

TPA4861

Audio Power Amplifier

Evaluation Module

DATA MANUAL: SLOU004

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TPA4861

Audio Power Amplifier

Evaluation Module

Abstract

The Texas Instruments (TI™) TPA4861 audio power amplifier sample evaluation module (EVM) (SLOP099) incorporates the circuitry required for designers of notebook, cellular, and other hand-held audio systems to evaluate the performance of the TPA4861 audio power amplifier without investing in a PC board layout and assembly (see the application note in the TPA4861 data sheet (SLOS163) for a description of the circuit configuration and selection of components).

The TPA4861 EVM plugs into TI's Plug-N-Play Audio Amplifier Evaluation Platform (SLOP097). The platform is a convenient evaluation vehicle incorporating the required circuitry to power and test all of its compatible audio power amplifier EVMs and thus eliminate the need for external implementation.

The TPA4861 EVM can be used with the TPA4860 EVM (SLOP098) to derive various drive configurations.



I. Quick Start for P-N-P Kit

Included below is a quick checklist of setup steps to get the TPA4861 up and running fast.

1. Set S1 to the “off” position.
2. Align the TPA4861 with either socket U3 or U4, such that the side with 4 pins is adjacent to the speaker connections, and firmly connect it to the P-n-P board.
3. Check the power supply jumper setting on the P-n-P board. To use battery power select JP3, to select wall mount AC/DC power select JP2, or to use a bench type DC power supply select JP1 **Note: be sure only one of these three jumpers is connected by a shorting block.**
4. Check the mode/mute jumper circuitry (JP6, JP7, JP8). To begin with, set JP7 to Lo, JP8 to Hi, and JP6 to Mode. This arrangement causes the TPA4861 to be active when no headphones are present. In the future refer to Table 1 in the P-n-P board Application Report (SLOU001) to adjust these settings.
5. Check the Audio Input Path Selection Circuitry, if there is no EVM present in U1, then set S2 to the “off” position
6. Set S3 to the “U5” position. (only if headphone EVM is connected to U5)
7. Connect a mono audio source to either J3 or J5 (or both), or connect a stereo audio source to J4.
8. Connect a 8 ohm speaker(s) to either (or both of) the RCA jacks at J7 (U3) and J9 (U4) or to the wire clips at J8.
9. Connect your power supply to the P-n-P board.
10. Push S1 to the “on” position. Activate the audio source.

Step 10 will activate the EVMS present on the P-n-P. If you do not hear sound, please consult the troubleshooting section of the P-n-P Board application report (SLOU001).

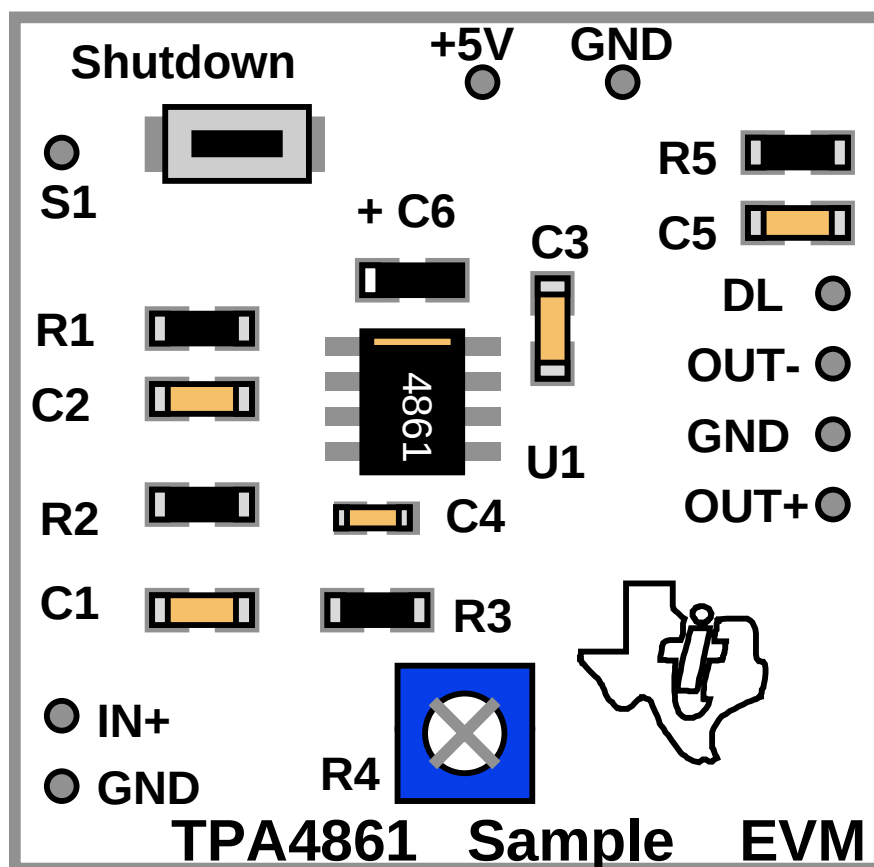
To use power from J1, J2, or B1 a DC/DC converter must be used at U6. If no converter is present, use DC power at J6.



1. Layout Definition

The TPA4861 is a CMOS device designed primarily for bridge tied load (BTL) operation (please consult the TPA4861 data sheet, SLOS163) in notebook, cellular, and other hand-held audio systems. The typical supply current of 3.5 mA at 5 V makes the TPA4861 an ideal upgrade for battery powered applications. Figure 1 shows The TPA4861 audio amplifier EVM layout.

Figure 1. TPA4861 Audio Amplifier EVM Circuit Component Placement





U1 - TPA4861D, Mono 1 W Audio Amplifier



C1 - Capacitor, 1.0 μ F Ceramic



C2, C3 - Capacitor, 2.2 μ F Ceramic



C4 - Capacitor, 5 pF Ceramic



C5 - Capacitor, 0.1 μ F Ceramic



C6 - Capacitor, 10 μ F Electrolytic



R1, R2, R3 - Resistor, 20 k Ω Carbon



R4 - Potentiometer, 200 k Ω 3/4 Turn



R5 - Resistor, 51 Ω Carbon



S1, - Switch, Normally Open, Momentary

The TPA4861 sample EVM offers the following key features:

- ☐ Mono Bridge Tied Load (BTL) drive for 8 ohm speakers and above
- ☐ Shutdown input
Controlled from an external TTL source or a switch to mute the speakers and place the IC in an ultra-low current mode.
- ☐ Gain Control Pot R4
Lower gains produce better distortion performance (see the TPA4861 data sheet for more information). Gain vs total harmonic distortion (THD) should be considered in each application. The gain adjustment range on the EVM is 2 to 22.

NOTE:

Most speakers have significantly worse distortion than the TPA4861 at high gain settings.

The connection pins of the TPA4861 EVM are on a 0.1" grid for easy interface to standard plugboard-based prototype systems.

For higher temperature applications, the TPA4861 sample EVM is packaged in an 8-pin small-outline integrated circuit (SOIC) that provides a thermal connection to the PC copper area for better heat dissipation. The TPA4861 offers an 8-pin SOIC package that is adequate for most room-temperature applications.



The thermal layout of the EVM is important because linear audio power amplifiers dissipate large amounts of heat during operation (see the TPA4861 data sheet (SLOS163) for details on heat dissipation for 5 V and 3.3 V applications). All GND pins must be connected to as much copper area as possible on the surface of the PC board. These copper areas should then be connected with vias to ground plane layers inside the PC board. These connections become even more important in high ambient temperature applications.



2. Operation

The TPA4861 EVM is compatible with the TI Plug-N-Play Audio Amplifier Evaluation Platform slots U3 and U4.

No soldering is required for use in the plug-and-play (PnP) system. The evaluation platform includes standard speaker jacks, RCA jacks, and 1/8" stereo input jacks for quick and easy evaluation of all TI TPA series audio power amplifiers.

The TPA302 EVM (SLOP100) is recommended for use as the headphone drive.

For standalone use, connections diagrams are shown in figures 3 and 4.



3. Input/Output Connections

Figure 2. TPA4861 EVM Schematic

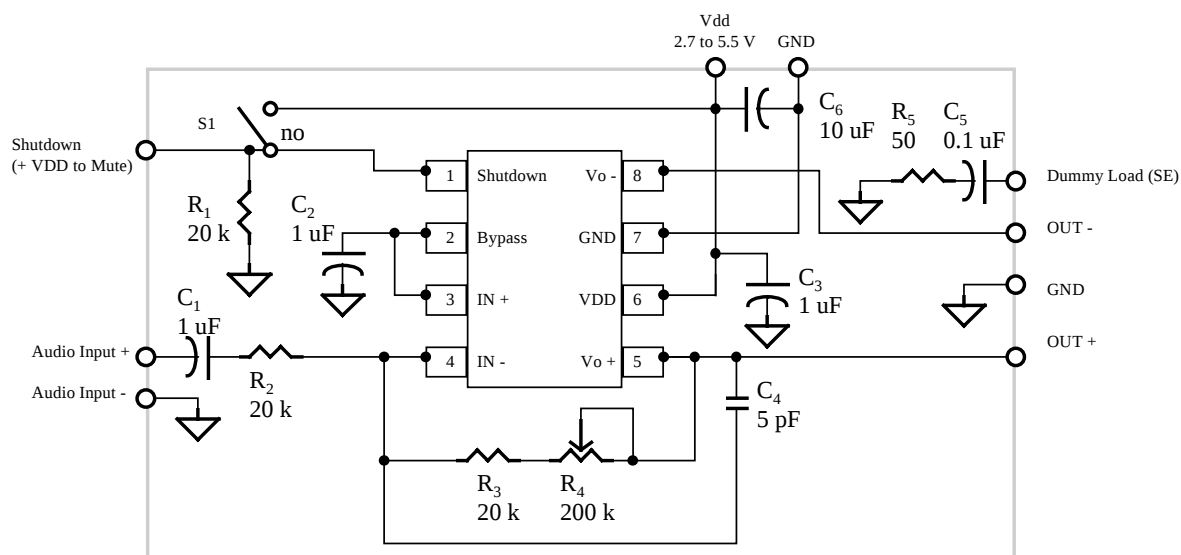


Figure 3 shows the TPA4861 connections diagram for the BTL drive configuration. The BTL configuration eliminates the large output coupling capacitors and quadruples the available output power when compared to single-ended (SE) solutions. As a result, the total PC board space required is much smaller than SE configurations of the same output power.

Figure 3. TPA4861 EVM Input/Output Connections - BTL Drive



Figure 4 shows two TPA4861 EVMs configured to drive stereo speakers. A standard 1/8" stereo input jack provides a convenient connection to CD players and other commercial sources of audio signals.

TPA4861 Sample EVM Circuit

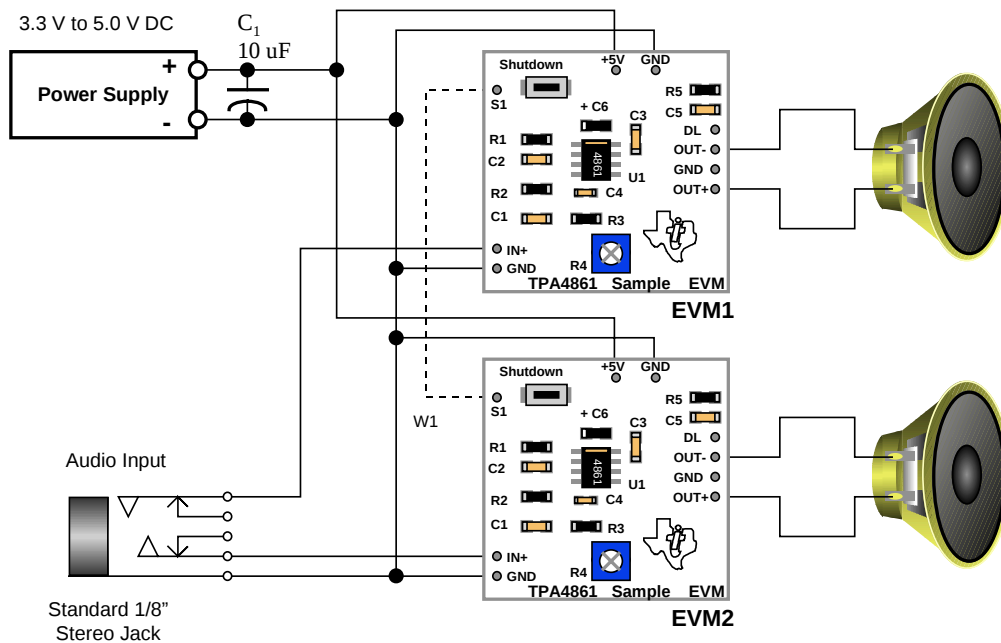


Figure 3. TPA4861 Circuit Applications Connections Diagram - BTL Drive

The stereo SE drive configuration requires the output from Out- to be connected to the Dummy Load (DL) input to prevent the unused output from becoming unstable and possibly oscillating during operation. Oscillations cause unwanted noise that can couple into other circuits (see the TPA460 data sheet for details).

Output power using stereo SE drive is reduced by a factor of four (see the TPA4861 data sheet for details of the tradeoffs between BTL and SE operation).

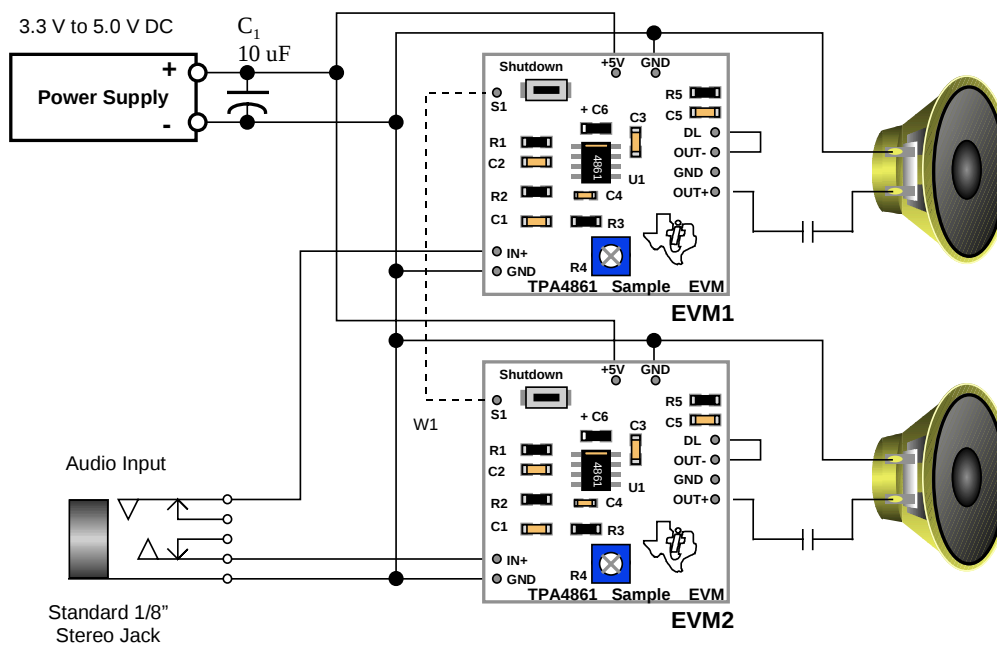
To prevent DC currents from flowing into the speakers, output coupling caps are required in SE mode.



Figure 4. TPA4861 Circuit Application Connections Diagram, SE Drive

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TPA4861 Sample EVM Circuit



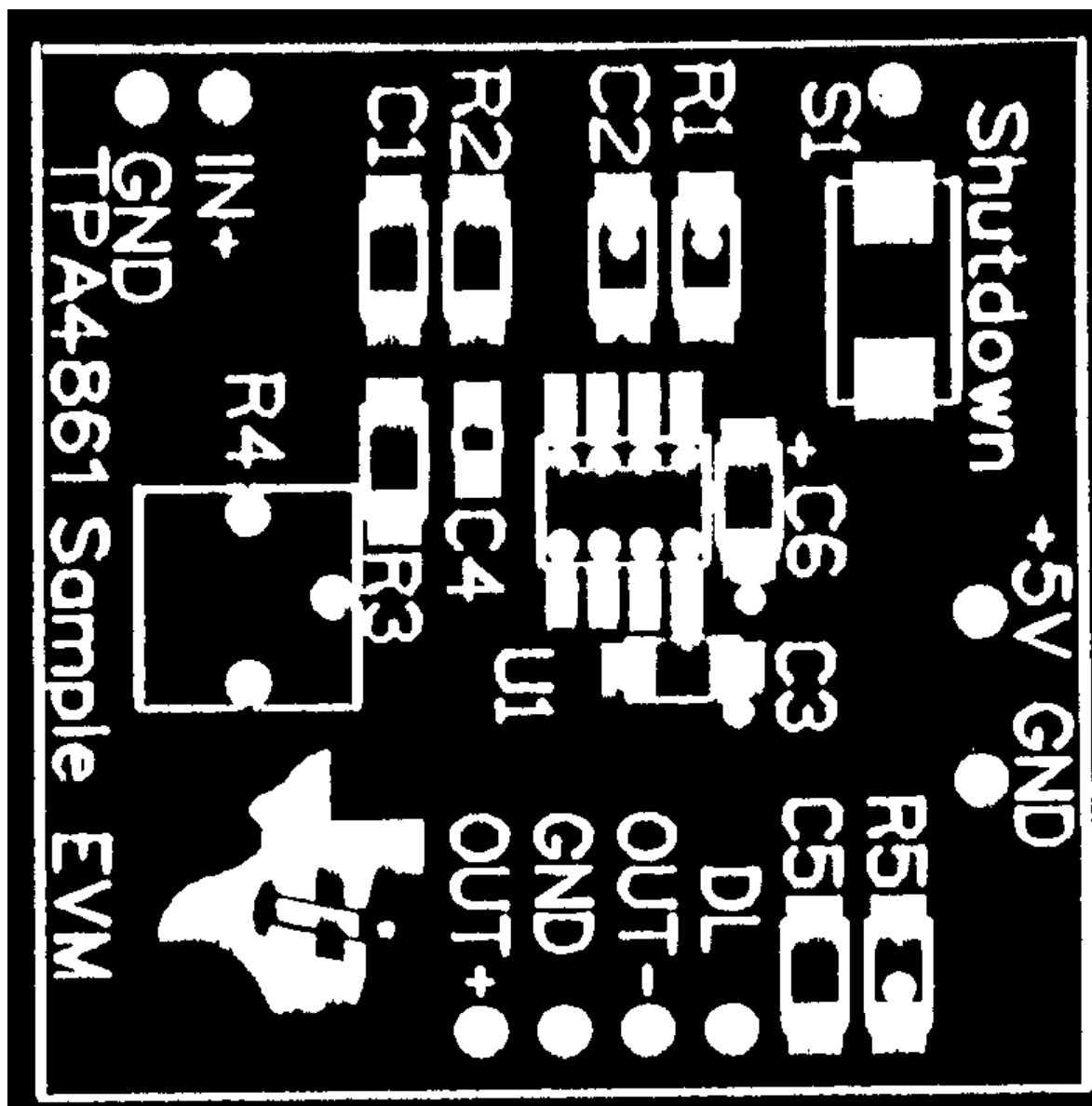
4. Specifications

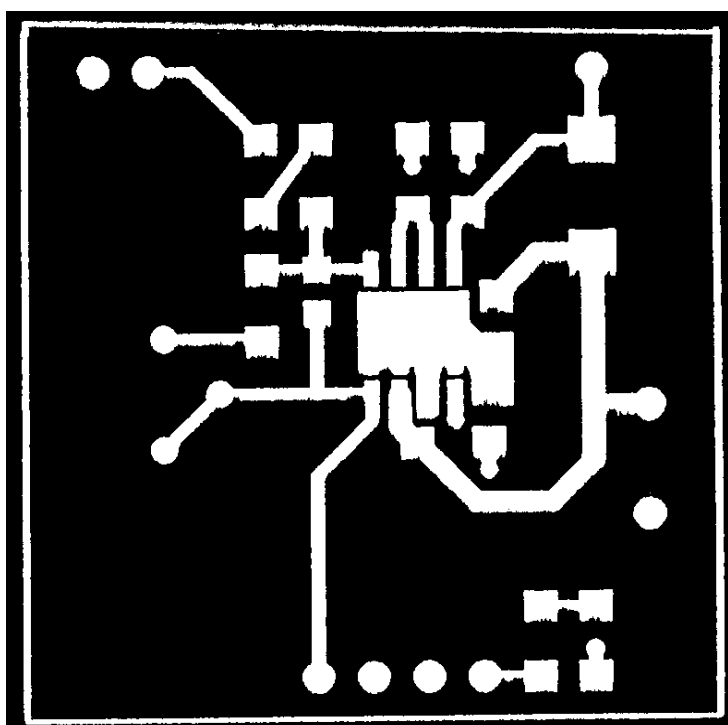
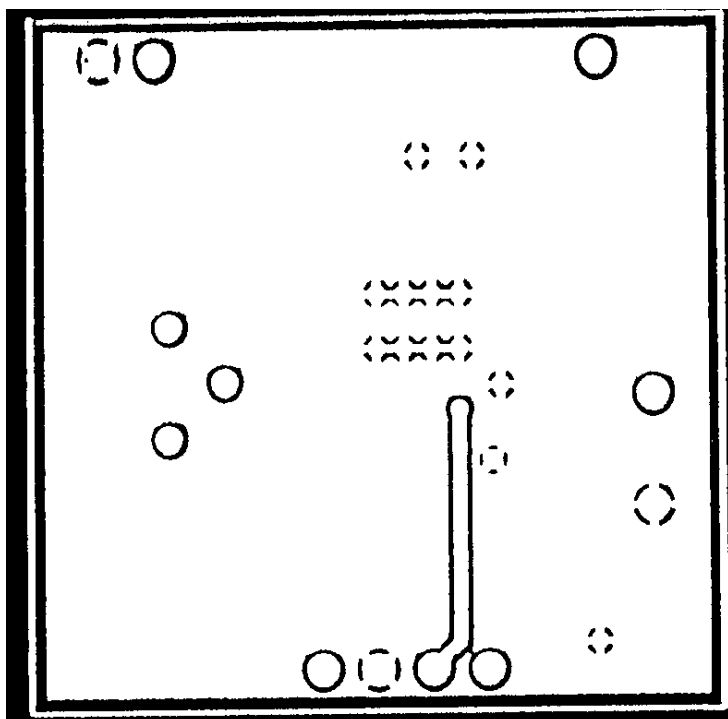
Power	2.7 to 5.5 Vdc, 500 mA max.
Audio Input	Mono, Cap Coupled (1.0 μ F), 4 Vpp Max @ G = 1
Speaker Outputs	BTL 8 ohm drive, 1 W rms continuous SE 8 ohm drive, 250 mW rms continuous SE 32 ohm drive, 70 mW rms continuous
Dummy Load Input (DL)	Recommended tie to Out- when operating in SE mode
Shutdown Input/Switch	High places amplifier in ultra-low current state. Outputs are muted. Switch is a momentary action push button. Press to mute.
R4 Gain Control Pot	3/4 turn adjusts amplifier gain from 2 to 20 BTL, 1 to 10 SE. Clockwise increases gain.



5. Layout

NOTE: Layouts are not to scale.





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6. Bill of Materials

Description	Ref	PCBA Qty	Manufacturer Part Number	Digi-Key Part Number
Pot., 200 K Ohm Cermet ST SL, Thru Hole	R4	1	Bourns 3323P-1-204	Digi-Key 3323P-204-ND
Cap., 10 μ F/6.3 V, SMD, Size "A"	C6	1	Panasonic ECS-TOJY106R	Digi-Key PCS1106CT-ND
Cap., 1.0 μ F, +80/-20%, Non-Polarized, SMD Size 1206	C1	1	Murata GRM42-6Y5V105Z16BL	Newark 93F2254
Cap., 2.2 μ F, 20%, Non-Polarized, SMD Size 1206	C2,C3	2	TDK C3216X5R1A225	
Cap., .1 μ F/16 V, SMD, Size 1206	C5	1	Panasonic ECS-H1CY105R	Digi-Key PCT104BCT-ND
Cap, 5.0 pF, SMD, Size 0805	C4	1	Panasonic ECU-V1H050CCN	Digi-Key PCC050CNCT-ND
Res., 20 K Ohm, 1/8 W, 5%, SMD, Size 1206	R1, R2, R3	3	Panasonic ERJ-8GEYJ203	Digi-Key P20KECT-ND
Res., 510 Ohm, 1/8 W, SMD, Size 1206	R5	1	Panasonic ERJ-8GEYJ511	Digi-Key P510ECT-ND
Switch, Momentary, SMD	S1	1	Panasonic P8048SCT-ND	Digi-Key P8048SCT-ND
IC., TPA4861, Audio Amplifier, 1 W, Mono, SMD, SOIC-8	U1	1	TI TPA4860	
PCB, TPA4681 Sample EVM	PCB1	1	Compuroute Tool	