

TPA3008D2EVM

10-W Stereo Class-D Audio Power Amplifier

User's Guide

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information 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.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265

EVM IMPORTANT NOTICE

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation kit being sold by TI is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not considered by TI to be fit for commercial use. As such, the goods being provided may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety measures typically found in the end product incorporating the goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may not meet the technical requirements of the directive.

Should this evaluation kit not meet the specifications indicated in the EVM User's Guide, the kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Please be aware that the products received may not be regulatory compliant or agency certified (FCC, UL, CE, etc.). Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive**.

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein**.

Please read the EVM User's Guide and, specifically, the EVM Warnings and Restrictions notice in the EVM User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact the TI application engineer.

Persons handling the product must have electronics training and observe good laboratory practice standards.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265

EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the supply voltage range specified in this user's guide. The supply voltage range should be 8.5 V to 18 V, and supply current (I_{CC}) should be no greater than 3 A maximum.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 60°C. The EVM is designed to operate properly with certain components above 60°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265

Read This First

Information About Cautions and Warnings

This book may contain cautions and warnings.

This is an example of a caution statement.

A caution statement describes a situation that could potentially damage your software or equipment.

This is an example of a warning statement.

A warning statement describes a situation that could potentially cause harm to you.

The information in a caution or a warning is provided for your protection. Please read each caution and warning carefully.

FCC Warning

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

Electrostatic Sensitive Devices



This EVM contains components that can potentially be damaged by electrostatic discharge. Always transport and store the EVM in its supplied ESD bag when not in use. Handle using an antistatic wristband. Operate on an antistatic work surface. For more information on proper handling, refer to SSYA008.

Related Documentation From Texas Instruments

- TPA3008D2 data sheet (SLOS435)

Contents

1	Introduction	1-1
1.1	Description	1-2
1.2	TPA3008D2EVM Specifications	1-2
2	Operation	2-1
2.1	Quick Start List for Stand-Alone Operation	2-2
2.1.1	Power Supply	2-2
2.1.2	Inputs and Outputs	2-2
2.1.3	Evaluation Module Preparations	2-2
2.1.4	Control Inputs	2-2
2.1.5	Control Output	2-3
2.1.6	Power Up	2-3
3	Reference	3-1
3.1	TPA3008D2EVM Schematic	3-2
3.2	EVM PCB Layers	3-3
3.3	TPA3008D2EVM Parts List	3-4

Figures

1-1	The TI TPA3008D2 Audio Power Amplifier EVM (Top View)	1-2
1-2	The TI TPA3008D2 Audio Power Amplifier EVM (Bottom View)	1-2
3-1	TPA3008D2EVM Schematic	3-2
3-2	TPA3008D2EVM (Top Layer)	3-3
3-3	TPA3008D2EVM (Bottom Layer)	3-3

Tables

2-1	TPA3008D2 Gain Settings	2-3
3-1	TPA3008D2EVM Parts List	3-4



Introduction

This chapter provides a brief description of the TPA3008D2EVM.

Topic	Page
1.1 Description	1-2
1.2 TPA3008D2EVM Specifications	1-2

1.1 Description

The TPA3008D2 audio power amplifier evaluation module is a 10-watt per channel class-D stereo audio power amplifier complete with a small number of external components mounted on a circuit board that measures approximately 2-1/4 inches by 1-3/4 inches (Figure 1–1 and Figure 1–2).

Figure 1–1. The TI TPA3008D2 Audio Power Amplifier EVM (Top View)

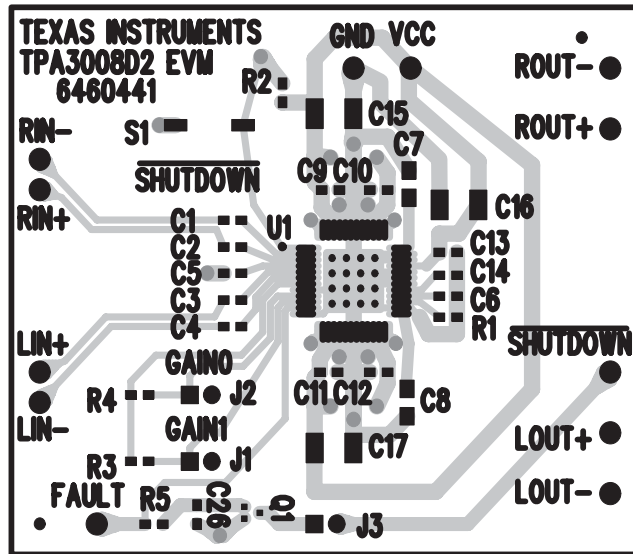
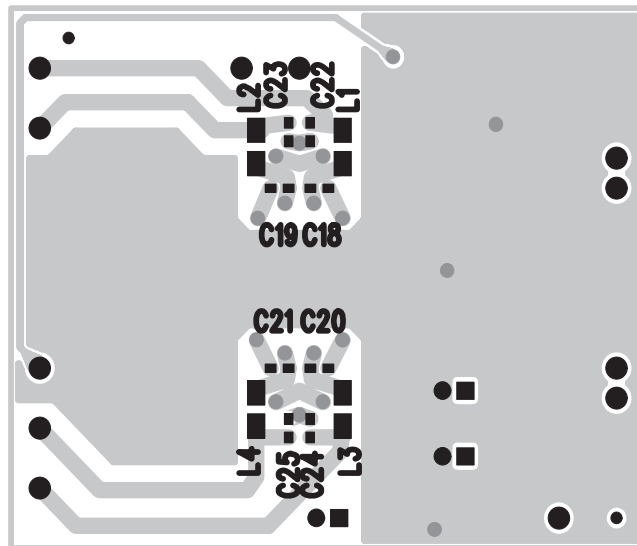


Figure 1–2. The TI TPA3008D2 Audio Power Amplifier EVM (Bottom View)



1.2 TPA3008D2EVM Specifications

Supply voltage range, V_{CC}	8.5 V to 18 V
Input voltage range, V_I (GAIN0, GAIN1, LINN, LINP, RINN, RINP)	-0.3 V to 6 V
V_I (SHUTDOWN)	-0.3 V to $V_{CC} + 0.3$ V
Supply current, I_{CC}	3 A Max
Continuous output power per channel, P_O : 16 Ω , $V_{CC} = 17$ V, THD+N = 10 %	10 W
Minimum load impedance, R_L	6 Ω

Operation

This chapter describes how to operate the TPA3008D2EVM.

Topic	Page
2.1 Quick Start List for Stand-Alone Operation	2-2

2.1 Quick Start List for Stand-Alone Operation

Follow these steps to use the TPA3008D2EVM stand-alone or when connecting it into existing circuits or equipment. Connections to the EVM module header pins can be made via individual sockets, wire-wrapping, or soldering to the pins, either on the top or the bottom of the module circuit board.

2.1.1 Power Supply

- 1) Ensure that all external power sources are set to OFF.
- 2) Connect an external regulated power supply, between 8.5 V and 18 V, to the module VCC and GND pins taking care to observe marked polarity.

2.1.2 Inputs and Outputs

- 1) Ensure that the audio signal source level adjustments are set to minimum.
- 2) Connect the right and left positive audio source to the module RIN+ and LIN+ pins, respectively. Connect the right and left negative audio source to the module RIN- and LIN- pins, respectively.
- 3) If using single-ended inputs, ground the LIN+ and RIN+ pins at the source and connect the signal source to RIN- and LIN-. Conversely, RIN- and LIN- should be grounded if RIN+ and LIN+ are connected to the signal source.

Note:

If RIN+ and LIN+ on the EVM are connected to ground, the RINP and LINP pins on the TPA3008D2 IC are ac-grounded through C2 and C3.

2.1.3 Evaluation Module Preparations

- 1) Adjust the signal source level as needed.

2.1.4 Control Inputs

Note:

See the TPA3008D2 data sheet for logic threshold voltage ratings.

- 1) **SHUTDOWN**: This pin is active low. A low on this pin shuts down the amplifier; a high on this pin places the amplifier in the active state. Leaving this pin floating also allows normal amplifier operation. Holding down switch S1 places the amplifier in the shutdown state. Releasing S1 returns the amplifier to the active state. The absolute maximum voltage on this terminal is $V_{CC} + 0.3$ V.
- 2) **GAIN0, GAIN1**: These pins control the amplifier gain. See Table 2-1.

2.1.5 Control Output

- 1) **FAULT:** This test point can be used to monitor the state of the FAULT output. A logic high on this pin indicates a short-circuit condition on one or both of the outputs. A logic low indicates normal amplifier operation. For automatic recovery from a short-circuit event, install a jumper in the J3 location.

Table 2–1. TPA3008D2 Gain Settings

GAIN1 (J1)	GAIN0 (J2)	GAIN (dB)
ON	ON	15.3
ON	OFF	21.2
OFF	ON	27.2
OFF	OFF	31.8

- ON = Jumper installed
 OFF = Jumper removed

2.1.6 Power Up

- 1) Verify correct voltage and input polarity and set the external power supply to ON. The EVM should begin operation.
- 2) Adjust the signal source level as needed.
- 3) Adjust the amplifier gain by installing or removing J1 and J2 jumpers. See Table 2–1.



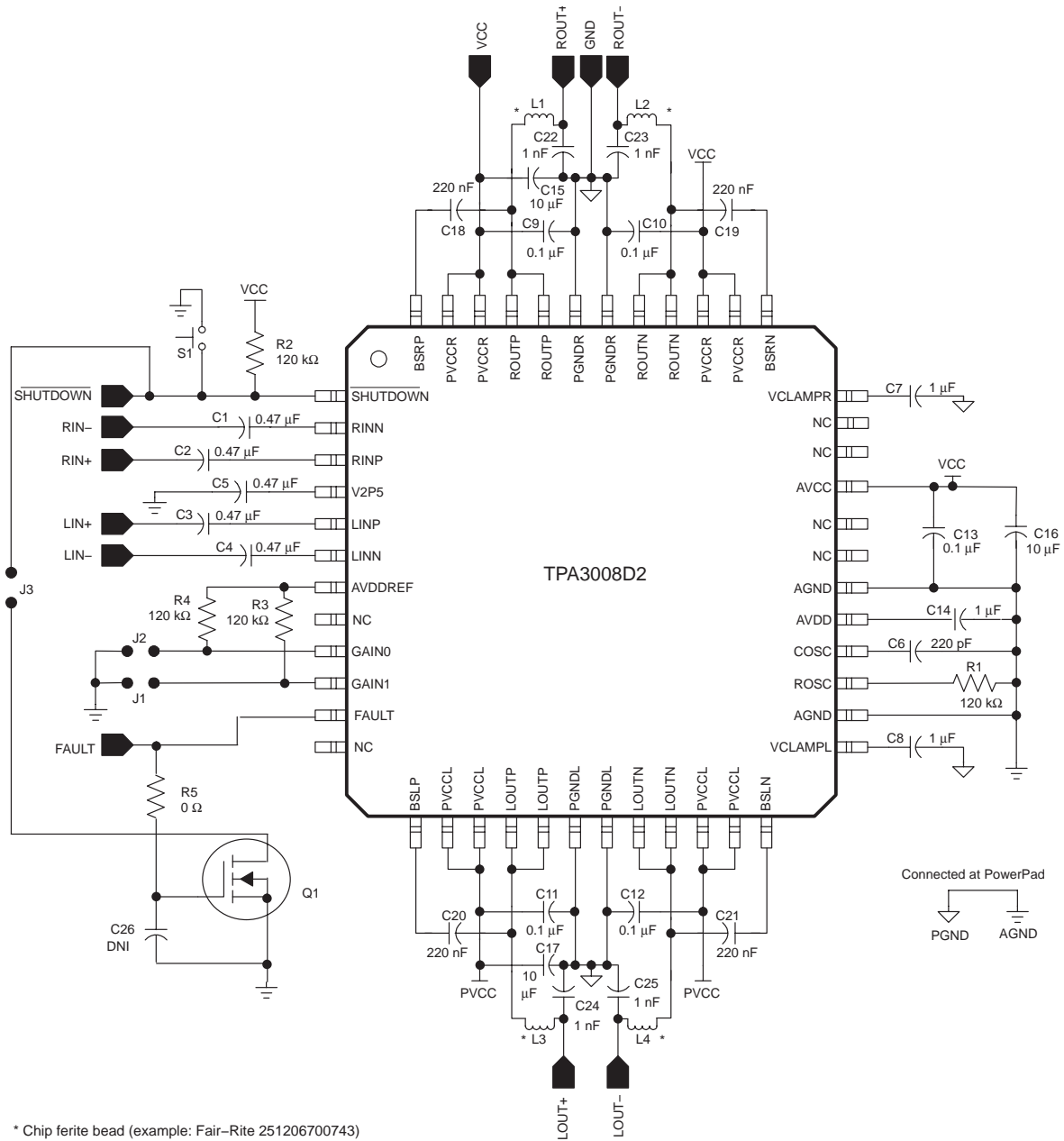
Reference

This chapter provides reference information for the TPA3008D2EVM.

Topic	Page
3.1 TPA3008D2EVM Schematic	3-2
3.2 EVM PCB Layers	3-3
3.3 TPA3008D2EVM Parts List	3-4

3.1 TPA3008D2EVM Schematic

Figure 3–1. TPA3008D2EVM Schematic



3.2 EVM PCB Layers

Figure 3–2. TPA3008D2EVM (Top Layer)

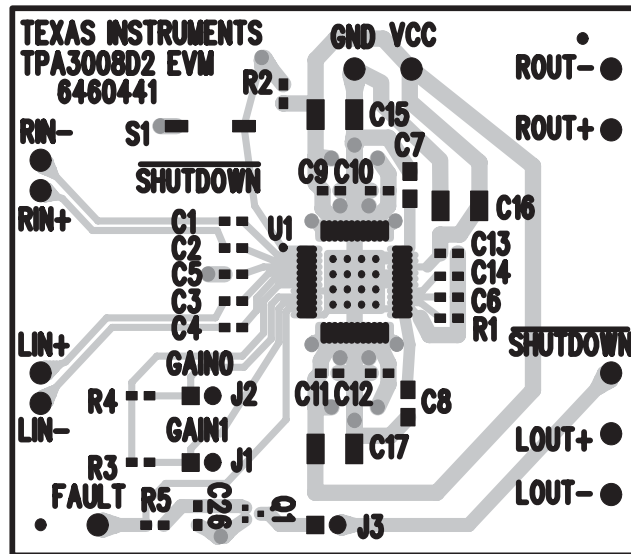
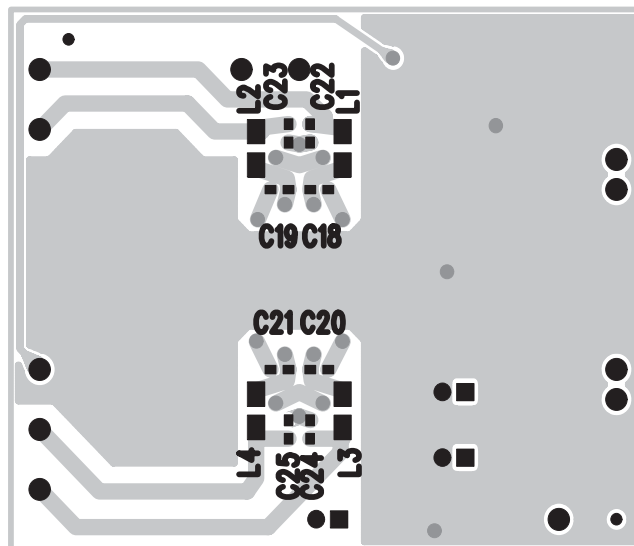


Figure 3–3. TPA3008D2EVM (Bottom Layer)



3.3 TPA3008D2EVM Parts List

Table 3–1. TPA3008D2EVM Parts List

Reference	Description	Size	Qty	Mfg.	Part #	Vendor Part #
C1–C5	Capacitor, ceramic, 0.47 μ F, +80%/–20%, Y5V, 16 V	0603	5	Panasonic	ECJ–1VF1C474Z	Digi-Key/ PCC1792
C6	Capacitor, ceramic, 220 pF, \pm 5%, 50 V	0603	1	Panasonic	ECJ–1VC1H221J	Digi-Key/ PCC221ACV
C7, C8	Capacitor, ceramic, 1.0 μ F, +80%/–20%, Y5V, 50 V	0805	2	Taiyo Yuden	UMK212F105ZG–T	TeCal/ UMK212F105ZG–T
C9–C13	Capacitor, ceramic, 0.1 μ F, +80%/–20%, Y5V, 50 V	0603	5	Panasonic	ECJ–1VF1H104Z	Digi-Key/ PCC2153
C14	Capacitor, ceramic, 1.0 μ F, +80%/–20%, Y5V, 10 V	0603	1	Murata	GRM188F51A105ZA01D	Digi-Key/ 490-1585-2
C15–C17	Capacitor, ceramic, 10 μ F, +80%/–20%, Y5V, 25 V	1210	3	Panasonic	ECJ–4YF1E106Z	Digi-Key/ PCC2171
C18–C21	Capacitor, ceramic, 0.22 μ F, +80%/–20%, Y5V, 16V	0603	4	Panasonic	ECJ–1VF1C224Z	Digi-Key/ PCC1790
C22–C25	Capacitor, ceramic, 1000 pF, \pm 10%, X7R, 50 V	0603	4	Panasonic	ECJ–1VB1H102K	Digi-Key/ PCC1772
C26	Do not install					
FAULT	Test point, 0.04" mounting hole		1	Farnell	240–345	
J1, J2, J3	Header, 2 position, male	2mm	3	Norcomp	2163–36–01–P2	Digi-Key/ 2163S–36
J1, J2, J3 (shunts)	SHUNT, 2MM	2mm	3	Specialty	2JM–G	
L1–L4	Ferrite bead, 0.05 Ω DCR, 70 Ω at 100 MHz, 3A	1206	4	Fair–rite	2512067007Y3	Mouser/ 623–2512067007Y3
Q1	N-channel MOSFET	SOT–523	1	Diodes, Inc.	2N7002T–7	Digi-Key/ 2N7002TDI
PnP pins	Headers, 0.1 in. centers, 1/2 in. long		11	Samtec	SW–19–8–G–S	
R1–R4	Resistor, chip, 120 k Ω , 1/16 W, 5%	0603	4	Panasonic	ERJ–3GEYJ124V	Digi-Key/ P120KG
R5	Resistor, 0 Ω , jumper, 1/10 W, 5%	0603	1	Panasonic	ERJ–3GEY0R00V	Digi-Key/ P0.0G
S1	Switch, momentary, SMD, low profile		1	Panasonic	EVQ–PPBA25	Digi-Key/ P8086S
U1	TPA3008D2PHP	48-pin QFP	1	TI	TPA3008D2PHP	