

## **LM48580 Evaluation Module**

---



---



---

This user's guide describes the characteristics, operation, and use of the LM48580 Evaluation Module (EVM). A complete schematic diagram, printed-circuit board layouts, and bill of materials (BOM) are included in this document.

### **Contents**

1	Introduction .....	2
2	Quick Start Guide .....	2
3	General Description .....	3
4	Operating Conditions .....	3
5	Application Circuit Schematic .....	3
6	Connections .....	4
7	PCB Layout Guidelines .....	4
8	Bill Of Materials .....	5
9	Demonstration Board PCB Layout .....	6

### **List of Figures**

1	LM48580 Demonstration Board.....	2
2	Demonstration Board Schematic .....	3
3	Top Overlay .....	6
4	Top Solder Mask.....	6
5	Top Layer .....	6
6	Bottom Layer .....	6
7	Bottom Solder Mask.....	6
8	Drill Drawing .....	6

### **List of Tables**

1	Operating Conditions.....	3
2	Connections .....	4
3	LM48580 Bill of Materials.....	5

### **Trademarks**

All trademarks are the property of their respective owners.

## 1 Introduction

To help the user investigate and evaluate the LM48580 performance and capabilities, a fully-populated demonstration board was created. [Figure 1](#) shows the board.

Connected to an external power supply ( $2.5\text{ V} \leq V_{DD} \leq 5.5\text{ V}$ ) and a signal source, the LM48580 demonstration board easily exercises features of the amplifier.



**Figure 1. LM48580 Demonstration Board**

## 2 Quick Start Guide

Use the following steps to set up the EVM board in hardware mode:

1. Short pins 1 (VDD) and 2 of J1 for normal operation.
2. Short pins 1 (VDD) and 2 on J3 to set the GAIN to 30 dB.
3. Connect the load across OUT+ and OUT-.
4. Connect a power supply (2.5 V to 5.5 V) and ground reference, respectively, to the VDD and GND headers on the demo board.
5. Connect a differential audio input to IN+ and IN-.
6. Power on the board and observe the output on OUT+ and OUT-.

### 3 General Description

The LM48580 is a high-voltage, high-efficiency, Class H driver for ceramic speakers and piezo actuators. The Class H architecture of the LM48580 offers significant power savings compared to traditional Class AB amplifiers. The device provides 30 V<sub>pp</sub> output drive while consuming only 2.7 mA of quiescent current from a 3.6-V supply.

The LM48580 features one fully-differential input, a programmable gain pin, and a shutdown pin. The gain pin has three settings for 18 dB, 24 dB, and 30 dB. The LM48580 has a low power shutdown mode that reduces quiescent current consumption to 0.5 μA.

### 4 Operating Conditions

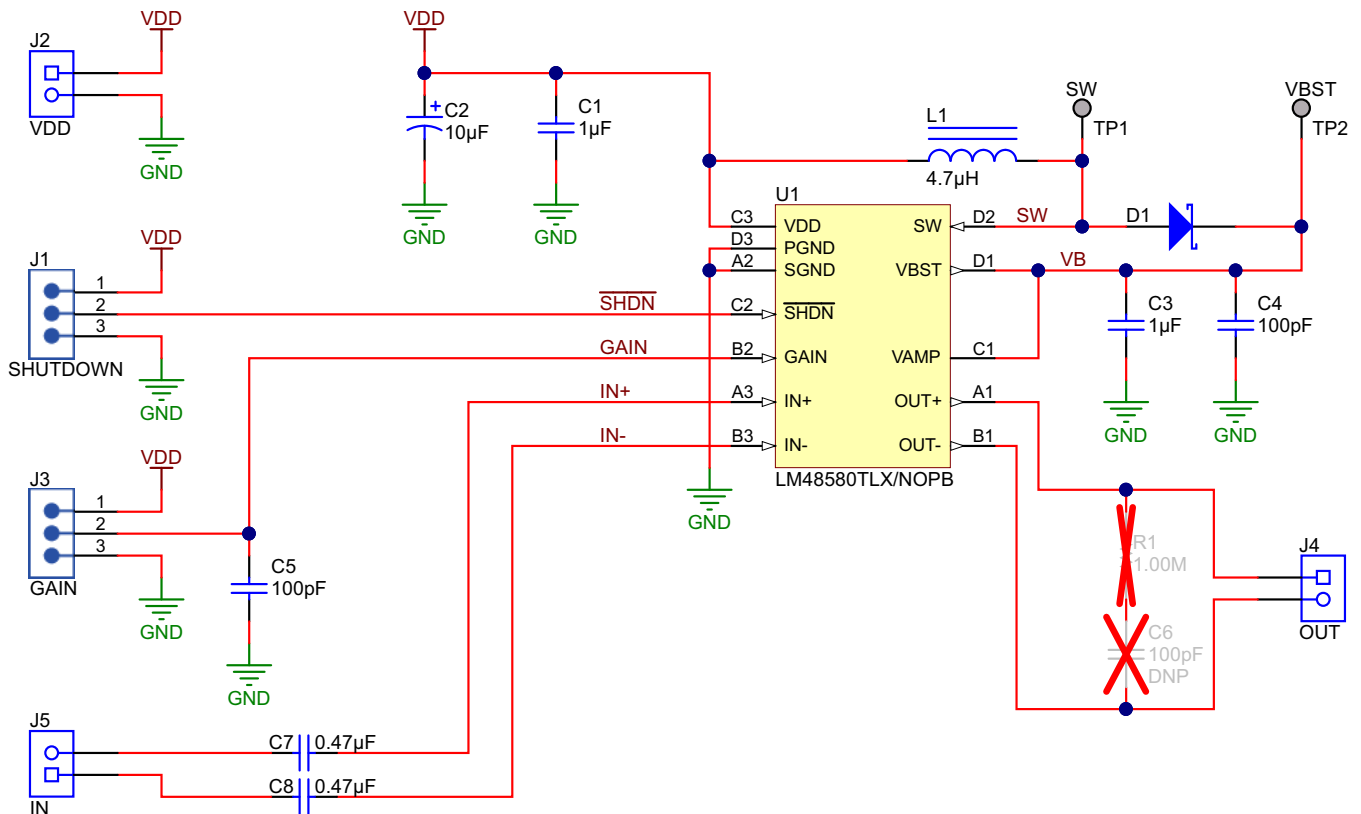
Table 1 lists the temperature range and supply voltage conditions for the EVM.

Table 1. Operating Conditions

Temperature Range: T <sub>MIN</sub> ≤ T <sub>A</sub> ≤ T <sub>MAX</sub>	-40°C ≤ T <sub>A</sub> ≤ 85°C
Supply Voltage (V <sub>DD</sub> )	2.5 V ≤ V <sub>DD</sub> ≤ 5.5 V

### 5 Application Circuit Schematic

Figure 2 shows the demonstration board schematic.



Copyright © 2017, Texas Instruments Incorporated

Figure 2. Demonstration Board Schematic

## 6 Connections

Table 2 lists the connections on the EVM board.

**Table 2. Connections**

Designator	Function	Notes
J1	Shutdown	Active Low Shutdown. Drive SHDN low to disable the device. Connect SHDN to VDD for normal operation.
J2	VDD/GND	Power supply and ground reference.
J3	GAIN	Gain select: GAIN = float: AV = 18 dB GAIN = GND: AV = 24 dB GAIN = VDD: AV = 30 dB
J4	OUT±	Positive and negative output terminals.
J5	IN±	Positive and negative input terminals.

## 7 PCB Layout Guidelines

Minimize trace impedance of the power, ground and all output traces for optimum performance. Voltage loss due to trace resistance between the LM48580 and the load results in decreased output power and efficiency. Trace resistance between the power supply and ground has the same effect as a poorly regulated supply: increased ripple and reduced peak output power. Use wide traces for power supply inputs and amplifier outputs to minimize losses due to trace resistance, as well as route heat away from the device. Proper grounding improves audio performance, minimizes crosstalk between channels and prevents switching noise from interfering with the audio signal. Use of power and ground planes is recommended.

## 8 Bill Of Materials

Table 3 lists the bill of materials for the EVM.

**Table 3. LM48580 Bill of Materials**

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
PCB	1		Printed Circuit Board		AAP086	Any	–	–
C1, C3	2	1 $\mu$ F	Capacitor, ceramic, 1 $\mu$ F, 16 V, $\pm$ 10%, X7R, 0603	0603	GRM188R71C105KE15D	MuRata		
C2	1	10 $\mu$ F	Capacitor, TA, 10 $\mu$ F, 16 V, $\pm$ 10%, 0.8 $\Omega$ , SMD	3528-21	TPSB106K016R0800	AVX		
C4, C5	2	100 pF	Capacitor, ceramic, 100 pF, 50 V, $\pm$ 5%, COG/NP0, 0603	0603	GRM1885C1H101JA01D	MuRata		
C7, C8	2	0.47 $\mu$ F	Capacitor, ceramic, 0.47 $\mu$ F, 10 V, $\pm$ 10%, X5R, 0603	0603	GRM188R61A474KA61D	MuRata		
D1	1	20 V	Diode, Schottky, 20 V, 0.5 A, AEC-Q101, SOD-523	SOD-523	NSR0520V2T1G	ON Semiconductor		
H1, H2, H3, H4	4		Bumpon, Hemisphere, 0.44 x 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M		
J1, J3	2		Header, 100 mil, 3 x 1, Gold, TH	PBC03SAAN	PBC03SAAN	Sullins Connector Solutions		
J2, J4, J5	3		Terminal Block, 2 x 1, 2.54 mm, TH	Terminal Block, 2 x 1, 2.54 mm, TH	282834-2	TE Connectivity		
L1	1	4.7 $\mu$ H	Inductor, Wirewound, 4.7 $\mu$ H, 1 A, 0.216 $\Omega$ , SMD	1210	BRL3225T4R7M	Taiyo Yuden		
SH1, SH2	2	1 x 2	Shunt, 100 mil, Gold plated, Black	Shunt	969102-0000-DA	3M	SNT-100-BK-G	Samtec
U1	1		High Efficiency Class H, High Voltage, Haptic Piezo Actuator / Ceramic Speaker Driver, 12-pin Micro SMD, Pb-Free	TLA12Z1A	LM48580TLX/NOPB	Texas Instruments		
C6	0	100 pF	Capacitor, ceramic, 100 pF, 50 V, $\pm$ 5%, COG/NP0, 0603	0603	GRM1885C1H101JA01D	MuRata		
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A		
R1	0	1.00 Meg	RES, 1.00 M, 1%, 0.1 W, 0603	0603	RC0603FR-071ML	Yageo America		

## 9 Demonstration Board PCB Layout

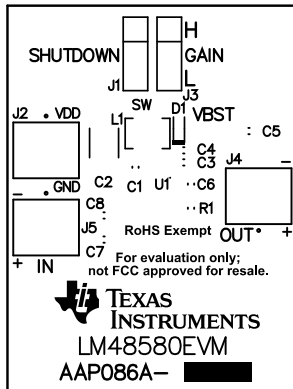


Figure 3. Top Overlay

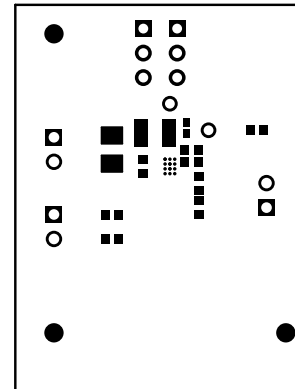


Figure 4. Top Solder Mask

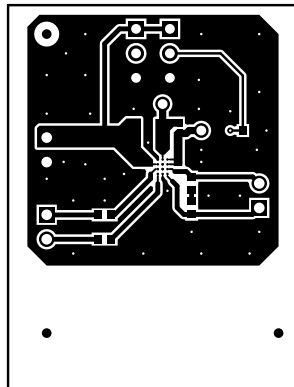


Figure 5. Top Layer

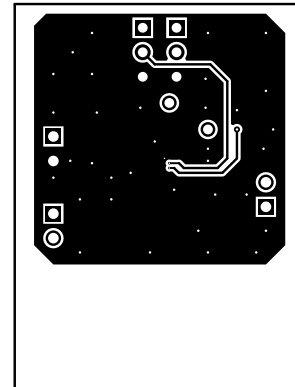


Figure 6. Bottom Layer

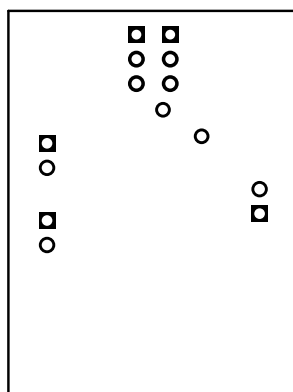


Figure 7. Bottom Solder Mask

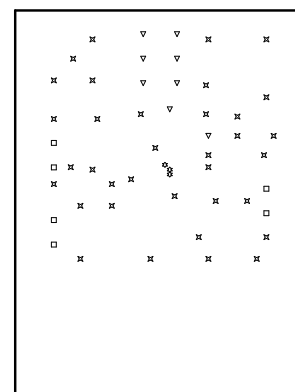


Figure 8. Drill Drawing

### Revision History

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

Date	Revision	Description
February 2018	*	Initial Release

## IMPORTANT NOTICE FOR TI DESIGN INFORMATION AND RESOURCES

Texas Instruments Incorporated ("TI") technical, application or other design advice, services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using any particular TI Resource in any way, you (individually or, if you are acting on behalf of a company, your company) agree to use it solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources.

You understand and agree that you remain responsible for using your independent analysis, evaluation and judgment in designing your applications and that you have full and exclusive responsibility to assure the safety of your applications and compliance of your applications (and of all TI products used in or for your applications) with all applicable regulations, laws and other applicable requirements. You represent that, with respect to your applications, you have all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. You agree that prior to using or distributing any applications that include TI products, you will thoroughly test such applications and the functionality of such TI products as used in such applications. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

You are authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING TI RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY YOU AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

You agree to fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of your non-compliance with the terms and provisions of this Notice.

This Notice applies to TI Resources. Additional terms apply to the use and purchase of certain types of materials, TI products and services. These include; without limitation, TI's standard terms for semiconductor products (<http://www.ti.com/sc/docs/stdterms.htm>), [evaluation modules](#), and [samples](http://www.ti.com/sc/docs/sampterm.htm) (<http://www.ti.com/sc/docs/sampterm.htm>).

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2018, Texas Instruments Incorporated