# TAS5421EVM User's Guide

The TAS5421-Q1 evaluation module (EVM) is intended to demonstrate the capabilities of the TAS5421-Q1 device. All the device features can be accessed through the hardware and the software graphical user interface (GUI) which is supplied. This user's guide contains a description of the EVM and the GUI. The schematic, bill of materials (BOM), and board layout are included.

## 1 Hardware Overview

The TAS5421EVM showcases TI's TAS5421-Q1 analog input class-D closed-loop mono amplifier. The EVM is usable as stand-alone platform with default $I^2C$ register settings. The EVM runs in default $I^2C$ register settings. The EVM can also work with a USB2IIC-2 board and TAS5421-Q1 GUI for programming the $I^2C$ register settings.

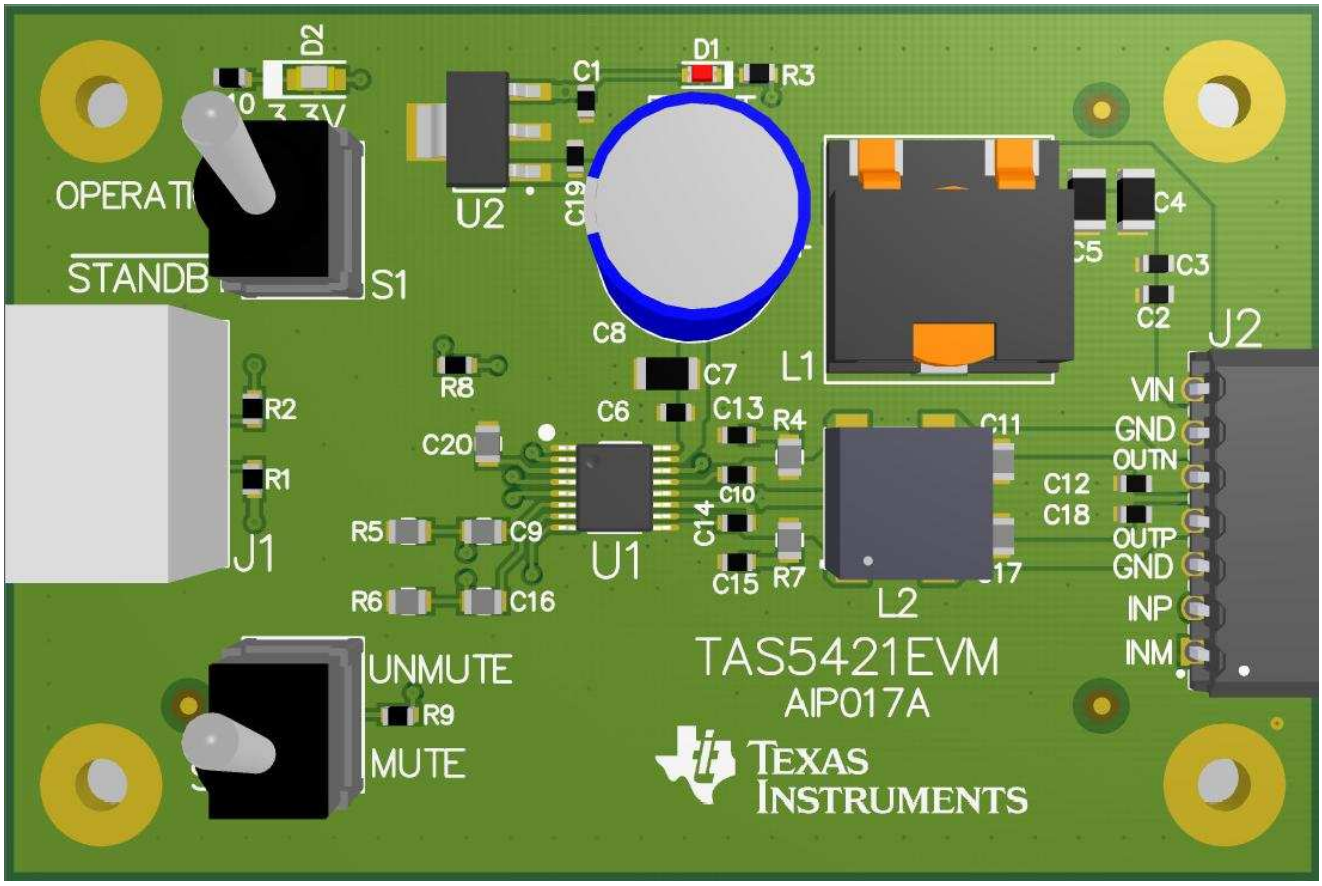



**Figure 1. TAS5421EVM**


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## 1.1 TAS5421EVM Features

- Runs without $I^2C$ initialization
- Has GUI control via USB port
- Passes EMC CISPR 25, class 5

## 1.2 TAS5421EVM Gain

The gain setting for TAS5421-Q1 device is $I^2C$ programmable. The four gain options are 20 dB, 26 dB, 32 dB, and 36 dB. Set the gain by modifying $I^2C$ control register 0x03. By default, the gain is 26 dB.

## 1.3 TAS5421EVM PWM Switching Frequencies

The PWM switching frequency is $I^2C$ programmable. The two $f_{(SW)}$ options are 400 kHz and 500 kHz. Programming the frequency in control register 0x03 is via the GUI and IIC2USB-2 board. By default, $f_{(SW)}$ is 400 kHz.

## 1.4 TAS5421EVM SpeakerGuard™ Protection Circuitry

The SpeakerGuard protection circuitry is programmable for different voltage levels. Programming the levels in control register 0x03 via the GUI and IIC2USB-2 board. The control register shows the default value for the SpeakerGuard protection-circuitry voltage level.

**Table 1. Control Register**

| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | FUNCTION |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 26-dB gain, $f_{(SW)}$ set to 400 kHz, SpeakerGuard protection circuitry is set to maximum voltage. |
| — | — | — | — | — | — | — | 1 | $f_{(SW)}$ set to 500 khz |
| — | — | — | — | — | 1 | 1 | — | RESERVED |
| — | — | 1 | 1 | 0 | — | — | — | SpeakerGuard protection circuitry is set to 14-V peak output. |
| — | — | 1 | 0 | 1 | — | — | — | SpeakerGuard protection circuitry is set to 11.8-V peak output. |
| — | — | 1 | 0 | 0 | — | — | — | SpeakerGuard protection circuitry is set to 9.8-V peak output. |
| — | — | 0 | 1 | 1 | — | — | — | SpeakerGuard protection circuitry is set to 8.4-V peak output. |
| — | — | 0 | 1 | 0 | — | —- | — | SpeakerGuard protection circuitry is set to 7-V peak output. |
| — | — | 0 | 0 | 1 | — | — | — | SpeakerGuard protection circuitry is set to 5.9-V peak output. |
| — | — | 0 | 0 | 0 | — | — | — | SpeakerGuard protection circuitry is set to 5-V peak output. |
| 0 | 0 | — | — | — | — | — | — | Set gain to 20 dB. |
| 0 | 1 | — | — | — | — | — | — | Set gain to 32 dB. |
| 1 | 1 | — | — | — | — | — | — | Set gain to 36 dB. |


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## 2 TAS5421EVM Setup

This section describes the TAS5421EVM setup and software installation.

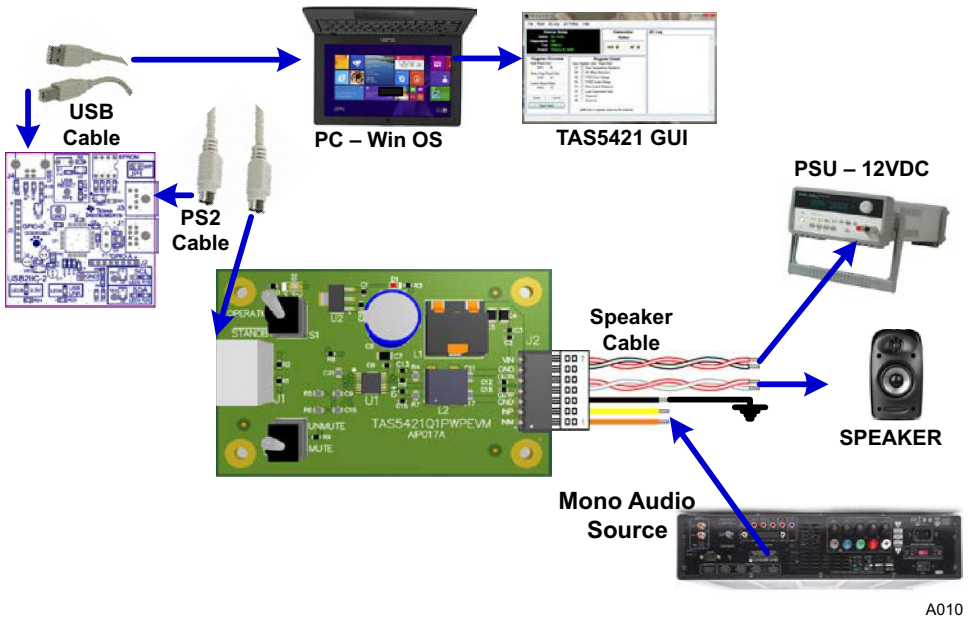



**Figure 2. TAS5421EVM Connection**

Hardware requirements (see Figure 2):

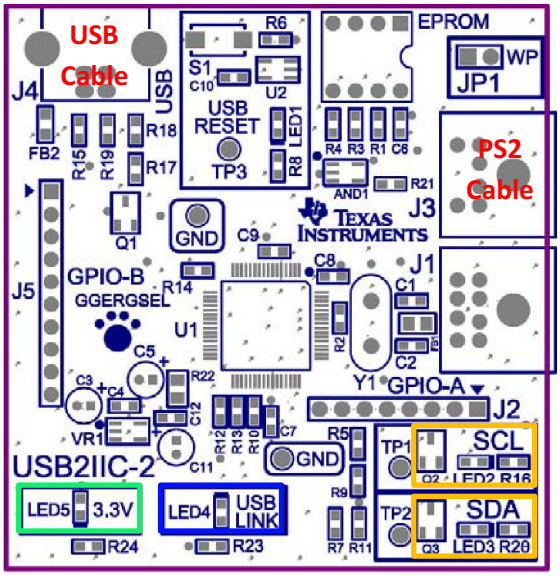
- Computer running Windows XP, Windows 7, or Windows 8
- Power supply unit (PSU) 5–18 VDC
- Speakers and cable (provided)
- USB cable (provided)
- PS2 cable (provided)
- USB2IIC-2 board (provided)
- Audio source: analog RCA input

Hardware setup:

1. Connect the 6-pin cable to the TAS5421EVM on one end and to the USB2IIC-2 board on the other (see Figure 2).
2. Plug in the USB cable from the PC to the USB2IIC-2 board (shown in Figure 3). The 3.3-V and USB LINK LEDs light. The $I^2C$ LEDs (SDA/SCL) on the USB2IIC-2 board are blinking (colored boxes in Figure 3).
3. Connect the I/O cable (see Figure 2):
   - PSU: red(+)-black(–) pair to PSU
   - The speaker: white-red pair to speakers
   - The audio input: yellow-orange audio input source
   - Leave the black wire on the I/O cable unconnected or connect it to ground.
4. Connect the PSU to the TAS5421EVM and turn on the power. The 3.3-V LED (D1 on the EVM board) lights (see Figure 1).
5. Set switch S1 to OPERATION and S2 to UNMUTE (see Figure 1).

**NOTE:** The TAS5421EVM can run without a USB2IIC-2 board.


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**Figure 3. USB2IIC-2 Board**

## 3 Software Installation

The TAS5421-Q1 GUI is available on the product folder by clicking on *Tools and Software* tab to obtain the latest release of the GUI.

Execute the GUI installation program, TAS5421-Q1 GUI Setup.exe. After the program is installed, run the TAS5421 EVM GUI. Figure 4 shows the start-up GUI image. The GUI displays the fault register when first started. I²C data is polling by default. The I²C device address for the TAS5421-Q1 device is D8. Green USB and I²C LEDs show that USB is connected and I²C communication is valid.




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**Figure 4. GUI Image at Start-Up**



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# 4 Using the GUI With the TAS5421EVM Board

The TAS5421EVM does not need initialization. On powering up, the device goes into load diagnostics. If there is no problem, the device goes into play mode with the following default values are set:

- Gain: 26 dB
- $f_{(SW)}$: 400 kHz
- SpeakerGuard protection circuitry: Maximum voltage level

## *4.1 Checking the Fault Register*

When the GUI first runs, the Register Detail box displays the fault register. The GUI runs with $I^2C$ data polling as the default setting, clearing any previous faults after the first poll. If any fault condition is still active after device goes into play mode, with the exception of open load, the device enters the load-diagnostics mode.



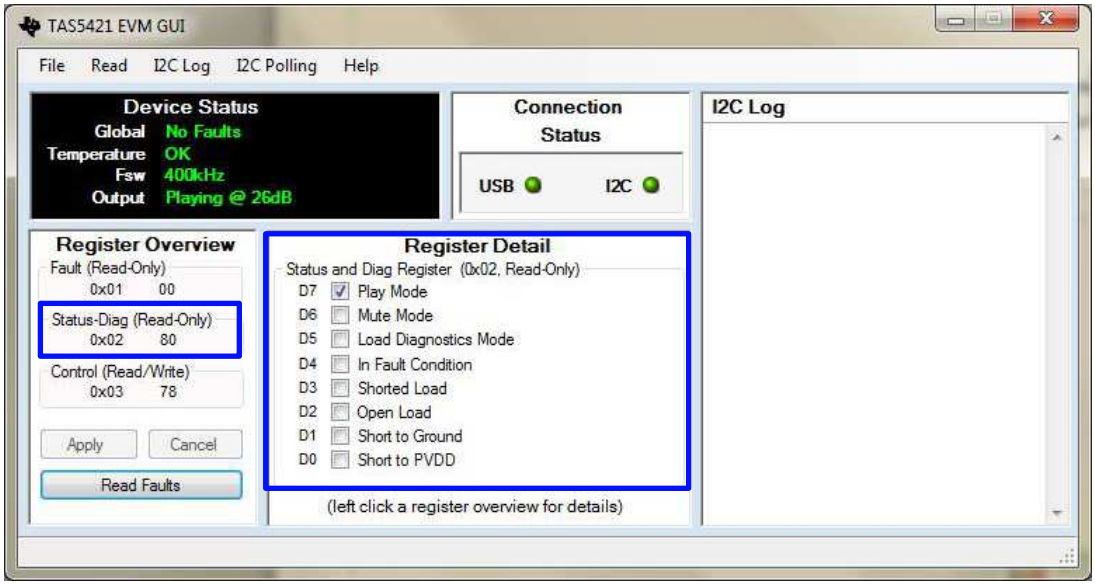

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**Figure 5. Fault Register**


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## 4.2 Checking the Status Register

Figure 6 shows the status register. Click on *Status-Diag (Read-Only)* (0x02), shown in Figure 6 (blue boxes for illustration only, not shown on GUI) and the register detail appears in the middle box.

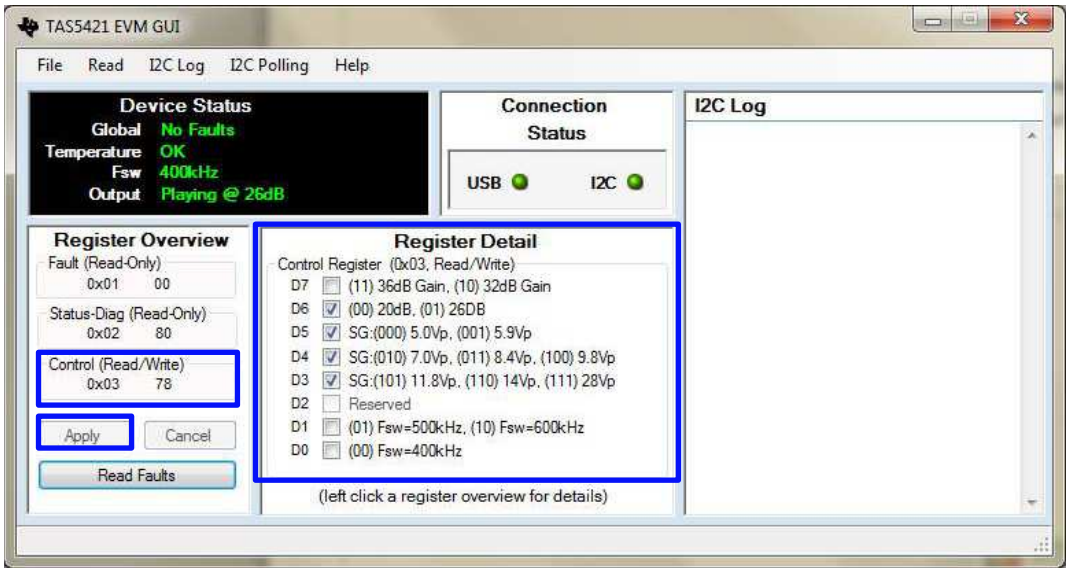



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**Figure 6. Status Register**

## 4.3 Checking and Changing the Control Register

Figure 7 shows the control register. In this register, one can change the default values for $f_{(SW)}$, SpeakerGuard protection circuitry, and gain. Select the desired check boxes; then click apply to update the device status box.




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**Figure 7. Control Register**

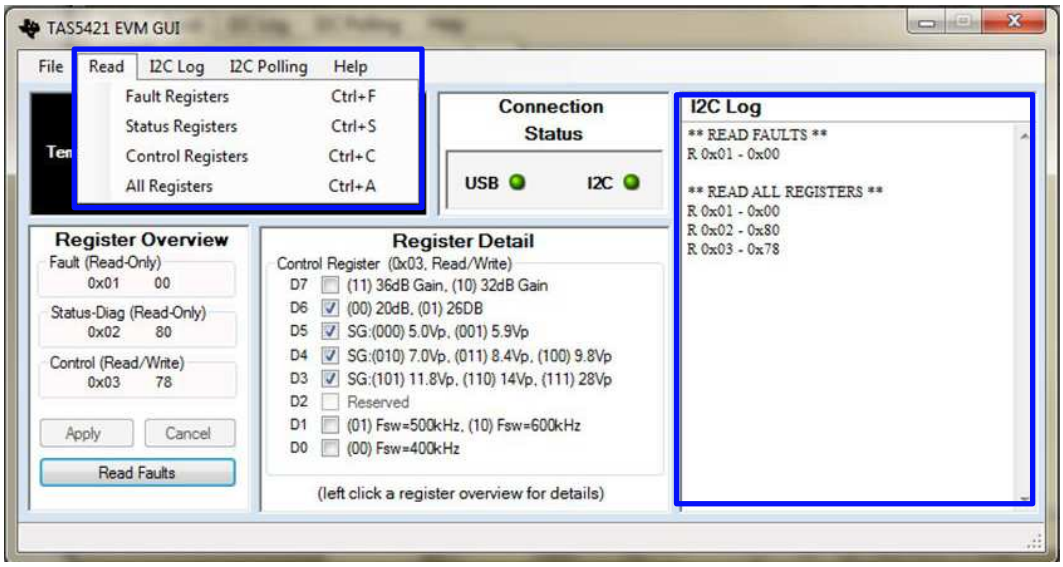


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## 4.4 Read and I²C Log

The I²C log displays I²C registers read data (see Figure 8). An option exists for reading the three registers all at once or individually. Pressing the Read Faults button displays the fault register value on the I²C log as well.

Starting the GUI enables the I²C log. An option is available to turn off logging on the pulldown I²C Log menu.

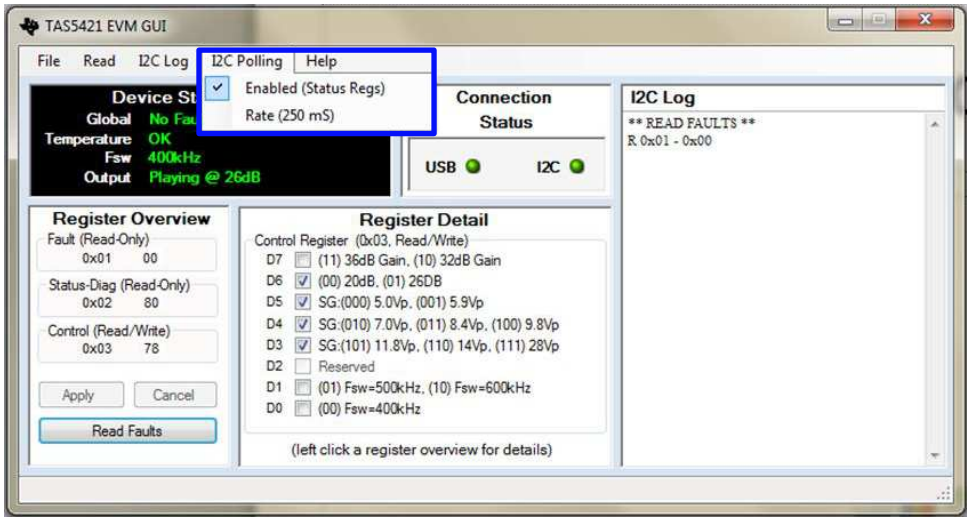



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**Figure 8. Read and I²C Log**

## 4.5 I²C Polling

As mentioned above, the I²C polling is on when the GUI starts. To disable I²C polling, click on I²C polling pulldown tab and unselect the check box. The polling time can also be changed as shown in Figure 9.




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**Figure 9. I²C Polling**


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# 5 Board Layouts, Bill of Materials, and Schematic

## 5.1 TAS5421EVM Board Layouts

Figure 10 and Figure 11 show the board layouts for the EVM.

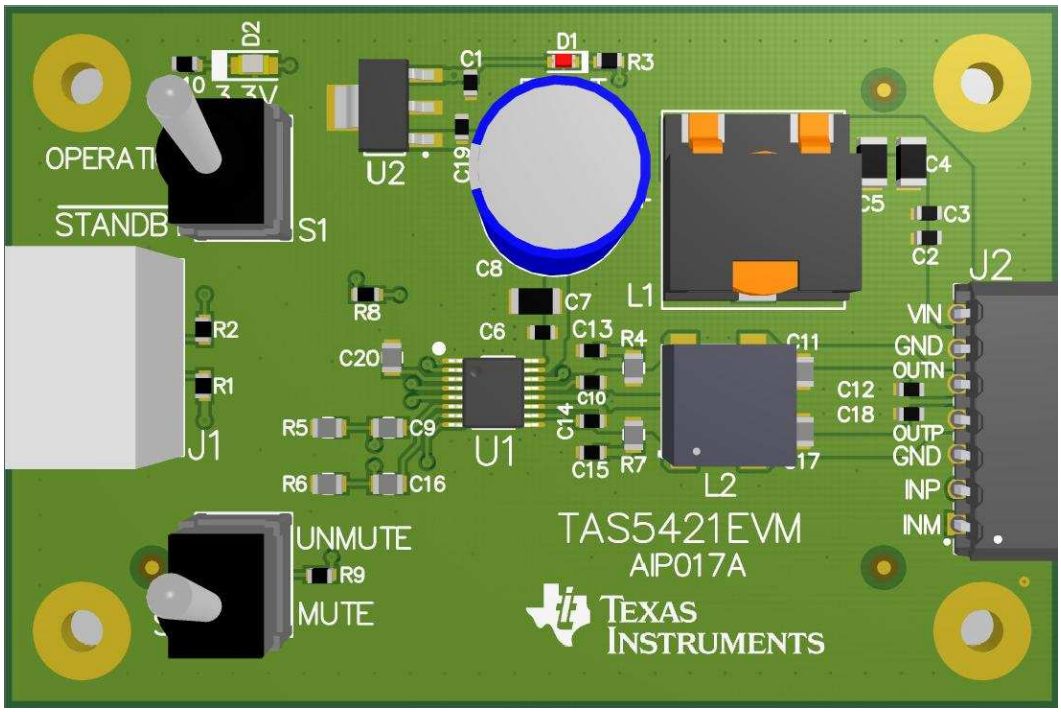
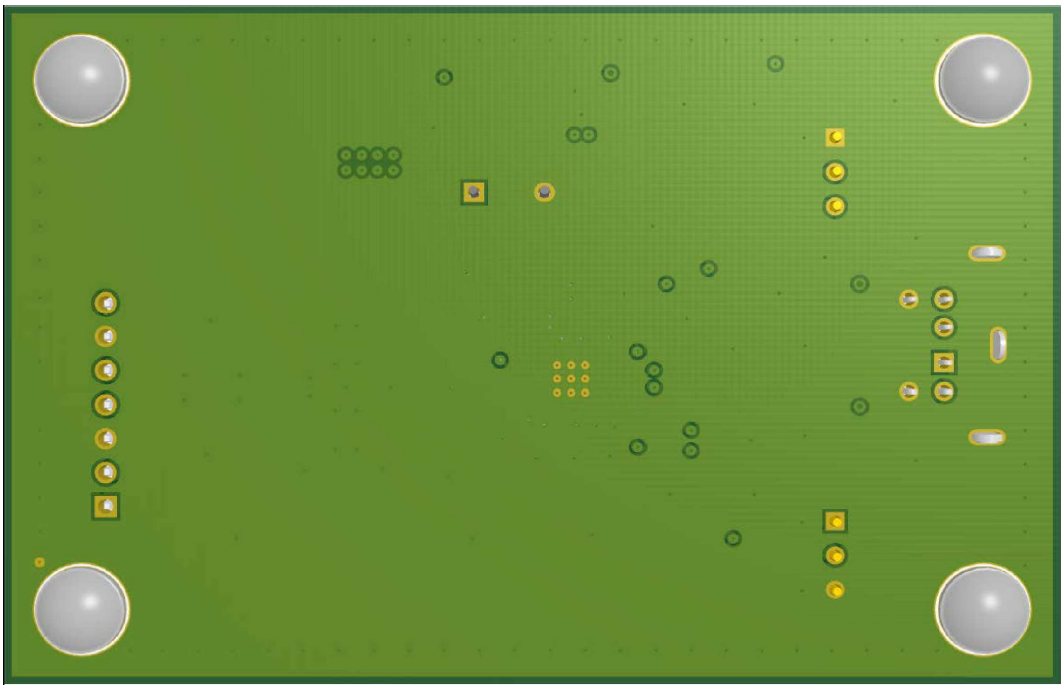



**Figure 10. TAS5421EVM Top View**



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**Figure 11. TAS5421EVM Bottom View**



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## 5.2 Bill of Materials

Table 2 lists the BOM for this EVM.

**Table 2. Bill of Materials**

| ITEM | MFR PART NO. | MFR | QTY | REF DESIGNATORS | DESCRIPTION |
|---|---|---|---|---|---|
| 1 | GRM188R71E104KA01D | MuRata | 3 | C1, C6, C19 | Capacitor, ceramic, 0.1-µF, 25-V, ±10%, X7R, 0603 |
| 2 | GRM188R71H222KA01D | MuRata | 1 | C2 | Capacitor, ceramic, 2200-pF, 50-V, ±10%, X7R, 0603 |
| 3 | GRM188R71E823KA01D | MuRata | 1 | C3 | Capacitor, ceramic, 0.082-µF, 25-V, ±10%, X7R, 0603 |
| 4 | GRM31CR71E475KA88L | MuRata | 2 | C4, C5 | Capacitor, ceramic, 4.7-µF, 25-V, ±10%, X7R, 1206 |
| 5 | GRM31CR71E106KA12L | MuRata | 1 | C7 | Capacitor, ceramic, 10-µF, 25-V, ±10%, X7R, 1206 |
| 6 | UBT1E331MPD1TD | Nichicon | 1 | C8 | Capacitor, AL, 330-µF, 25-V, ±20%, 0.075-Ω, TH |
| 7 | GRM21BR71E105KA99L | MuRata | 3 | C9, C16, C21 | Capacitor, ceramic, 1-µF, 25-V, ±10%, X7R, 0805 |
| 8 | GRM188R71E224KA88D | MuRata | 2 | C10, C14 | Capacitor, ceramic, 0.22-µF, 25-V, ±10%, X7R, 0603 |
| 9 | GRM21BR71E335KA73L | MuRata | 2 | C11, C17 | Capacitor, ceramic, 3.3-µF, 25-V, ±10%, X7R, 0805 |
| 10 | GRM188R71E103KA01D | MuRata | 2 | C12, C18 | Capacitor, ceramic, 0.01-µF, 25-V, ±10%, X7R, 0603 |
| 11 | GRM188R72E471KW07D | MuRata | 2 | C13, C15 | Capacitor, ceramic, 470-pF, 250-V, ±10%, X7R, 0603 |
| 12 | LTST-C190CKT | Lite-On | 1 | D1 | LED, Red, SMD |
| 13 | LTST-C171GKT | Lite-On | 1 | D2 | LED, Green, SMD |
| 14 | SJ5382 | 3M | 4 | H1, H2, H3, H4 | Bumpon, hemisphere, 0.25 × 0.075, clear |
| 15 | MD-60SM | CUI Inc. | 1 | J1 | Receptacle, 6x1_3MH, R/A, TH |
| 16 | 1778670 | Phoenix Contact | 1 | J2 | Header, 7x1, 2.5-mm, TH |
| 17 | SER1360-103KLB | Coilcraft | 1 | L1 | Inductor, shielded E core, ferrite, 10-µH, 7.2-A, 0.01-Ω, SMD |
| 18 | 7G08B-220M-R | Sagami Elec Co Ltd | 1 | L2 | Coupled inductor, 22-µH, 3-A, 69-Ω, ±20%, SMD |
| 19 | RC0603FR-074K7L | Yageo America | 4 | R1, R2, R8, R9 | Resistor, 4.70 kΩ, 1%, 0.1-W, 0603 |
| 20 | CRCW0603499RFKEA | Vishay-Dale | 2 | R3, R10 | Resistor, 499-Ω, 1%, 0.1-W, 0603 |
| 21 | CRCW08055R60JNEA | Vishay-Dale | 2 | R4, R7 | Resistor, 5.6-Ω, 5%, 0.125-W, 0805 |
| 22 | CRCW080549K9FKEA | Vishay-Dale | 2 | R5, R6 | Resistor, 49.9-kΩ, 1%, 0.125-W, 0805 |
| 23 | B12AP | NKK Switches | 2 | S1, S2 | Switch, toggle, SPDT, 28-V |
| 24 | TAS5421QPWPRQ1 | Texas Instruments | 1 | U1 | 10-W mono automotive digital amplifier with diagnostics, PWP0016A |
| 25 | UA78M33CDCY | Texas Instruments | 1 | U2 | Positive voltage regulator, DCY0004A |


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## 5.3 TAS5421EVM Schematic

Figure 12 shows the TAS5421EVM schematic.

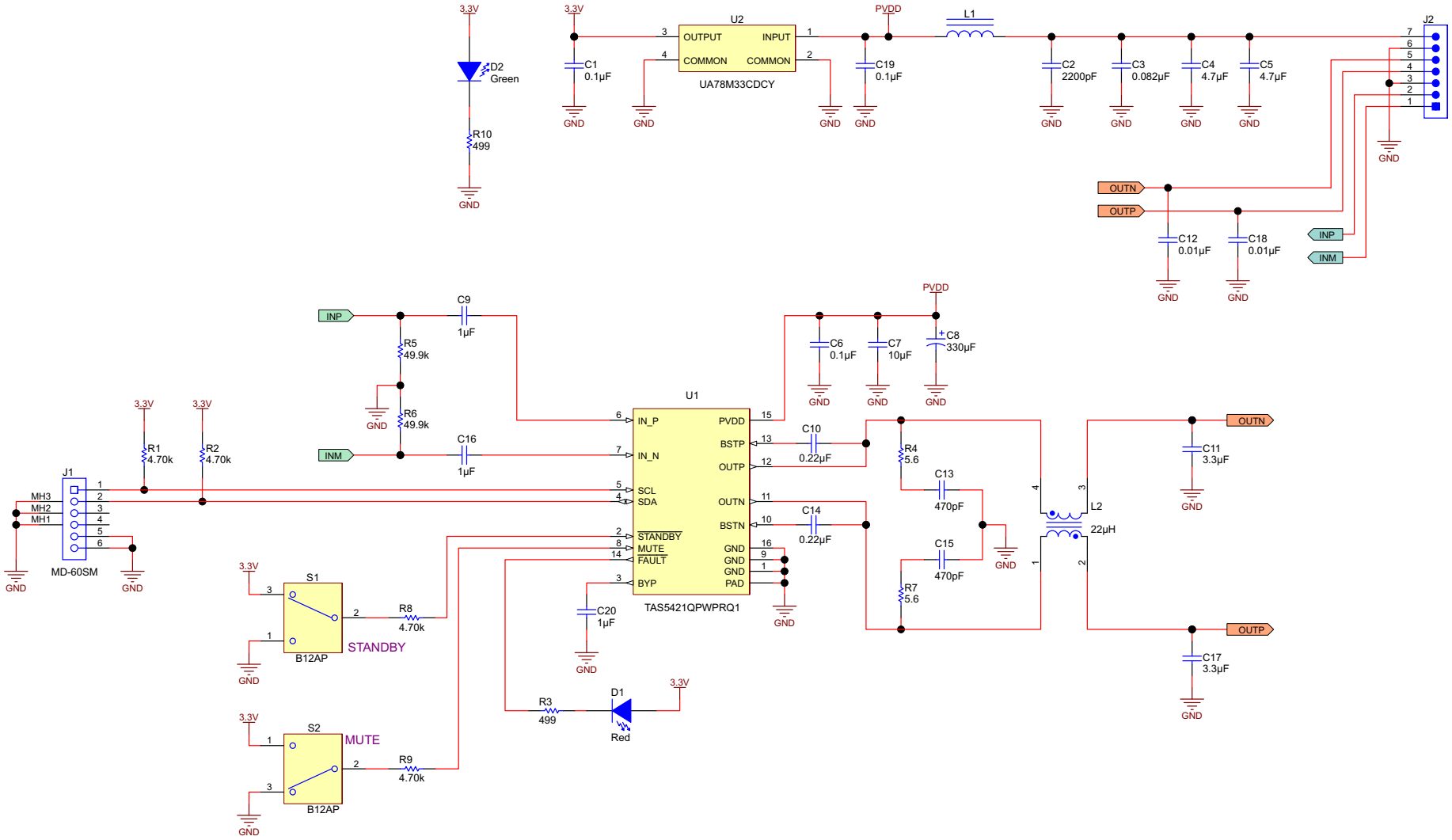



**Figure 12. TAS5421EVM Schematic**



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