AUIR3241S/AUIR3242S - Board Back to Back 12V

User Guide

About this document

Scope and purpose

Help customers to “plug and play” AUIR3241S/AUIR3242S back-to-back board in order to assess the features of the underlying product AUIR3241S/AUIR3242S.

For sake of simplicity this document is valid for both AUIR3241S back-to-back board and AUIR3242S back-to-back board.

Difference between AUIR3241S and AUIR3242 is Vin pin logic:

AUIR3242S ON → Vin= low
AUIR3241S ON → Vin= high

Table of contents

1 Overview

AUIR3241S/AUIR3242S board back-to-back is a semiconductor-based solution of a fail-safe/fail operational power switch for automotive applications.

AUIR3241S/AUIR3242S board has a back-to-back, N-channel MOSFET common source structure and allows replacement of any mechanical relay by cutting the current flow in both directions. Additionally, the back-to-back structure blocks current in case of reverse battery situation.

The MOSFET are protected against linear mode by UVLO (Under voltage lock-out) feature, integrated in the driver. See driver datasheet for more information on the feature.

An analog and digital circuit are implemented to monitor driver's boost converter activity and detect gate-source leakage of MOSFET.

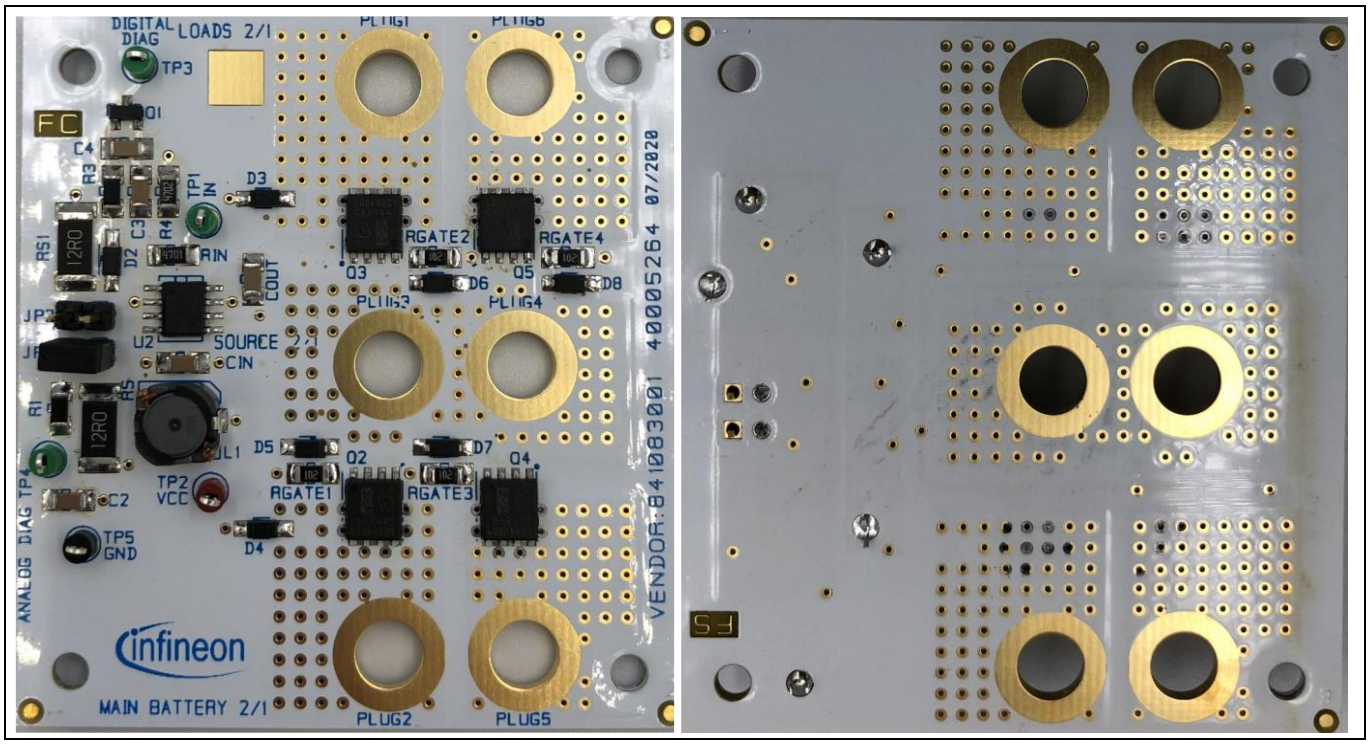

Figure 1 Top & Bottom view

Table 1 Infineon parts used

Type	Reference	PCS	Comment
Driver	AUIR3241S	**1**	Full analog driver, **AUIR3241S** board only
Driver	AUIR3242S	**1**	Full analog driver, **AUIR3242S** board only
MOSFET Trench 40V	IAUC120N04S6N009	**4**	Also exists in 0.60mΩ version

2 Connecting and operating the board

This chapter describes how to connect the board and gives a non-exhaustive list of actions to avoid in order to keep AUIR3241S/AUIR3242S and the board operational.

The board is designed for 50A continuous, 80A for one-minute operation.

Note: It is important to always connect TP5 GND to the battery or power supply negative/ground terminal.

Important tips:

- Connect both power connectors (P5&P6, P2&P5) if using continuous currents >10A.
- Do not connect P1 and P2 jumper at the same time. Start by connecting P1, analog diag.

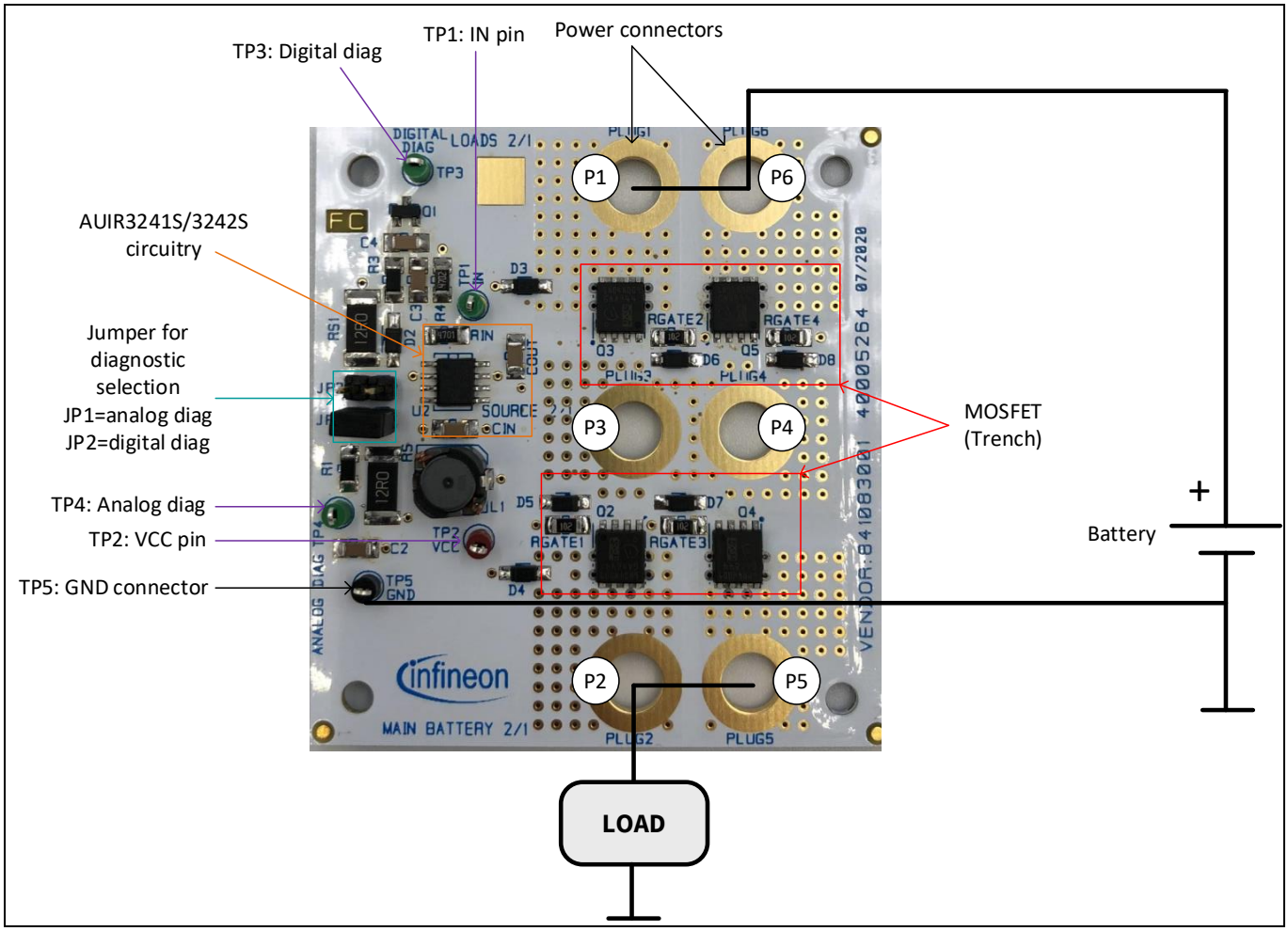

Figure 2 Power connection diagram

Please Avoid the following:

- Short between Cout and GND as this will lead to driver destruction—Short Vout to Vcc to try UVLO feature.
- Do not connect two batteries/power sources together as there is no protection implemented.

3 Switching behaviour

Note: Values shown in this chapter are measured under lab conditions and will vary for different cooling conditions and setups, and samples used.

Figure 3 Waveforms from OFF to ON mode [Yellow V_{IN}; Green V_{RS}; Blue $V_{GS(AUIR3241S)}$; Purple V_{LOAD}]

Figure 4 shows the behavior of the RS pin and analog diagnostic during turn-on, assuming that a short-circuit is present across gate- source of one of the MOSFET. This can be tested by replacing one of the diodes (D5, D6, D7, D8) across a MOSFET gate-source by an appropriate SMD resistor.

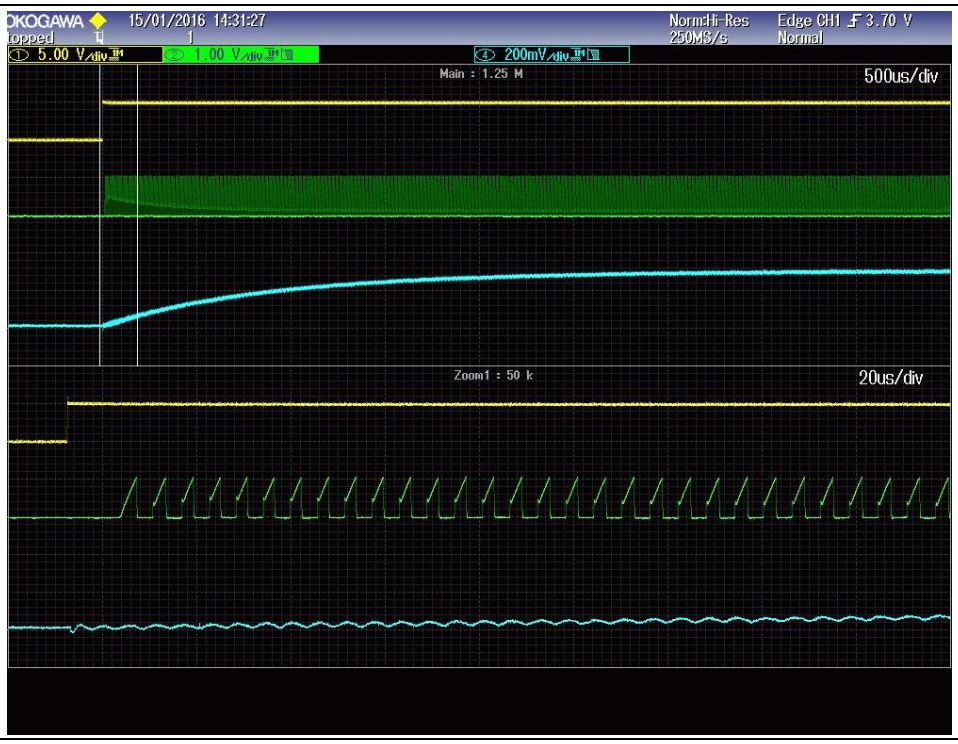

Figure 4 Waveforms from OFF to ON mode with $R_{GS(SHORT)}$=100Ω [Yellow V_{IN}; Green V_{RS}; Blue V_{DIAG_ANALOG}]

4 Mechanicals

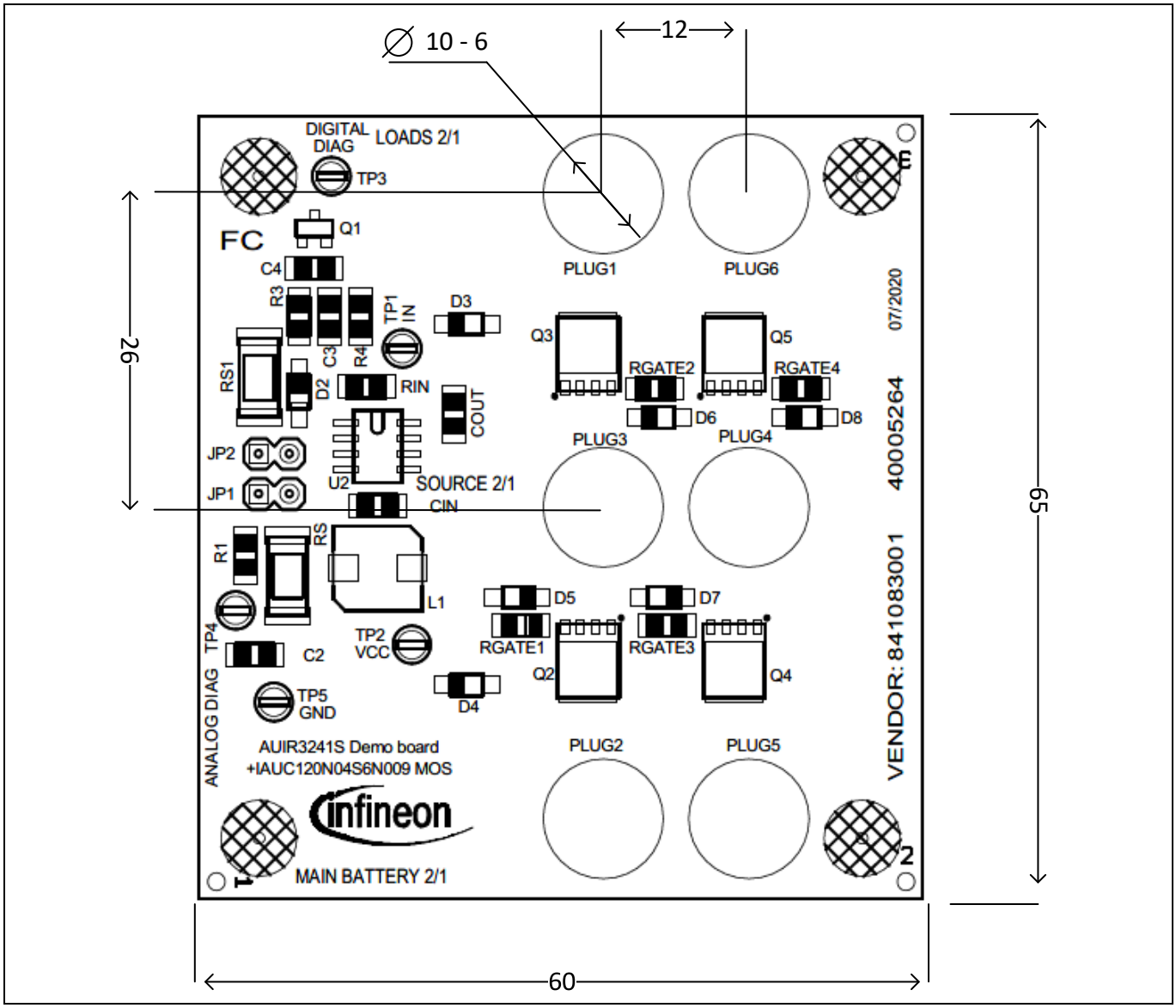

Figure 5 Top Assembly [mm]

5 Electrical schematic

5.1 Electrical diagram

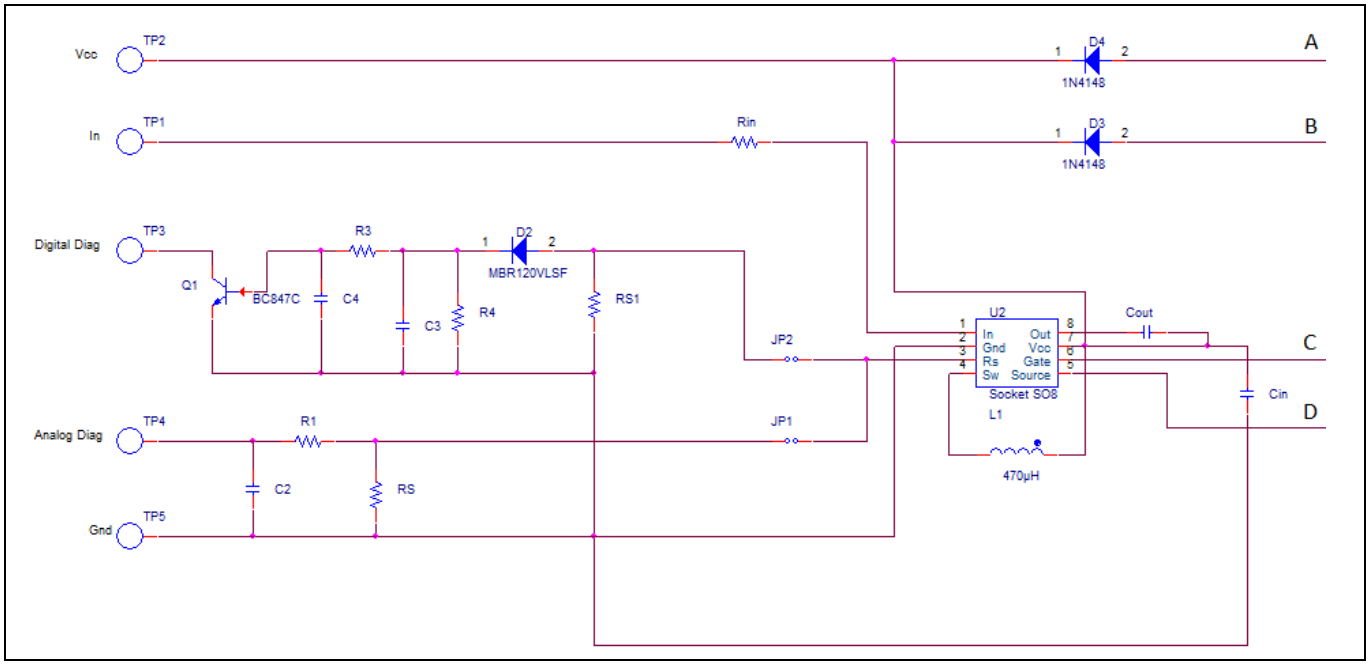

Figure 6 Driver side, valid for both AUIR3241S and AUIR3242S

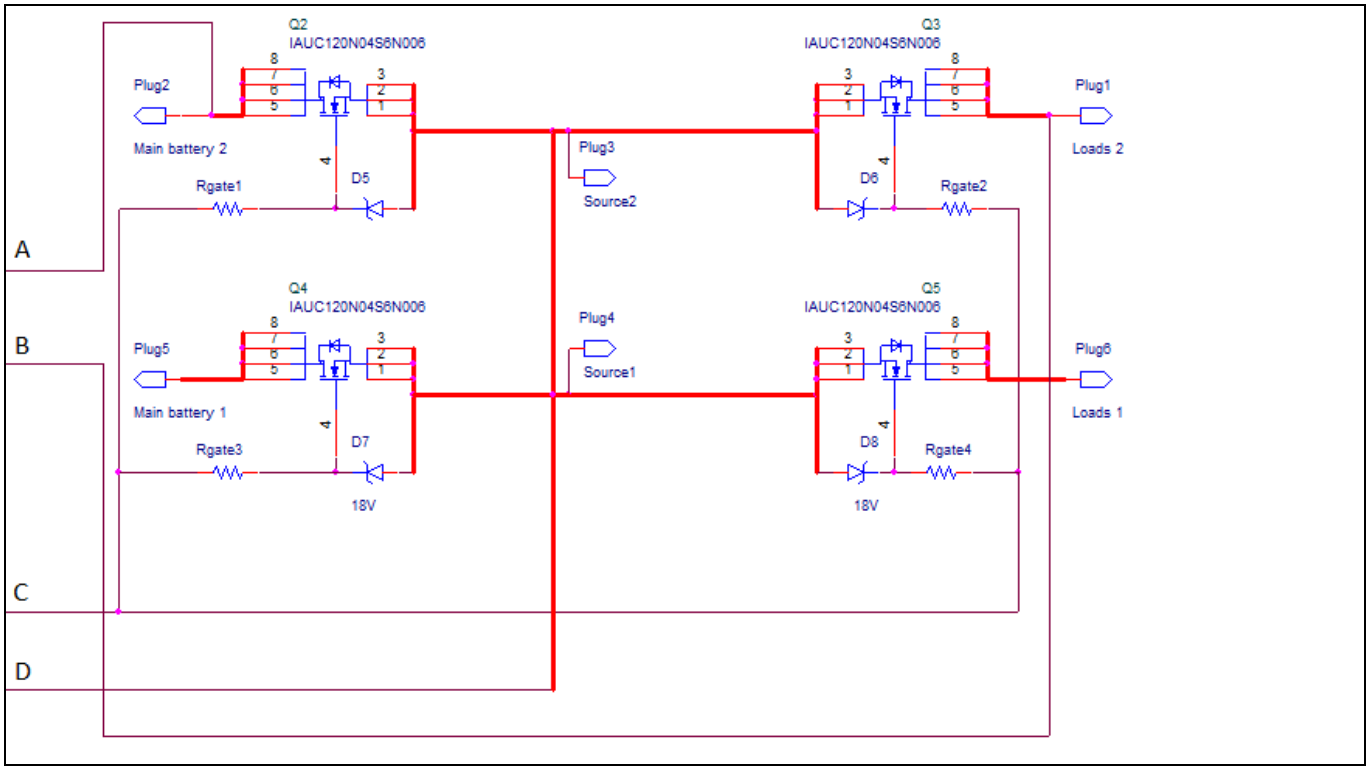

Figure 7 Power side, valid for both AUIR3241S and AUIR3242S

5.2 Bill of materials

Table 2 Bill of material

Item	Quantity	Reference in electrical diagram	Value / Type	Package / brand when available
1	1	Cin	470 nF, 50V	Package 1206
2	3	C2,C3,C4	100nF, 25V	Package 1206
3	6	D6,D5,D7,D8	18V MMSZ5248BT1G	SOD-123
4	2	D3, D4	1N4148W	SOD-123
5	2	JP1,JP2	Multicomp-pro 2pins	+ 1 Jumper per board
6	1	L1	470µH	CLF7045NIT-471M-D
7	1	Q1	BC847C	TO-236AB
8	1	Rin	4.7kΩ	SMD1206
9	6	Rgate1 to 8	1kΩ	SMD1206
10	2	RS, RS1	12Ω / 1W	**SMD1812**
11	2	R1,R3	10kΩ	SMD1206
12	5	TP1,TP2,TP3,TP4,TP5	Test point	Test point
13	1	U2	AUIR3241S or AUIR3242S	SOIC8
14	6	Q2, Q3, Q4, Q5	IAUC120N04S6N009	SSO8: PG-TDSON-8
15	1	Cout	1µF, 25V	SMD1206
16	1	D2	20V Schottky MBR120VLSFT1G	SOD-123
17	1	R4	47kΩ	SMD1206

6 PCB details

AUIR3241S/AUIR3242S PCB is a 2-layer, FR4 material board. Figure 8 describes the layer arrangements; layer details can be found in figure 9.

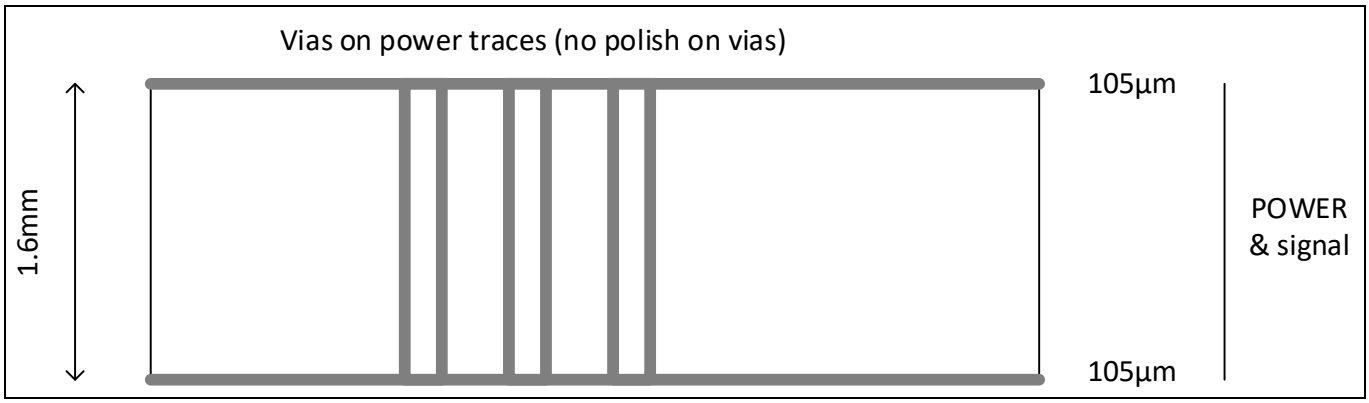

Figure 8 PCB layers

Vias were used to connect the two layers on the power side to allow better thermal flow and current sharing between layers. However, the number of vias is not optimized and can be reduced without reducing the board thermal performance.

The layout choice offers many MOSFET test possibilities: back-to-back, Q-diode, one MOSFET + 3 Q-diodes or high-side switch MOSFET.

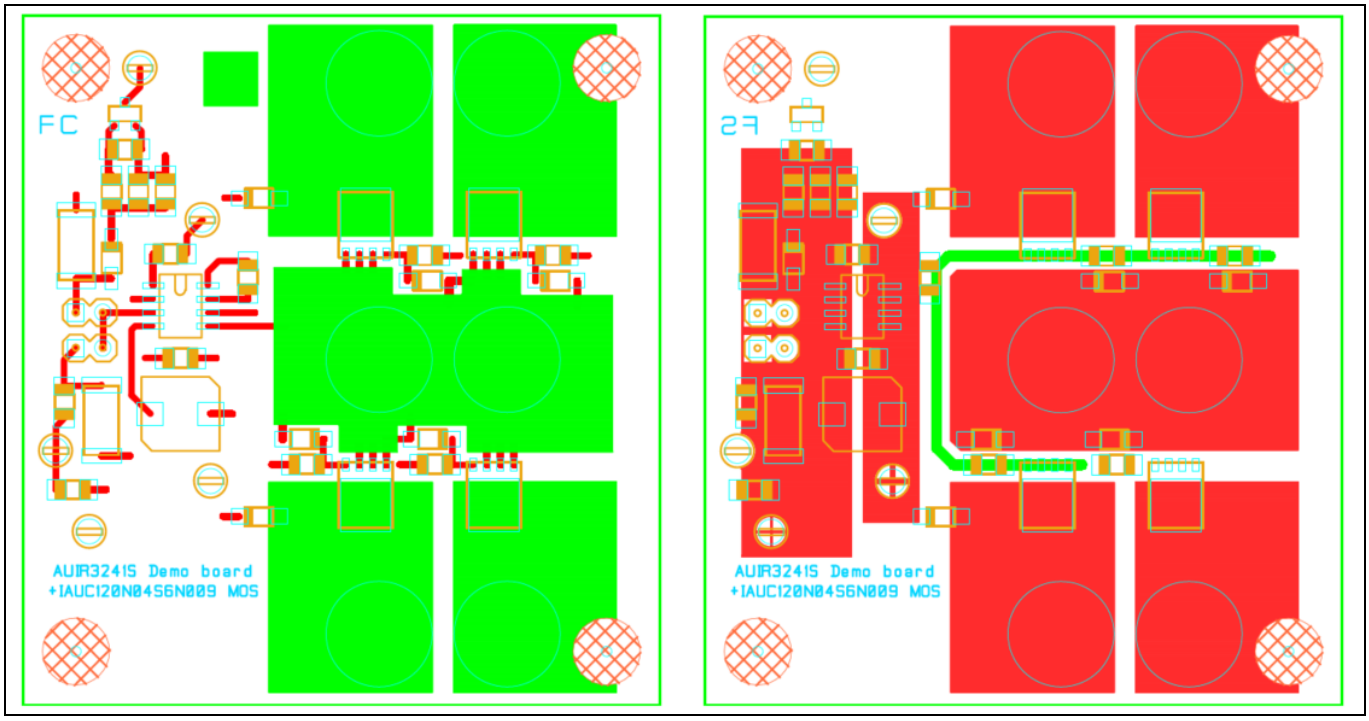

Figure 9 Top layer (left) and bottom layer (right) [105µm]

Revision history

Document version	Date of release	Description of changes
A1	November 30, 2015	Initial document
A2	December 10, 2015	BOM modification
A3	December 28, 2015	Update digital diagnostic schematic
A4	April 26, 2016	Add measure and labels updated
2.0	August 24, 2020	New board version: Mechanicals, BOM, layout updated One user guide for AUIR3241S and AUIR3242S boards.
2.1	September 09, 2020	Updated current capability and layer thickness

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