Evaluation board for FDA803S and FDA903S power amplifiers

Introduction

This document describes how to use the evaluation board in order to check FDA803S and FDA903S device’s performance.

For any other information and deeper details, refer to the FDA803S and FDA903S datasheets.

1 Ordering information

The board can only be ordered with the FDA903S mounted on it. The ordering information is shown in Table 1.

Table 1. Ordering information

Order code	Device mounted on the board
EVAL-FDA903S-SA	FDA903S

2 General information

This evaluation board/kit is intended for use as ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY and is not considered by ST Microelectronics to be a finished end-product fit for general consumer use. People handling the product(s) must have electronics training and observe good engineering practice standards.

This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore is not requested to meet the technical requirements of these directives or other related directives.

3 Board description

The board features a single channel Class-D amplifier able to deliver up to 10 W (14.4 V at 4 Ω), based on the FDA903S (or FDA803S) and is intended to demonstrate the device capabilities.

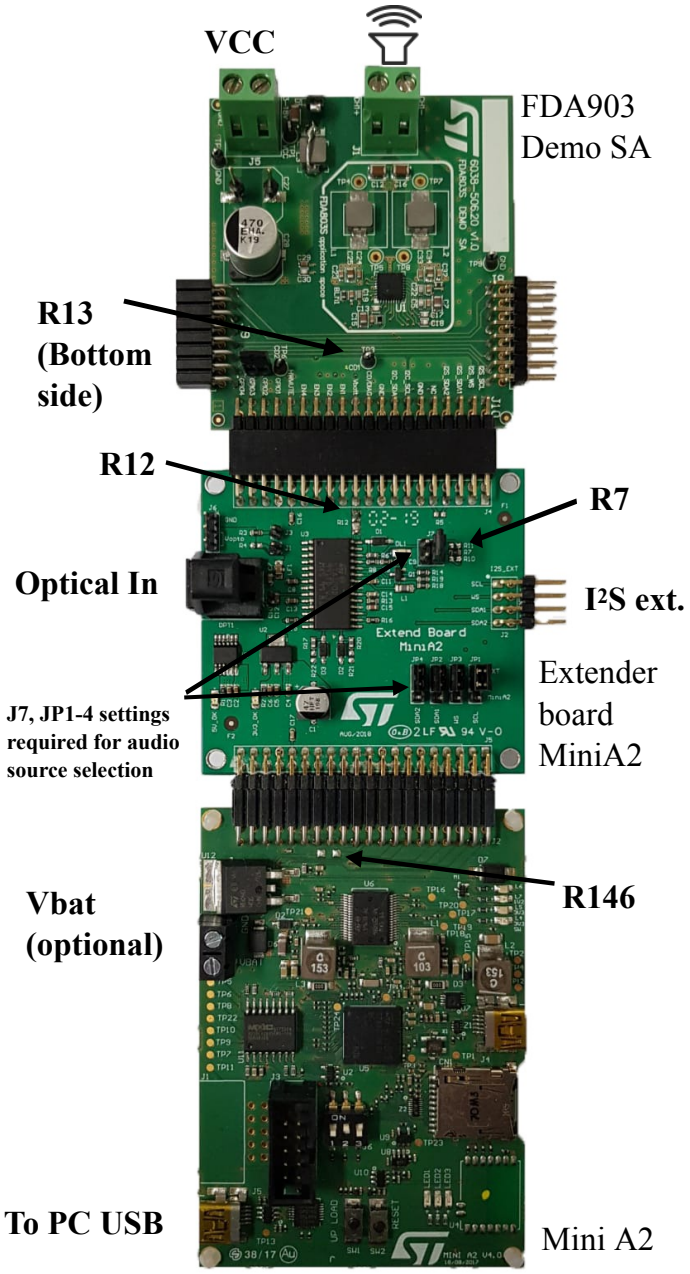
Figure 1. Top view

Figure 2. Bottom view

3.1 Board connection

The board can be connected directly to other ST modules such as the Extend Board Mini A2 and MiniA2 via connector J10.

Figure 3. FDA903S Demo SA board + Extend board MiniA2 + Mini A2 board



For information on the configuration and start-up procedures of the mentioned additional modules, dedicated documentation is available (see Section 5 Quick start guide).

3.1.1 Connectors and connections

Power supply

The amplifier power supply (VCC) with a voltage value between 3.3 V and 18 V can be connected to the J5 terminal as shown by the markings on the board.

Outputs

The amplifier outputs are connected to the J1 terminals.

Board cascading

The bus expansion connectors J8-J9 make it possible to address and drive cascaded amplifier boards using the same I^2C control and I^2S (TDM mode) signal lines.

3.2 Board options

Vbus voltage reference

An on-board voltage reference is used to supply the pull-up resistors connected to digital lines. In order to measure the Vbus current consumption, J2 can be used.

Attention: *Do not use J2 to connect an external voltage source.*

Address selection

As described in the datasheet, it is possible to modify the I^2C address of the device by suitably removing R7 or/and R6, and adding R15 or/and R16. However, no HW modification is required to set the I^2C addresses if the GUI is used through the Mini A2 board. The board is already configured to be used with the Mini A2 board (see Section 5 Quick start guide).

HW Mute

The hardware muting/unmuting is controlled through the connector J10, in turn tied to the MUTE pin (J10 pin 31).

CD/Diag

The CD/DIAG function can be monitored through the J10 connector, in turn tied to the CD/DIAG1 and CD/DIAG2 pins (J10 pins 19 and 33).

Load current monitor (only for FDA903S)

The FDA903S is able to sense the current flowing through the load and communicate its value to the system host micro.

Setting IB15[5] to ‘1’, the information is available to the host via I^2C inside the read registers DB8 and DB9, whereas setting IB2[2] to ‘1’, the real time information is available via I^2S bus through the I2S_SDA2 data line.

4 Startup sequence

The following start-up procedure is recommended:

1. Connect J5 to a 14.4 V supply
2. Provide an I^2S input signal (the device works as I^2S slave, so the clock must be provided by the signal source)
3. Load the device file (.dev) provided by ST
4. Load the default register setting file (.cfg), if available. If no .cfg file is available, the configuration set in the .dev file is applied.

At the end of the sequence, the device is ready to transition to the desired operating status such as “play”.

5 Quick start guide

This chapter describes a few steps to have audio output by the amplifier using the complementary ST tools: Extend Board MiniA2, Mini A2 board and control Graphical User Interface.

5.1 Hardware connection

- Extend board MiniA2 (if present):
  - It is recommended to supply the Extend board MiniA2 through the VCC supply rail of the FDA803S Demo SA Board. In this case R12 (0 Ω) must be inserted.

    As an alternative, the Extend board can be supplied by the Mini A2 board VBAT supply. In this case R12 must be removed.
  - Connect the Extend board MiniA2 to the Mini A2 board on one side and to the FDA803S DEMO SA board on the other, as shown in Figure 3.
  - Connect the desired audio source to the Extend board MiniA2 and set the jumpers (J7, JP1-4) to select the correct input (refer to the Extend board MiniA2 manual for details).
  - Since the Extend board MiniA2 has R7 mounted by default shorting I2S_SDA1 to I2S_SDA2, remove R7 in case the FDA903S is mounted on the board and if the I2S_SDA2 is used independently to read the current sensing values.
- MINI A2 Board:
  - Connect the USB port connector J5 (near the corner) to a PC USB port.
  - In case the alternative supply concept is used of the Extend Board miniA2 (R12 not mounted), check that the resistor R146 is present and the VBAT connector is connected to a power supply (min 5 V, max 25 V) (by default R146 is not mounted).
- FDA803S Demo SA Board:
  - Connect the VCC power supply (J5) and the load (J1).
  - Make sure that R13 (0 Ω) is mounted to supply the Extend board as recommended (by default R13 is not mounted).

Attention: *It is not allowed to supply the VCC power line of the FDA803S Demo SA from the MiniA2 connector (VBAT) side.Consequently, the 3 resistors (R12, R13, R146) must not all be mounted at same time.*

6 GUI setup

- Unzip the device file (“Mini A2 FDA803S-*.zip” or “Mini A2 FDA903S-*.zip”) in the GUI installation folder “.\AccordoGUIFDAXXX\Devices\”. It includes the amplifier’s specific registers description (FDA803S.dev or FDA903S.dev) and if available, the configuration file (registers best settings, FDAx03S_I2Cbest_Setting.cfg).
- Launch the GUI (rev 2.2 april 2018) with the Mini A2 board connected to the PC via USB(J5). When the module is detected, two “LED’s” on the bottom left of the GUI panel start blinking:
  - Menu “Settings” → ”serial port”: select the proper COM port;
  - Menu “Settings” → ”I^{2}C Setup”: configure the proper I^{2}C address by clicking the button “Find Device Address”;

Figure 4. I^{2}C setup

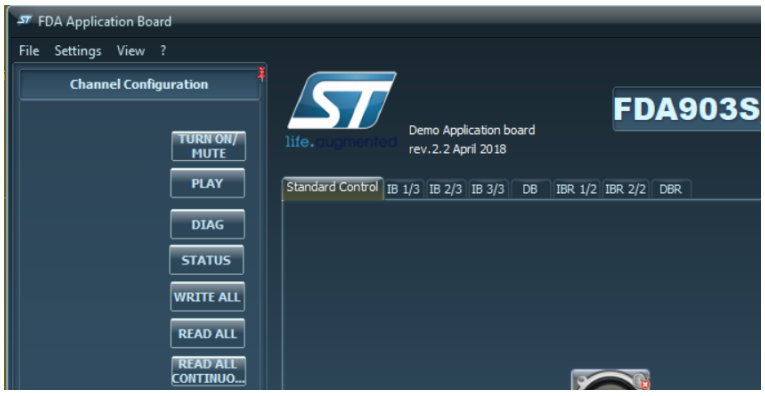
  - Menu “File” → ”Open Device File”: select the FDA903S.dev or FDA803S.dev file present in the “.\AccordoGUIFDAXXX\Devices\” folder;
  - Menu “File” → ” Open Reg Values File”: select the FDAx03S_I2Cbest_Setting.cfg file if present in the “.\AccordoGUIFDAXXX\Devices\” folder.

Attention: *If at any time a pop-up window appears with a “read violation“ notification, it must be ignored. Operation can continue normally after discarding the pop-up.*

7 Device setup for playback

- Turn the device on with an I^{2}S clock present:
  - Click the buttons “channel conf.” followed by “Write all“ to apply the settings loaded from the “FDAx03S_I2Cbest_Setting.cfg” file;
  - Click the “PLAY” button.

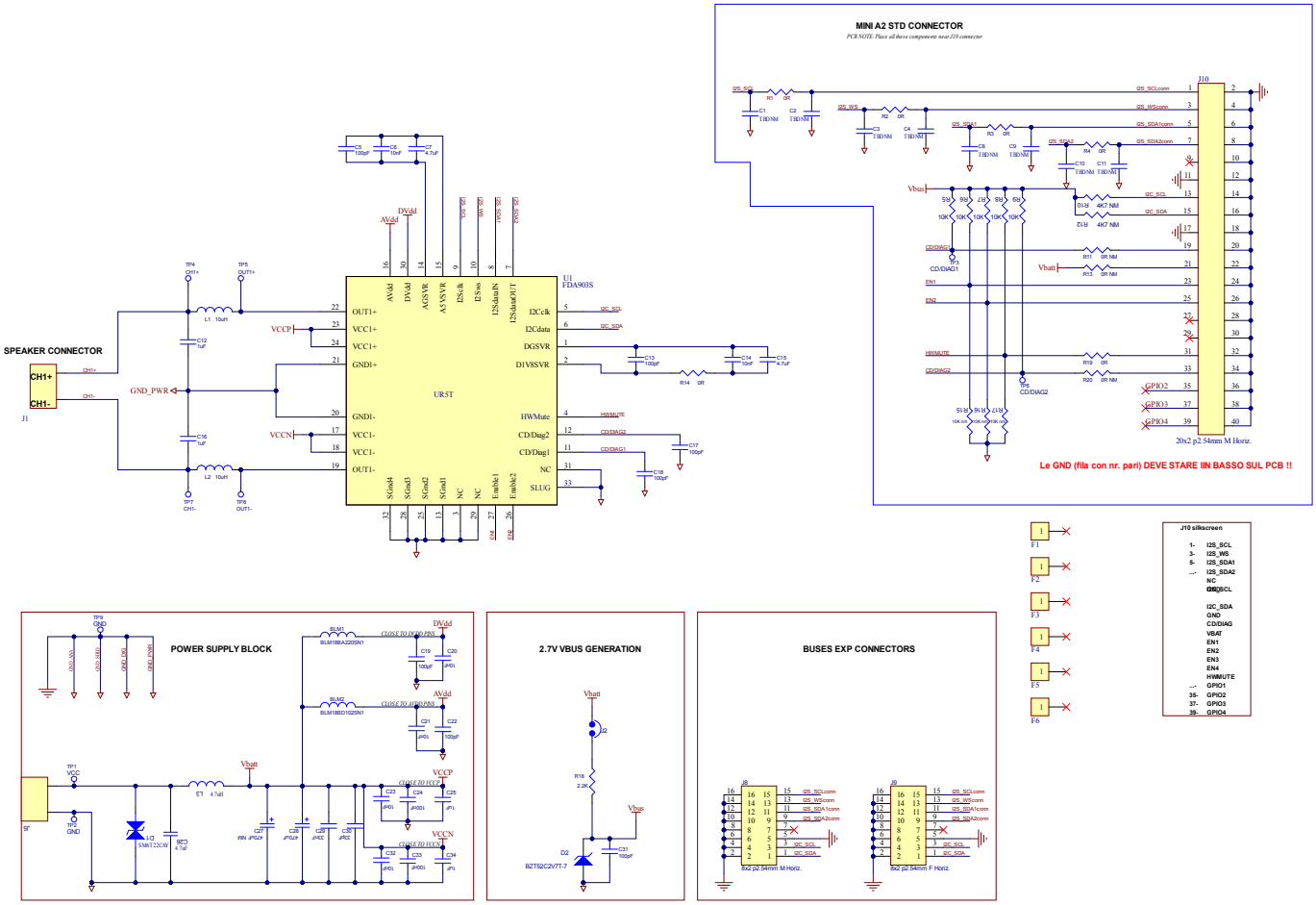
Figure 5. Channel configuration



8 Board schematic

The Figure 6 shows the schematics of the “6038-506.20 v1.0 FDA803S DEMO SA“ board.

Figure 6. 6038-506.20 v1.0 FDA803S DEMO SA schematic



9 Bill of materials

The list provided here shows all the components (including parts necessary for this board but not required when the IC is used in a real project) used to assemble the board described in this manual, with which performance measurements have been performed. The manufacturer and part number information is provided to allow the user to look up the characteristics of the components and select equivalent components from different manufacturers if needed.

Table 2. Bill of materials

Qty	Designator	Description	Value	Tol.	(1)	(2)	(3)	(4)	Package	Manufacturer PN
1	BLM1	SMD EMI Suppression Filter	22 R	25%	-	0.5 A	-	100	0603	BLM18BA220SN1
1	BLM2	SMD EMI Suppression Filter	1 K	25%	-	0.1 A	-	100	0603	BLM18BD102SN1
5	C5, C13, C17, C18, C31	SMD MLCC C0G/NP0 Capacitor	100 pF	5%	25 V	-	-	-	0603	C0603X101J3GACAUTO
2	C6, C14	SMD MLCC X7R Capacitor	10 nF	10%	25 V	-	-	-	0603	C0603S103K3RACAUTO
2	C7, C15	SMD MLCC X7R Capacitor	4.7 µF	10%	25 V	-	-	-	0805	CGA4J1X7R1E475K125AC
2	C12, C16	SMD MLCC X7R Capacitor	1 µF	10%	50 V	-	-	-	1206	CGA5L3X7R1H105M160AB
2	C19, C22	SMD MLCC C0G/NP0 Capacitor	100 pF	5%	50 V	-	-	-	0603	CGA3E2NP01H101J080AA
4	C20, C21, C23, C32	SMD MLCC X7R Capacitor	10 nF	10%	50 V	-	-	-	0603	C0603X103K5RAC3316
2	C24, C33	SMD MLCC X7R Capacitor	100 nF	10%	50 V	-	-	-	0603	CGA3E2X7R1H104K080AA
2	C25, C34	SMD MLCC X7R Capacitor	1 µF	10%	50 V	-	-	-	0805	GCM21BR71H105KA03L
1	C26	SMD MLCC X7R Capacitor	4.7 µF	10%	50 V	-	-	-	1206	CGA5L3X7R1H475K160AB
1	C28	SMD Electrolytic Capacitor	470 µF	-	25 V	-	-	-	d10h10.2	EEEHA1E471P
1	C29	SMD MLCC X7R Capacitor	33 µF	10%	50 V	-	-	-	0603	C0603C333K5RACAUTO
1	C30	SMD MLCC C0G/NP0 Capacitor	33 pF	5%	50 V	-	-	-	0603	C0603C330J5GACAUTO
1	D1	Bidirectional 22 V Transil	-	-	22 V	-	600 W	-	DO-214AA	SM6T36CAY
1	D2	SMD 2.7V Zener Diode	-	7%	2.7 V	-	0.3 W	-	SOD-523	BZT52C2V7T-7
2	J1, J5	TH Terminal Header, Male, 2 position, p5.08 mm	-	-	-	-	-	-	p5.08mm	2008004

Qty	Designator	Description	Value	Tol.	(1)	(2)	(3)	(4)	Package	Manufacturer PN
1	J2	Header, 2-Pin, Single row, TH, Straight, Male	-	-	-	-	-	-	p2.54mm	
1	J8	Header, 8-Pin, Dual row, TH, Right Angle, Male	-	-	-	-	-	-	p2.54mm	TSW-108-11-G-D-RA
1	J9	Header, 8-Pin, Dual row, TH, Right Angle, Female	-	-	-	-	-	-	p2.54mm	803-87-016-20-001101
1	J10	TH Header Male, Dual row, 20x2, p2.54 mm, Horiz.	-	-	-	-	-	-	p2.54mm	TSW-120-08-L-D-RA
2	L1, L2	SMD inductor	10uH	20%	-	1.6 A	-	-	CUSTOM	VCTA32251B-100MS6-11
1	L3	SMD inductor	4.7 µH	20%	-	8.2 A	-	-	CUSTOM	IHLP-2020CZ-4R7M-A1
5	R1, R2, R3, R4, R14	SMD chip resistor	0 Ω	1%	75 V	-	0.1 W	-	0603	CRCW06030000Z0EB
5	R5, R6, R7, R8, R9	SMD chip resistor	10 KΩ	1%	75 V	-	0.1 W	-	0603	CRCW060310K0FKEB
1	R18	SMD chip resistor	2.2 KΩ	1%	150 V	-	0.125 W	-	0805	CRCW08052K20FKEA
5	TP1, TP2, TP3, TP6, TP9	TH Test Point terminal Assembly - 1.04 mm	-	-	-	-	-	-		20-2137
1	U1	1x10 W Class D digital input amplifier	-	-	18 V	-	45 W	-	QFN32	FDA903S / FDA803S
UNMOUNTED COMPONENTS										
8	C1, C2, C3, C4, C8, C9, C10, C11	SMD Capacitor	TBD	-	-	-	-	-	0603	
1	C27	SMD Electrolytic Capacitor	470 µF	-	25 V	-	-	-	d10h10.2	EEEHA1E471P
2	R10, R12	Surface mount chip resistor	4.7 KΩ	1%	75 V	-	0.1 W	-	0603	CRCW06034K70FKEA
1	R13	SMD chip resistor	0 Ω	1%	75 V	-	0.1 W	-	0603	CRCW06030000Z0EB
3	R15, R16, R17	SMD chip resistor	10 KΩ	1%	75 V	-	0.1 W	-	0603	CRCW060310K0FKEB

1. *Voltage rating*
2. *Current rating*
3. *Power rating*
4. *Frequency rating (in MHz)*

10 Board layout

Figure 7. **Assembly Top**

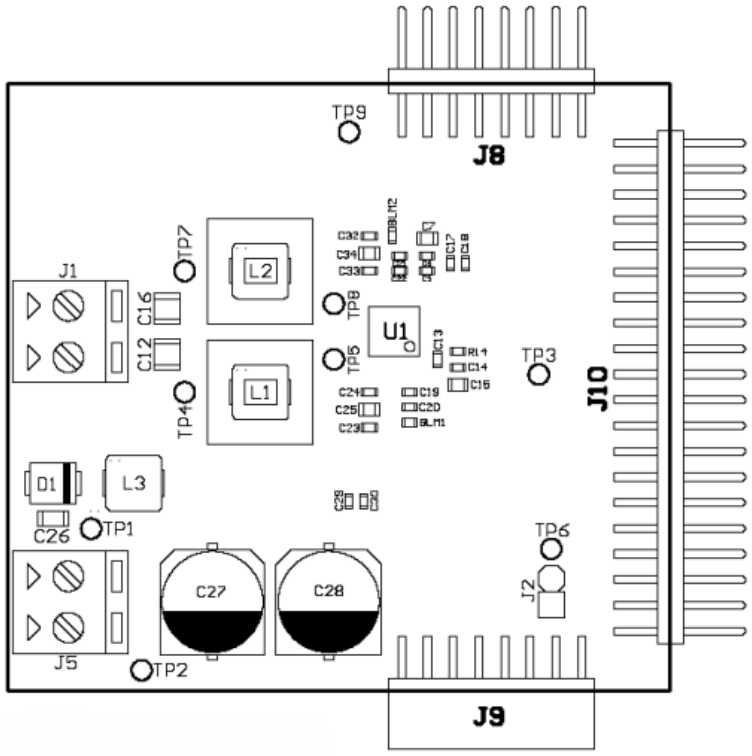


Figure 8. **Top layer**

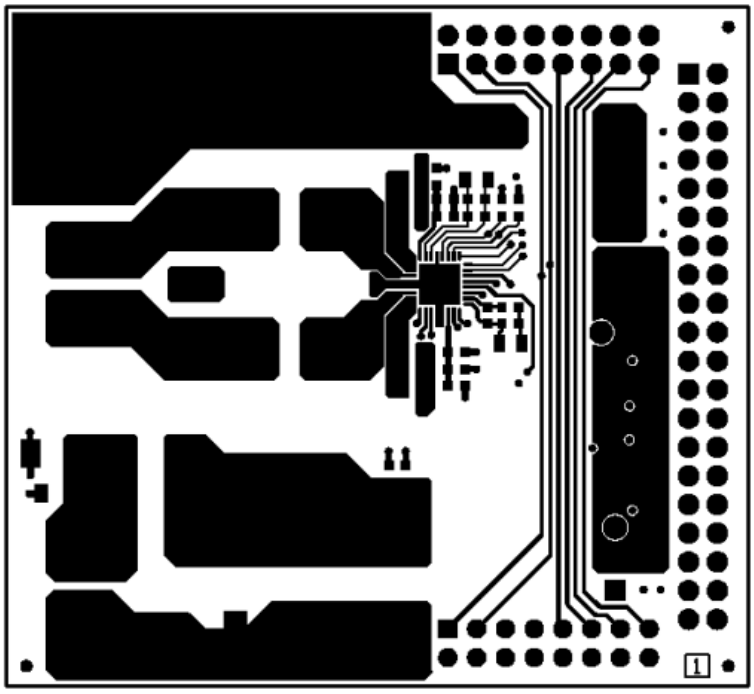


Figure 9. **Layer 2**

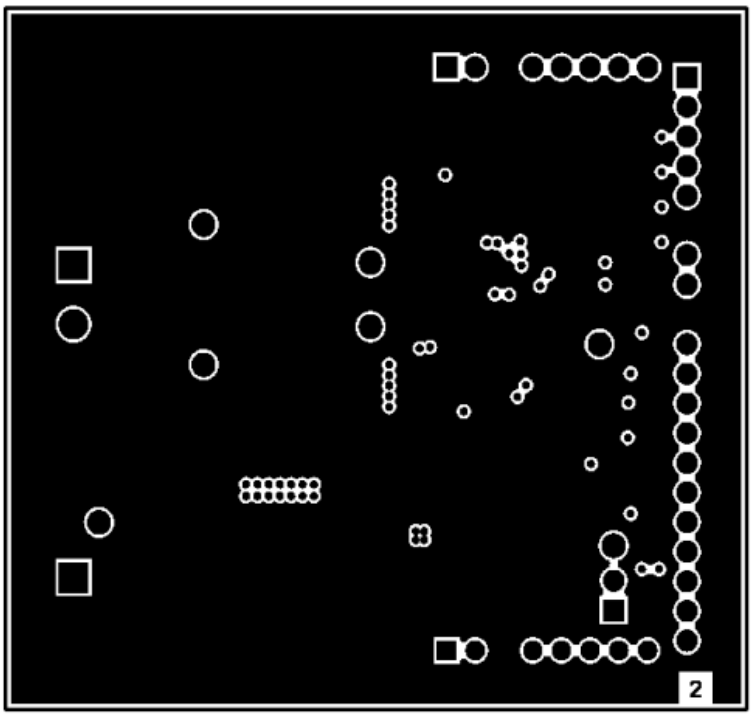


Figure 10. **Layer 3**

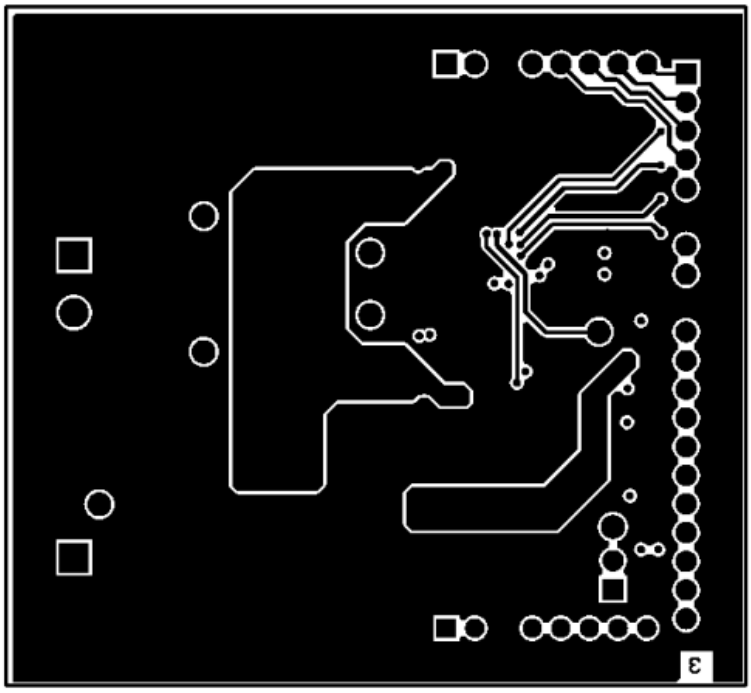


Figure 11. **Bottom layer**

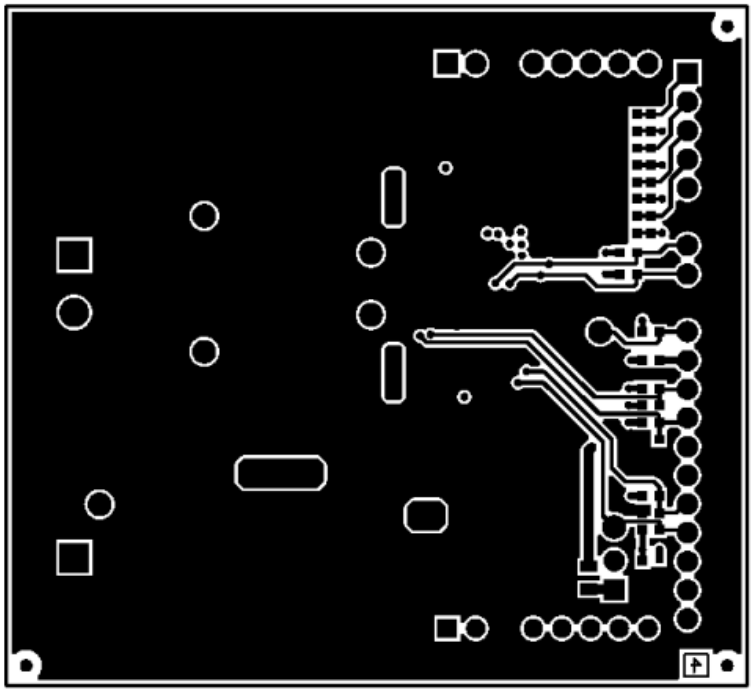
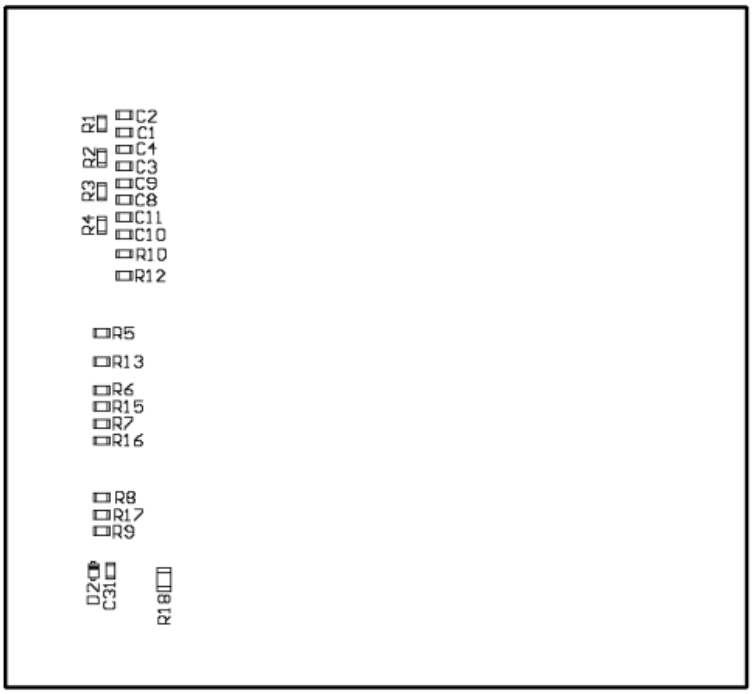


Figure 12. **Assembly Bottom**



Revision history

Table 3. **Document revision history**

Date	Version	Changes
22-Mar-2022	1	Initial release.

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