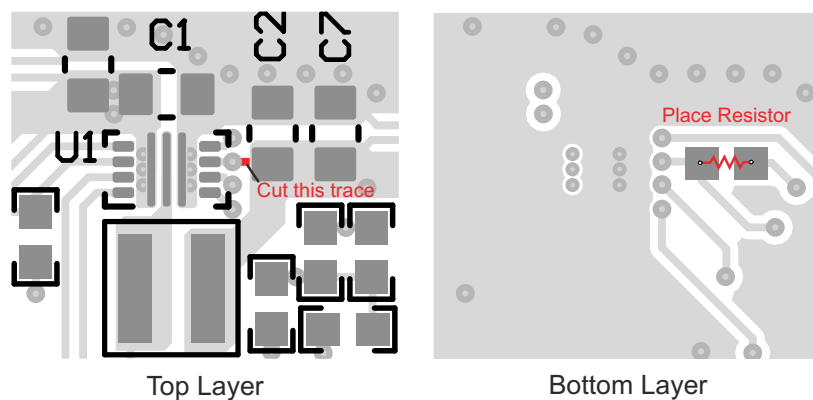


Figure 1-1. Loop Response Measurement Modification

2 Setup

This section describes how to properly use the TPS62148EVM-034.

2.1 Connector Descriptions

J1, Pin 1 and 2 – VIN	Positive input voltage connection from the input supply for the EVM.
J1, Pin 3 and 4 – S+/S–	Input voltage sense connections. Measure the input voltage at this point.
J1, Pin 5 and 6 – GND	Input return connection from the input supply for the EVM.
J2, Pin 1 and 2 – VOUT	Positive output voltage connection.
J2, Pin 3 and 4 – S+/S–	Output voltage sense connections. Measure the output voltage at this point.
J2, Pin 5 and 6 – GND	Output return connection.
J3 – SS/TR/GND	The SS/TR pin voltage appears on pin 1 of this header with a convenient ground on pin 3.
J3 – TRACK-IN	The TRACK-IN pin can be used to scale down a tracking-voltage.
J4 – PG/GND	The PG output appears on pin 1 of this header with a convenient ground on pin 2.
JP1 – EN	EN pin jumper. Place the supplied jumper across ON and EN to turn on the IC. Place the jumper across OFF and EN to turn off the IC.
JP2 – MODE	Mode pin jumper. Place the supplied jumper across PWM and MODE to operate the converter in a forced PWM mode. Placed the jumper across MODE and PFM to operate the converter in power-saving mode.
JP3 – FSEL	FSEL pin jumper. Place the supplied jumper across LOW and FSEL to operate the IC at a reduced switching frequency of nominally 1.25MHz. Place the jumper across HIGH and FSEL to operate the IC at the full switching frequency of nominally 2.5MHz.
JP4 – PG Pullup Voltage	PG pin pullup voltage jumper. Place the supplied jumper on JP4 to connect the PG pin pullup resistor to the output voltage. Alternatively, the jumper can be removed and a different voltage can be supplied on pin 1 to pull up the PG pin to a different level. This externally applied voltage must remain below 6 V.

2.2 Hardware Setup

To operate the EVM, set jumpers JP1 through JP4 to the desired positions per [Section 2.1](#). Connect the input supply to J1, and connect the load to J2.

3 TPS62148EVM-034 Test Results

The TPS62148EVM-034 was used to take the data in [Data sheet title](#). See the device data sheet for the performance of this EVM.

This section provides the TPS62148EVM-034 board layout and illustrations. The Gerbers are available on the EVM product page: [TPS62148EVM-034](#).

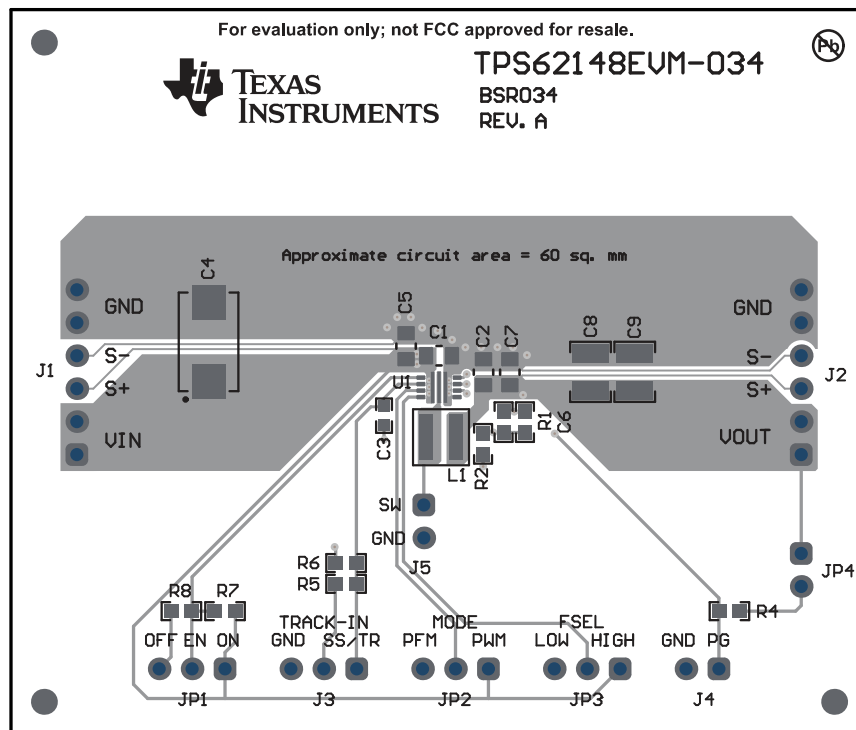


Figure 4-1. Assembly Layer

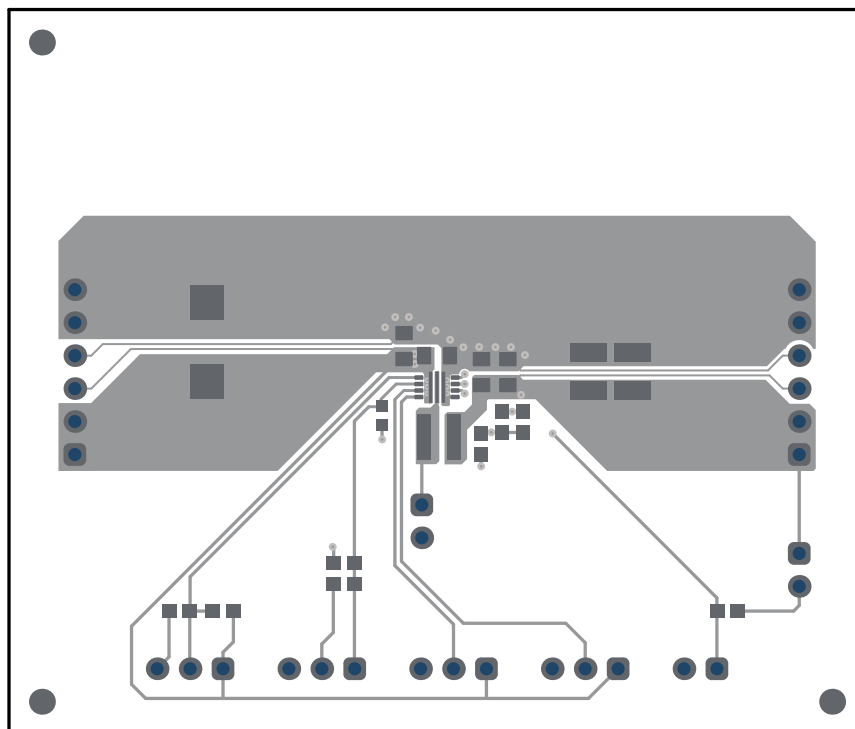
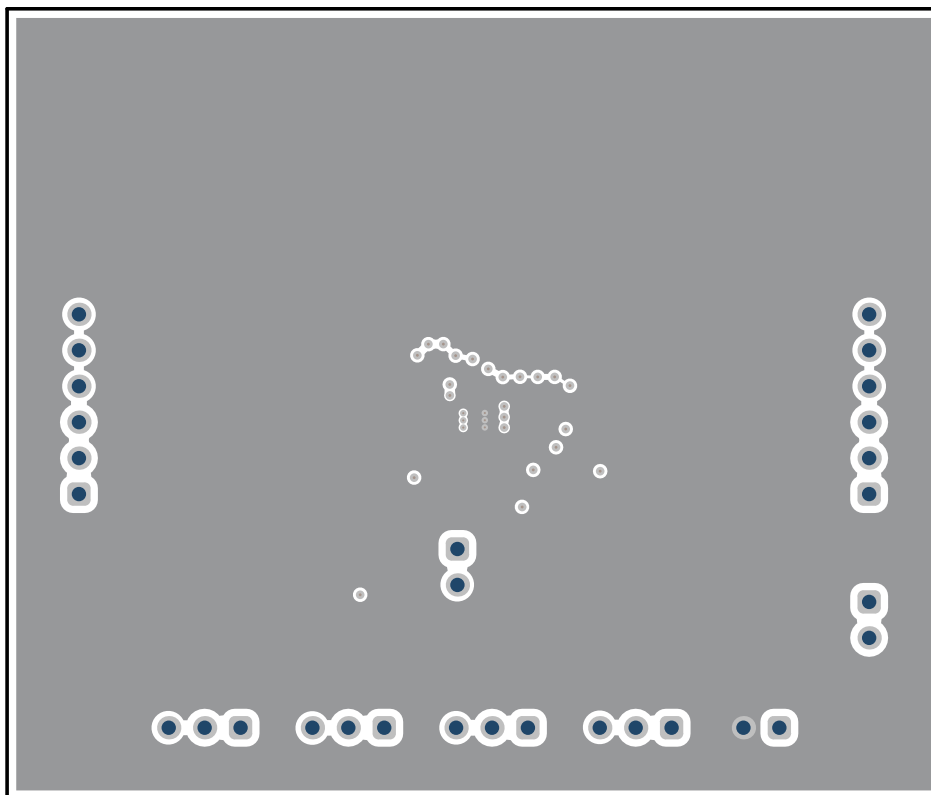
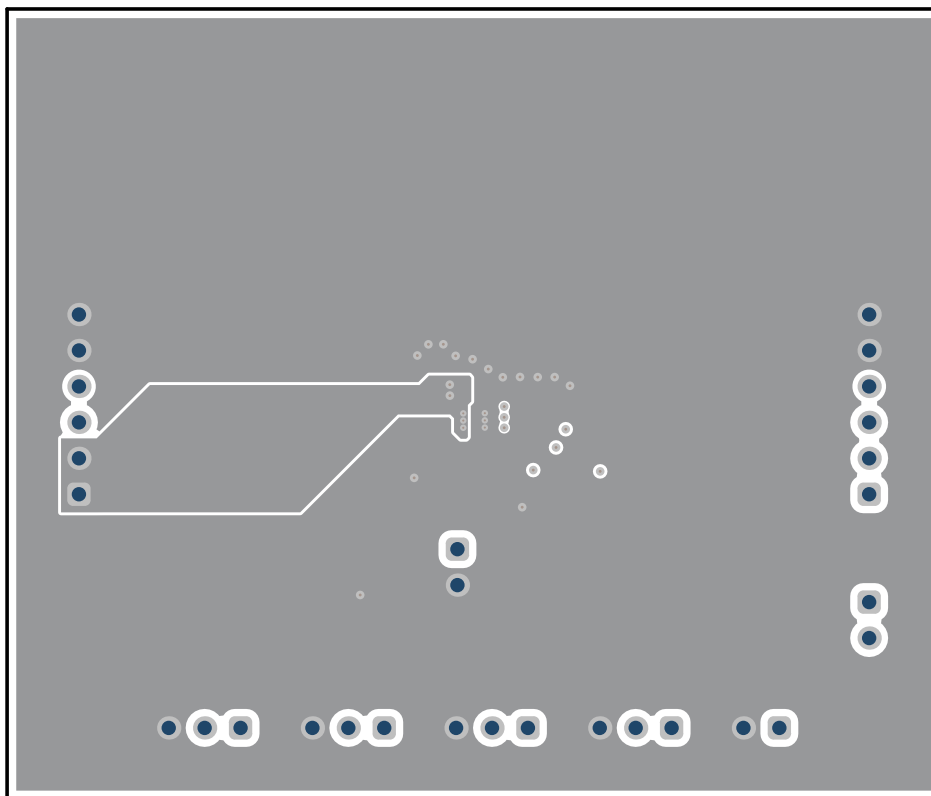


Figure 4-2. Top Layer

**Figure 4-3. Internal Layer 1****Figure 4-4. Internal Layer 2**

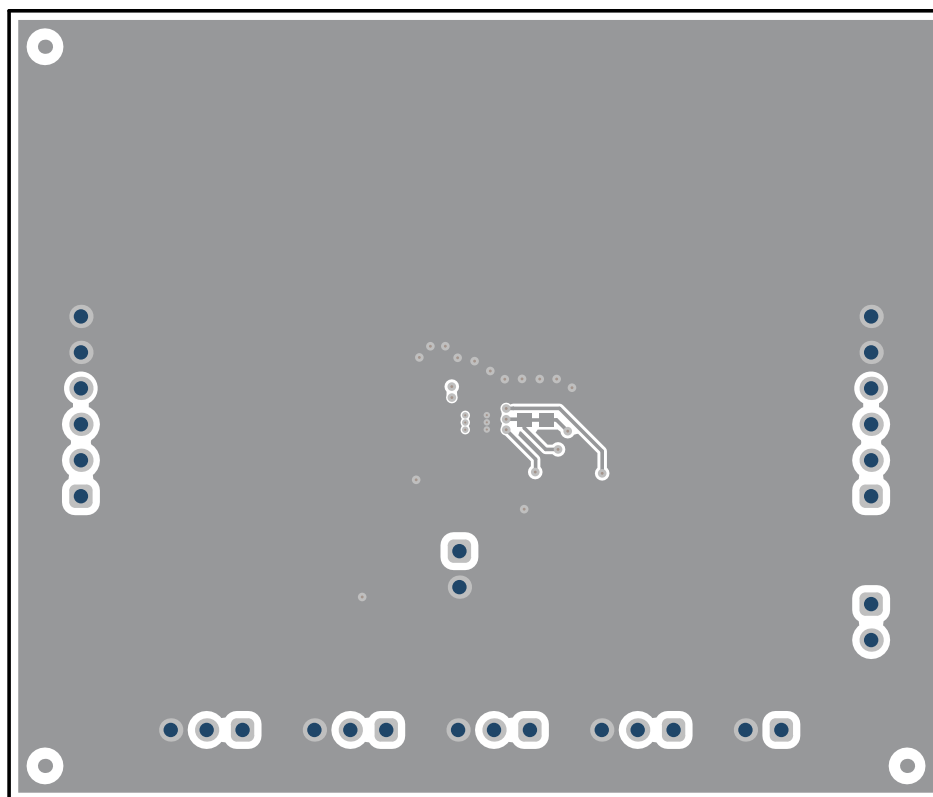


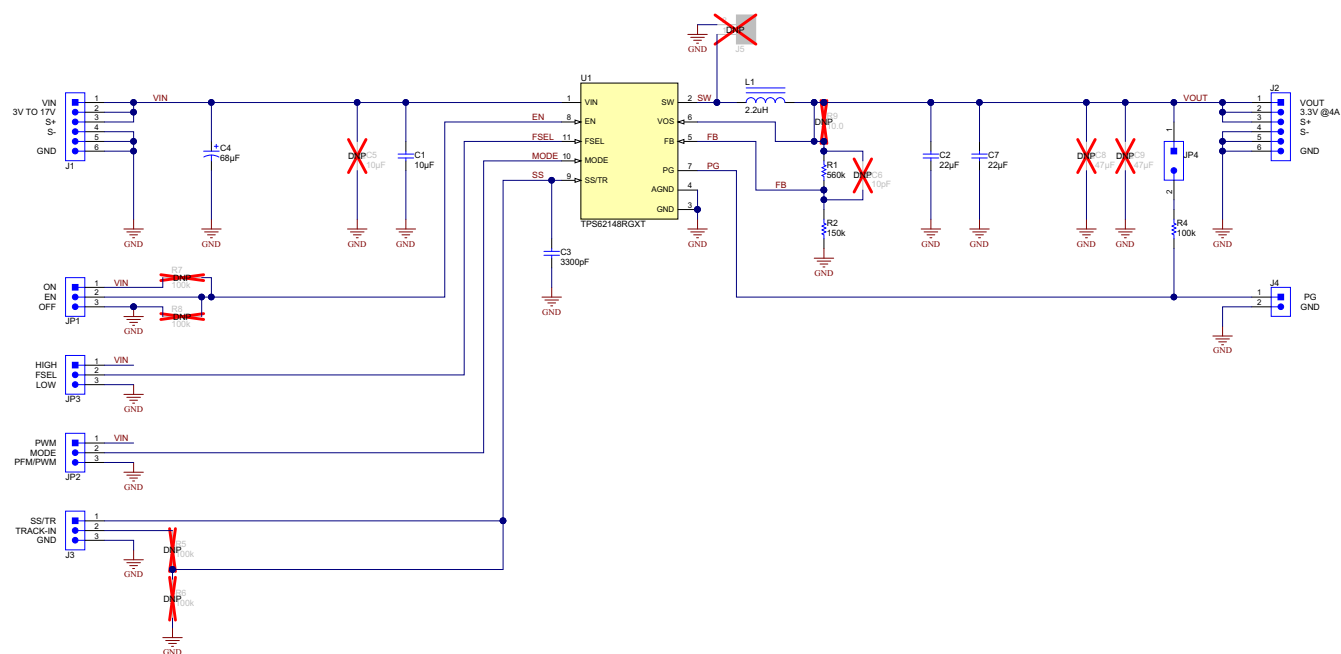
Figure 4-5. Bottom Layer

5 Schematic and Bill of Materials

This section provides the TPS62148EVM-034 schematic and bill of materials.

5.1 Schematic

Figure 5-1 illustrates the TPS62148EVM-034 schematics.



Copyright © 2018, Texas Instruments Incorporated

Figure 5-1. TPS62148EVM-034 Schematic

5.2 Bill of Materials

Table 5-1 lists the BOM for the TPS62148EVM-034.

Table 5-1. TPS62148EVM-034 Bill of Materials

Qty	Ref Des	Value	Description	Size	Part Number	Manufacturer
1	C1	10 μ F	Capacitor, Ceramic, 25V, X5R, $\pm$ 10%	0805	TMK212BBJ106KG-T	Taiyo Yuden
1	C2, C7	22 μ F	Capacitor, Ceramic, 16V, X5R, $\pm$ 10%	0805	EMK212BBJ226MG-T	Taiyo Yuden
1	C3	3300 pF	Capacitor, Ceramic, 50V, C0G/NP0, $\pm$ 5%	0603	Std	Std
1	C4	68 μ F	Capacitor, Tantalum, 35V, 68uF, $\pm$ 20%	7343-43	TPSE686M025R0125	AVX
1	L1	2.2 μ H	Inductor, Shielded, 3.7A, 0.02 Ω , $\pm$ 20%	4x4x2 mm	XFL4020-222MEB	Coilcraft
1	R1	560k	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	R2	150k	Resistor, Chip, 1/16W, 1%	0603	Std	Std
1	U1	TPS62148	IC, 17V 2-A Step-Down Converter	2x3 mm	TPS62148RGX TI	TI

6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (March 2018) to Revision A (June 2021)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document.	2
• Updated user's guide title.....	2

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](#) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2022, Texas Instruments Incorporated