TPA5052EVM

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1 Introduction

1.1 Description

The TPA5052 evaluation module (EVM) consists of a single TPA5052 audio delay device, along with other external components mounted on a printed-circuit board (PCB). It can be used to digitally delay both channels by up to 8191 samples (with a 48-kHz sampling rate, that equates to more than 170 ms of delay).

The TPA5052EVM is designed so that analog music can be input to the board. The music is converted to I^2S digital format where the TPA5052 delays it. The music then is converted back to analog where it is fed to the TPA4411 audio amplifier. The output of the TPA4411 is connected to a 3.5-mm stereo headphone jack. A simple pair of stereo headphones are all that are required to listen to the music. This allows the user to quickly and easily use the TPA5052EVM to delay the television audio to synchronize with the video. Probe points also are provided.

Additional evaluation may be performed with small modifications that allow for direct interaction with the TPA5052 in I^2S format.

1.2 TPA5052EVM Specifications

+5 V	Supply Voltage	5 V
I_{DD}	Supply current	150 mA maximum

2 Operation

2.1 Quick Start List

Follow these steps to use the TPA5052EVM

2.2 Power Supply

1. Ensure that all external power sources are set to OFF.
2. Connect an external regulated power supply set to 5 V to the module +5V (**J8**) and GND (**J9**), taking care to observe marked polarity.

2.3 EVM Preparation

3. Ensure that the shunts are open on jumpers **J3** through **J7**. This jumper setting sets the TPA5052 to operate with minimum delay. If more delay is required, shunt the appropriate jumpers. See the TPA5052 data sheet for more information about delay settings.
4. Connect a cable from a music source, such as a CD player, to input jack **J1.** Insert headphones into output jack **J2**.

2.4 Operation

5. Turn on the power supply for the TPA5052EVM.
6. The Power On LED glows green, indicating that the EVM has adequate power.
7. Start playing music with the music source.
8. Place headphones on head and listen to the music.

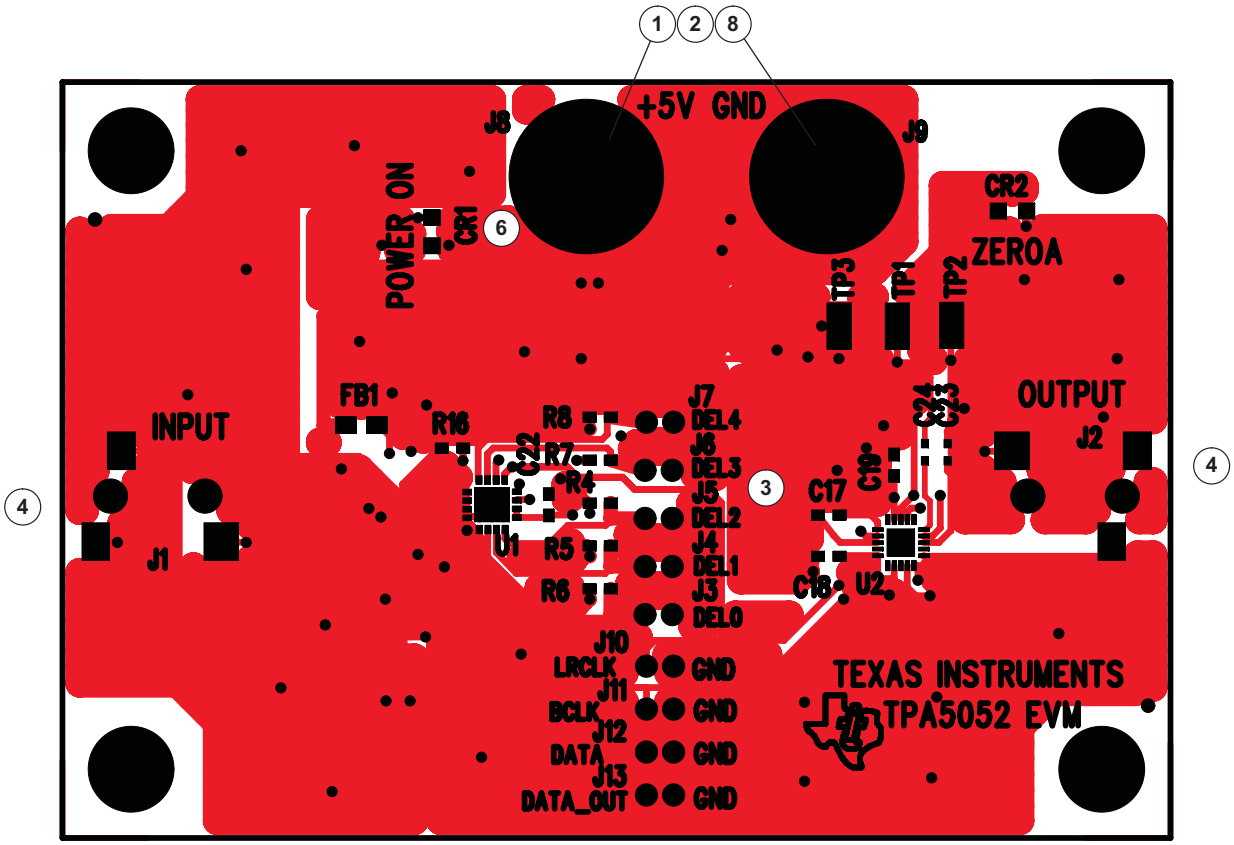


Figure 1. Top Layer of TPA5052EVM

3 Advanced Features

The TPA5052EVM is designed to allow for extensive evaluation of the TPA5052. Removing a few components allows for direct access to the TPA5052 and measurement of the delay.

3.1 Configuration for Advanced Measurements

If the need arises to directly evaluate the TPA5052 with digital data, follow these steps.

1. Ensure that no power supply or signal cables are connected to the TPA5052EVM.
2. Locate and remove resistors **R14** and **R15** on layer four of the PCB.
3. Locate and remove resistor **R16** on the top layer of the PCB.
4. Connect LRCLK of the source to **J10**. Be sure to ground the accompanying LRCLK ground to the adjoining GND pin for optimal performance
5. Connect BCLK of the source to **J11**. Be sure to ground the accompanying BCLK ground to the adjoining GND pin for optimal performance
6. Connect DATA of the source to **J12**. Be sure to ground the accompanying DATA ground to the adjoining GND pin for optimal performance
7. Connect the DATA_OUT pin **J13** and the associated GND to the measurement device.
8. Connect an external regulated power supply set to 5 V to the module +5V (**J8**) and GND (**J9**), taking care to observe marked polarity.
9. Turn on digital audio source.
10. The delay is changed by closing or opening jumpers **J3** through **J7**, and measuring the output with respect to the input.

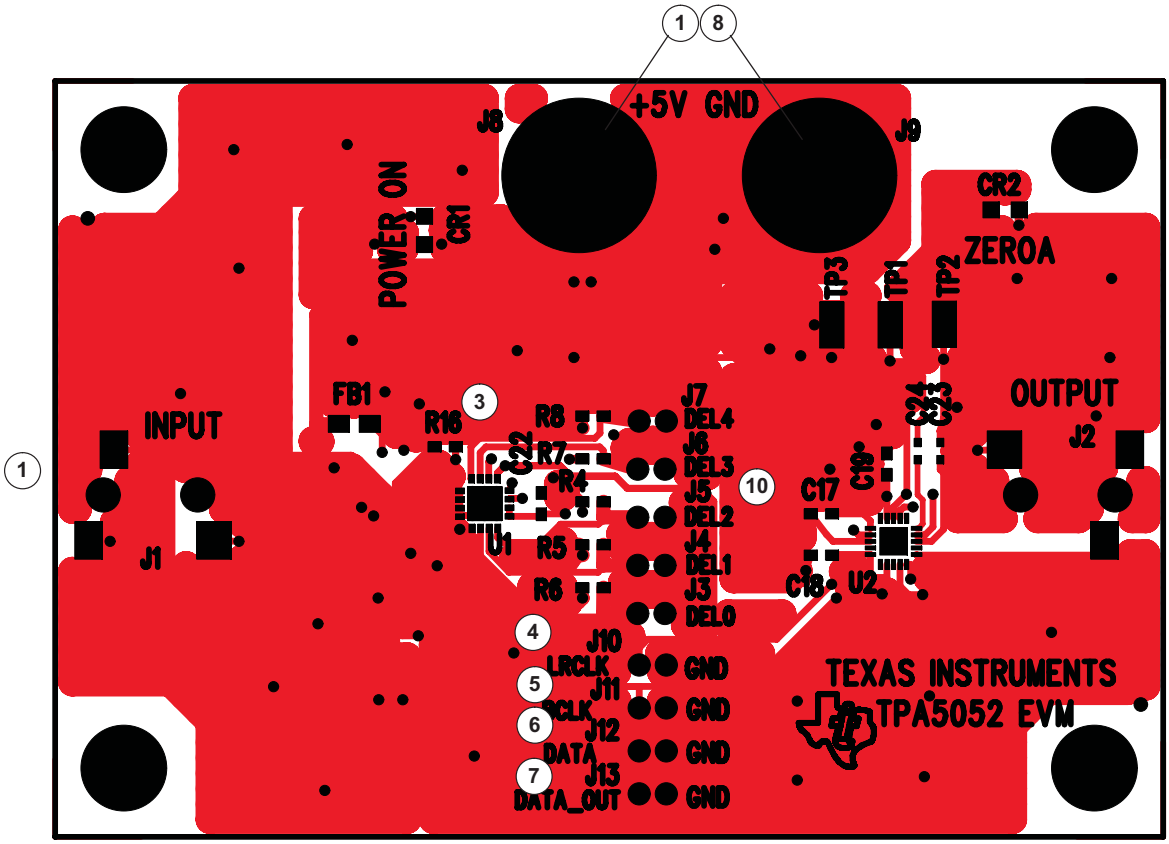


Figure 2. Top Layer of TPA5052EVM

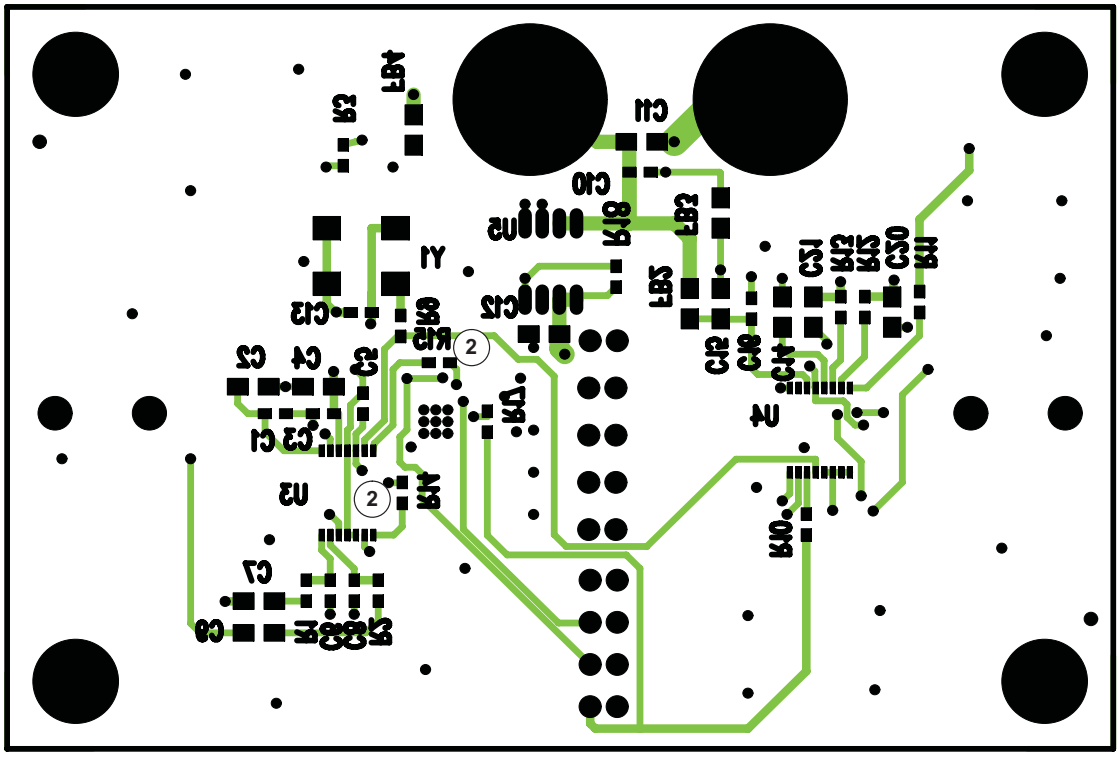


Figure 3. Bottom Layer of TPA5052EVM

4 Reference

4.1 TPA5052EVM PCB Layers

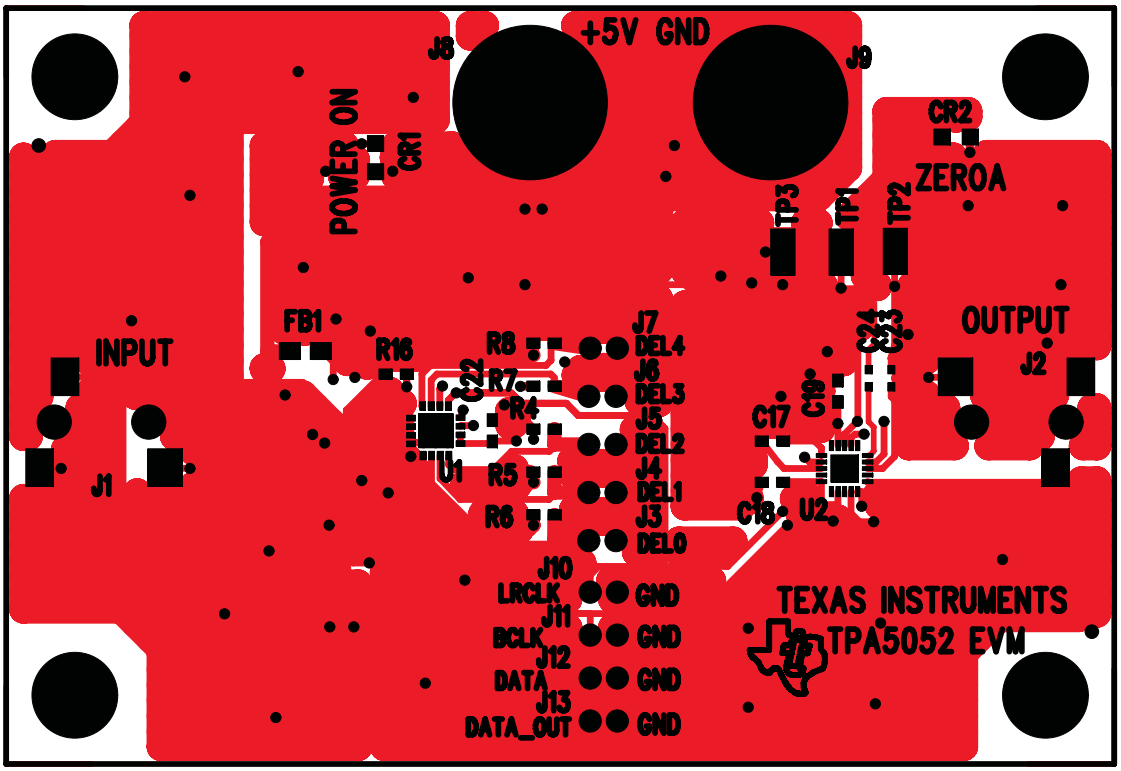


Figure 4. TPA5052EVM Top Layer

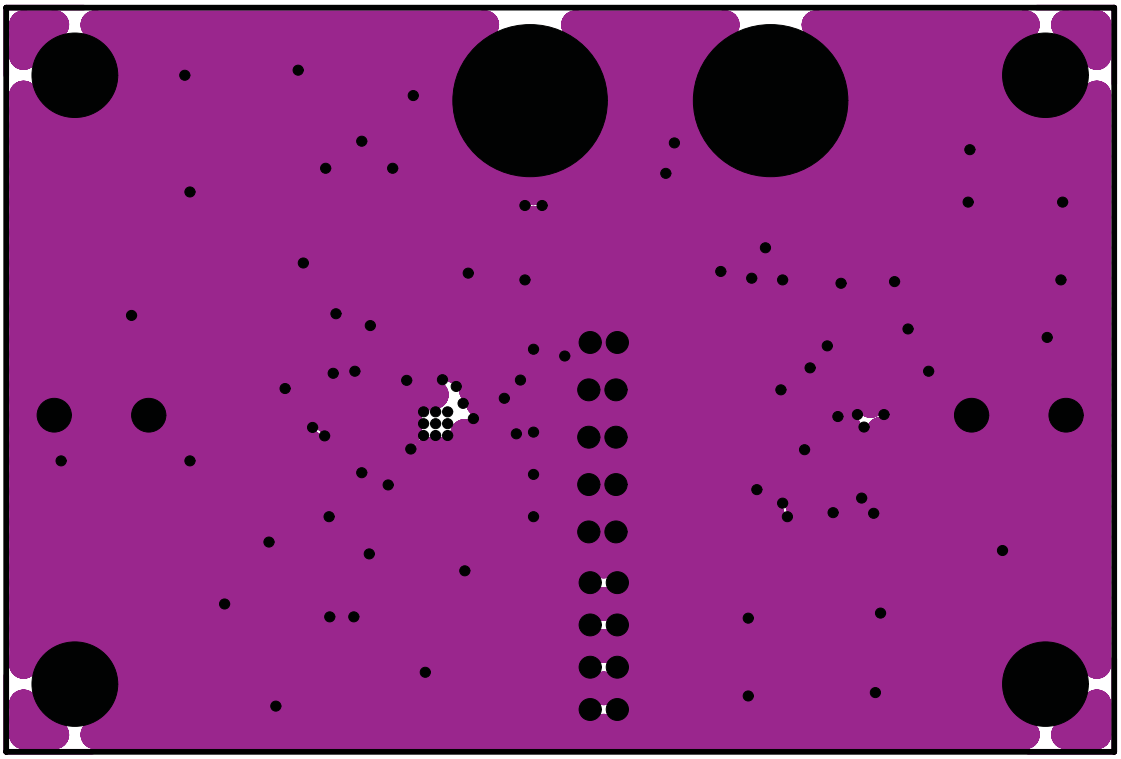


Figure 5. TPA5052EVM Second Layer

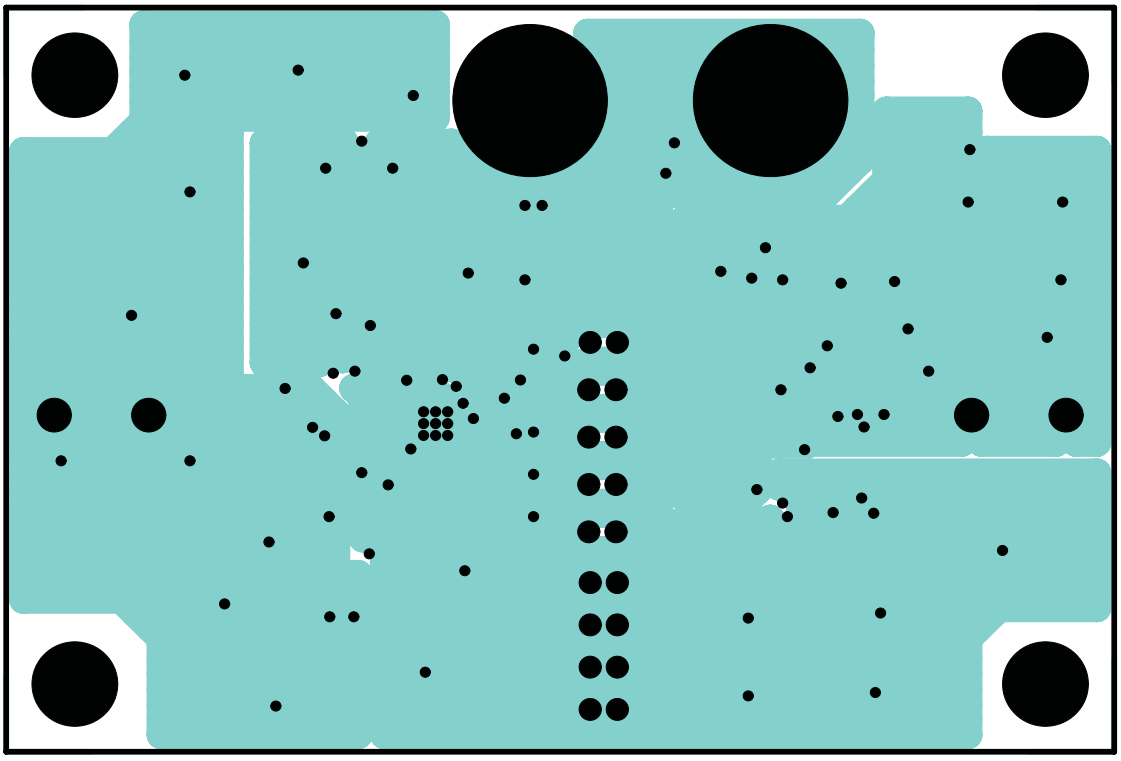


Figure 6. TPA5052EVM Third Layer

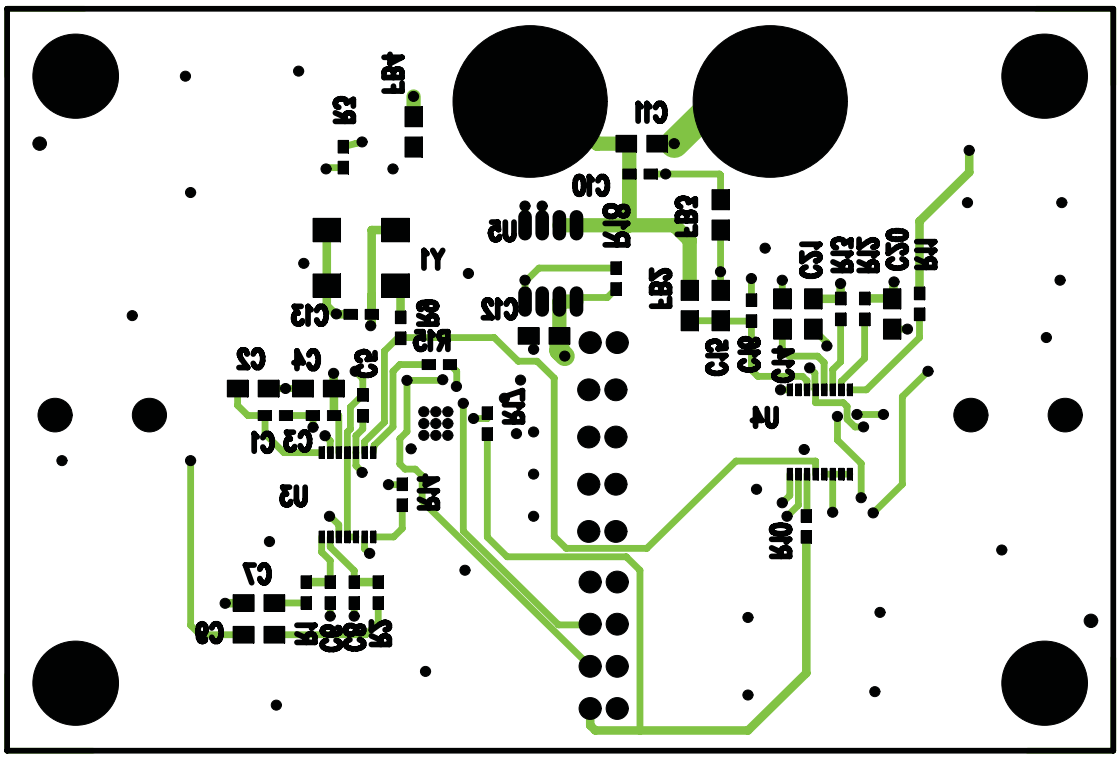


Figure 7. TPA5052EVM Bottom Layer

4.2 TPA5052EVM Bill of Materials

Table 1. Bill of Materials

Part No.	QTY	Value	Description	Distributor No.(1)	Manufacturer Part No.
R1, R2	2	1kΩ	Resistor, 1kΩ, 1/10W, 1%, 0603	311-1.00KHRTR-ND	Yageo RC0603FR-071KL
R3, R11	2	470Ω	Resistor, 470Ω, 1/10W, 1%, 0603	311-470HRTR-ND	Yageo RC0603FR-07470RL
R4, R5, R6, R7, R8, R18	6	100kΩ	Resistor, 100kΩ, 1/10W, 1% , 0603	311-100KHRTR-ND	Yageo RC0603FR-07100KL
R9, R14, R15, R16, R17	5	40.2Ω	Resistor, 40.2Ω, 1/10W, 1%, 0603	311-40.2HRTR-ND	Yageo RC0603FR-0740R2L
R10	1	0Ω Jumper	Resistor, 0Ω, 1/10W, 5%, 0603	311-0.0GRTR-ND	Yageo RC0603JR-070RL
R12, R13	2	300Ω	Resistor, 300Ω, 1/10W, 1%, 0603	311-300HRTR-ND	Yageo RC0603FR-07300RL
C1, C3, C5, C10, C13, C16, C22	7	0.1µF	Cap, Ceramic, 0.1µF, 10V, X7R, +/-10%, 0603	399-1095-1-ND	Kemet C0603C104K8RACTU
C2, C4, C11, C12, C14, C15	6	10µF	Cap, Ceramic, 10µF, 10V, 10%, 0805	490-3905-1-ND	Murata GRM21BR71A106KE51L
C6, C8	4	4700pF	Cap, Ceramic, 4700pF, 50V, 10%, X7R, 0603	445-1310-1-ND	TDK C1608X7R1H472K
C7, C9	2	1µF	Cap, Ceramic, 1µF, 16V, 10%, X7R, 0805	399-1284-1-ND	Kemet C0805C105K4RACTU
C17, C18, C19	3	2.2µF	Cap, Ceramic, 2.2µF, 10V, 20%, X5R, 0603	490-1546-1-ND	Murata GRM188R61A225ME34D
C20, C21	2	.018µF	Cap, Ceramic, .018µF, 50V, 10%, X7R, 0805	399-1162-1-ND	Kemet C0805C183K5RACTU
C23, C24	2	0.1µF	Cap, Ceramic, .1µF, 16V, 10%, X7R, 0402	399-3521-1-ND	Kemet C0402C104K4RACTU
FB1, FB2, FB3, FB4	4	600Ω Ferrite Bead	Ferrite Bead, 600Ω, 500mA, 200 milliohms DAR, 0805	445-1554-1-ND	TDK MMZ2012R601A
CR1	1	Green LED	Green LED, 0805	67-1553-1-ND	Lumen S.L.-LXT0805GW-TR
CR2	1	Red LED	Red LED, 0805	67-1552-1-ND	Lumen S.L.-LXT0805IW-TR
J1, J2	2		Headphone Jack, 3.5mm, Black		Chaconne, Inc SEX-3500-3N
J3, J4, J5, J6, J7	5		Jumper, Position, 2mm Header	2163S-36-ND	Norcomp 2163-36-01-P2
J3, J4, J5, J6, J7	5		2mm Shunts	A26244-ND	Tyco/AMP 382575-2
J8, J9	2		Banana Jack with Knurled Thumbnut	J587-ND	Johnson 111-2223-001
J10, J11, J12, J13	4		Jumper, Position, 2mm Header	2163S-36-ND	Norcomp 2163-36-01-P2
TP1, TP2, TP3	3		Test Point, Small, SMT	5015KCT-ND	Keystone 5015
Y1	1	12.288MHz	Clock, Oscillator, 12.288 MHZ, 3.3V	CTX266LVCT-ND	CTS CB3LV-3C-12M2880-T
U1	1	TPA5052	IC, TPA5052, Stereo Digital Audio Lip-Sync Delay	Texas Instruments: TPA5052RSA	Texas Instruments

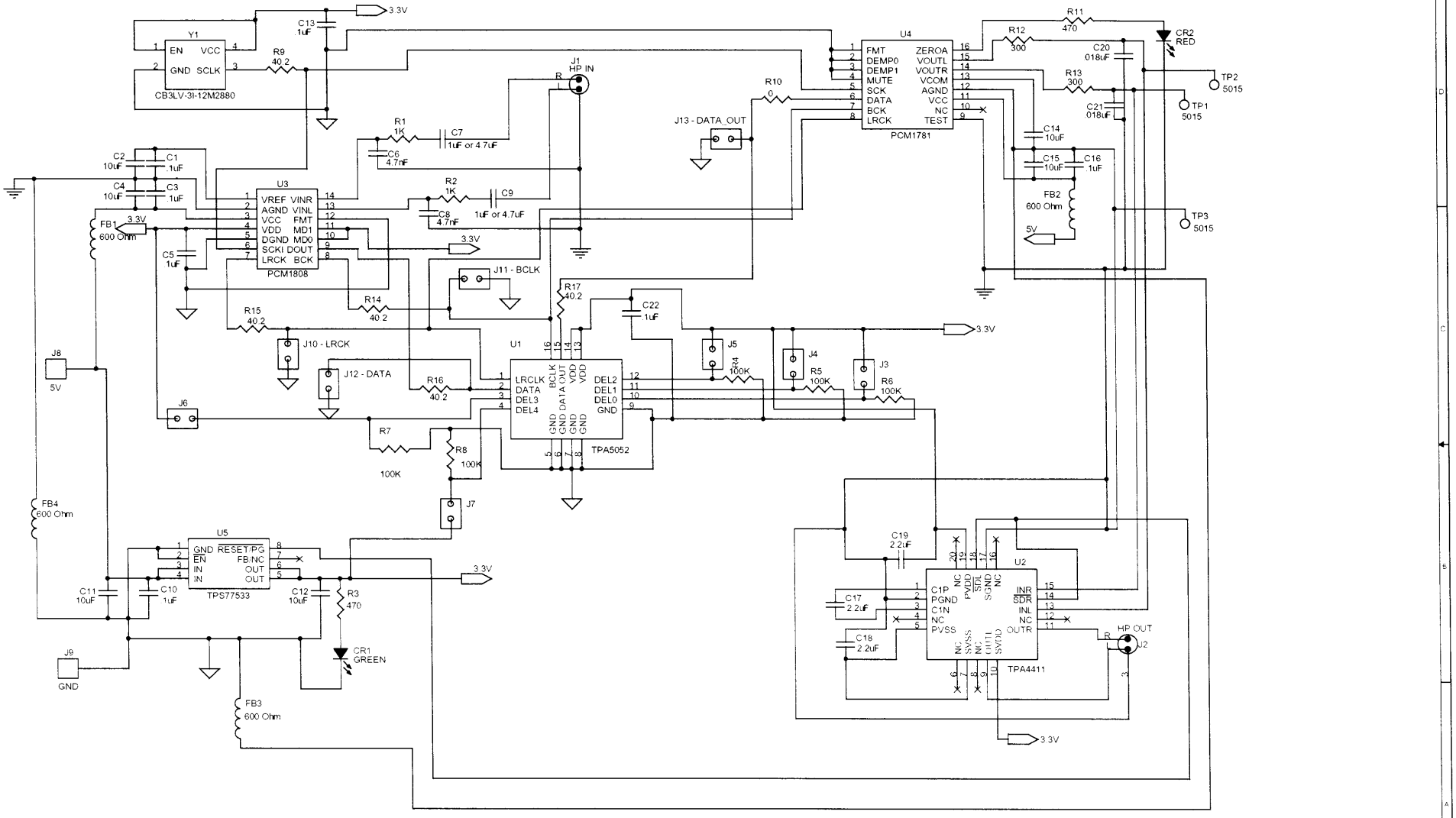
(1) Distributor is Digikey, unless otherwise specified.

Table 1. Bill of Materials (continued)

Part No.	QTY	Value	Description	Distributor No.(1)	Manufacturer Part No.
U2	1	TPA4411	IC, TPA4411, 80mW Cap-Free Stereo Headphone Driver	Texas Instruments: TPA4411RTJ	Texas Instruments
U3	1	PCM1808	IC, PCM1808, Single Ended, Analog-Input 24-Bit, 96kHz Stereo A/D Converter	Texas Instruments: PCM1808PW	Texas Instruments
U4	1	PCM1781	IC, PCM1781, 24-Bit, 192kHz Sampling, Enhanced Multilevel, Delta-Sigma, Audio Digital-to-Analog Converter	Texas Instruments: PCM1781DBQ	Texas Instruments
U5	1	TPS77533	IC, TPS77533, 3.3V 500MA LDO REG	Texas Instruments: TPS77533D	Texas Instruments
	4		Standoff, Aluminum, Hex, 4-40 x .625"	1808K-ND	Keystone 1808
	4		Screw, 4-40 x .25", PPH		

5 TPA5052EVM Schematic Diagram

The TPA5052EVM schematic diagram is appended to this page.



Title	**TPA5052 EVM**	
Size B	Document Number <Doc>	Rev 1
Date: Tuesday, July 18, 2006	Sheet 1 of 1	

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It is important to operate this EVM within the voltage supply range of 4.5 V to 5.5 V.

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 85°C. The EVM is designed to operate properly with certain components above 85°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.

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