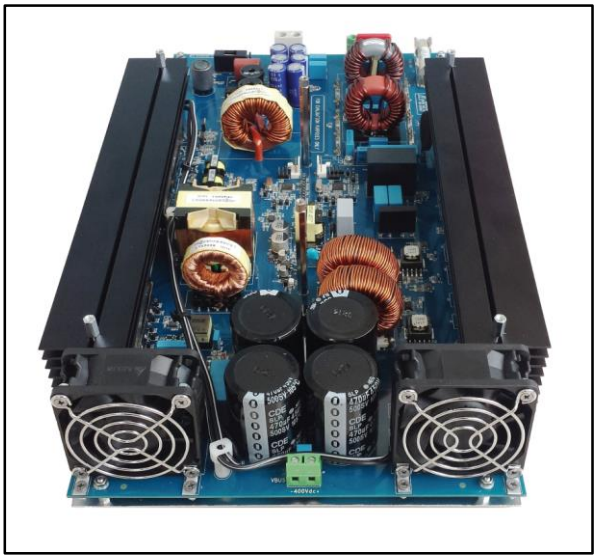
STEVAL-ISA172V1

2 kW fully digital AC-DC power supply (D-SMPS) evaluation board

Data brief



Features

- Input AC voltage: 90 V to 264 V
- Output voltage: 48 V or 52 V, max output current: 42 A
- Input AC frequency: 45 Hz to 65 Hz
- Nominal output power: 2 kW
- Interleaved PFC stage
- PFC switching frequency: 60 kHz
- PFC average current mode control
- Cycle-by-cycle PFC current control
- Maximum power factor: 0.99
- Mains under and overvoltage, under- and over-frequency protection
- DC-DC stage: full-bridge phase-shifted ZVS with synchronous rectification
- DC-DC switching frequency: 100 kHz
- HF transformer isolation voltage: 4 kV
- Forced cooling with air flow speed modulation according to the output power
- Overtemperature protection
- Full set of input and output protections
- PFC control & DC-DC control managed by STM32F334C8
- PFC power stage based on MDmesh M2 power MOSFETs and SiC diodes
- DC-DC power stage based on MDmesh DM2 power MOSFETs
- Synchronous rectification based on STripFET power MOSFETs
- EMC filter for noise reduction
- RoHS compliant

Description

The STEVAL-ISA172V1 is a 2 kW fully digital switch mode AC-DC converter consisting of two power sections: a two phase interleaved power factor corrector (PFC) and a DC-DC phase-shifted full-bridge converter, controlled by an STM32F334 microcontroller for each section.

The interleaved PFC comprises two boost converters operating 180° out of phase, based on 600 V MDmesh M2 power MOSFETs. The downstream section comprises a DC-DC phase-shifted full-bridge converter based on MDmesh DM2 power MOSFETs and performs voltage step-down using an HF transformer, with a primary-to-secondary ratio chosen to maintain a sufficiently high efficiency and regulation over the entire operating range.

On the primary side, the transformer is supplied by the full-bridge converter and switching losses are reduced thanks to zero voltage switching (ZVS).

On the secondary side, synchronous rectification (SR) is used to ensure low conduction losses. The output voltage waveform is rectified by STripFET power MOSFETs and then smoothed by the output filter.

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Additional information

The combination of the design choices results in boosted efficiency, in line with standard requirements in the power supply industry. The system is controlled by two STM32F334 microcontrollers, one for each section. This microcontroller adds innovative features such as a high-resolution timer, which gives increased accuracy in terms of current regulation on the primary PFC and on the secondary DC-DC phase-shifted full-bridge side. The two microcontrollers exchange information about the status of the input and output power stage via bidirectional serial communication. Both the power stage and control stage are supplied by an off-line flyback circuit based on the VIPer27H, which provides a suitable regulated voltage to the microcontrollers, as well as the gate driver ICs and the signal conditioning circuits.

1 Schematic diagram

Figure 1: STEVAL-ISA172V1 circuit schematic: input section and EMI filter

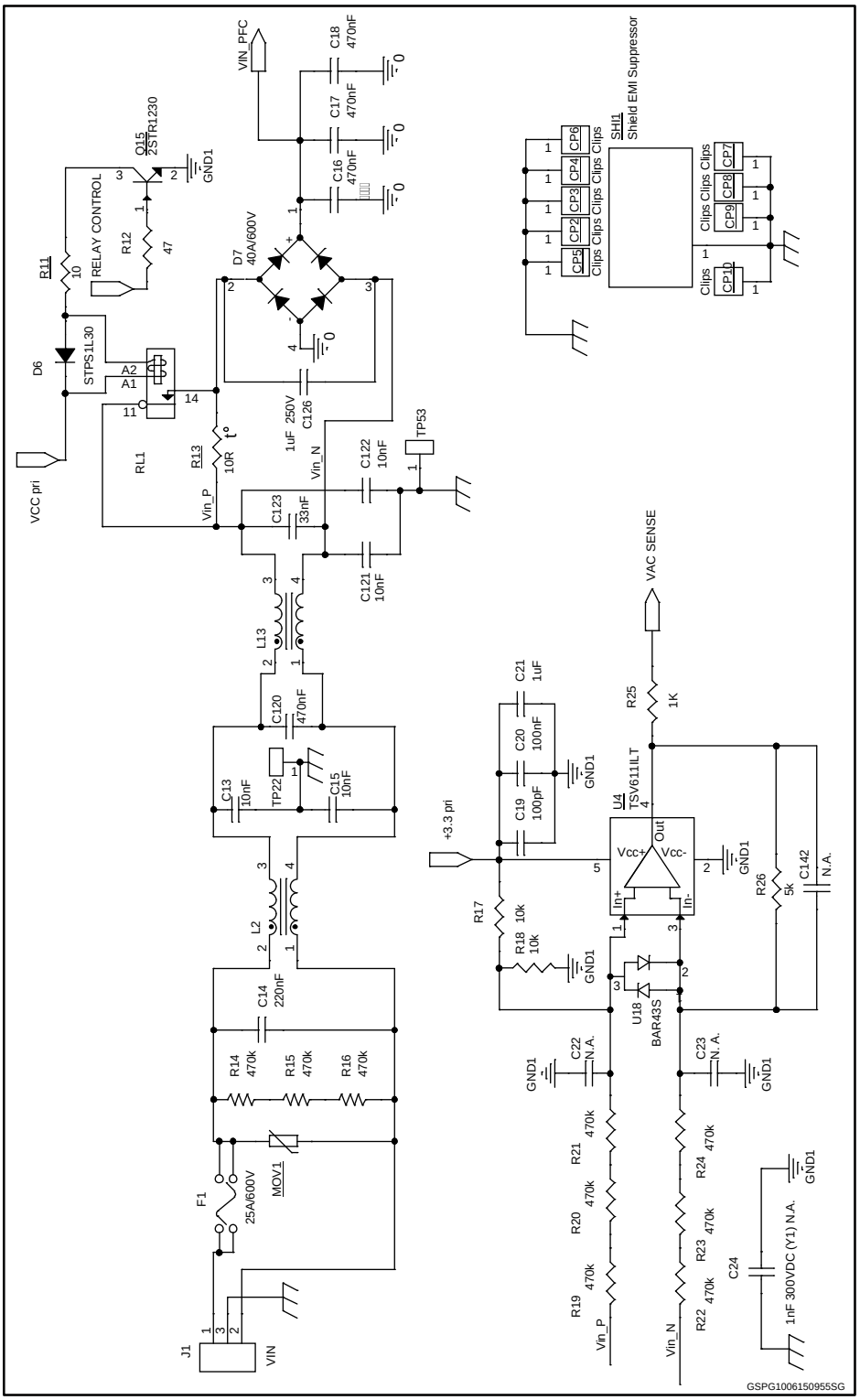


Figure 2: STEVAL-ISA172V1 circuit schematic: interleaved PFC

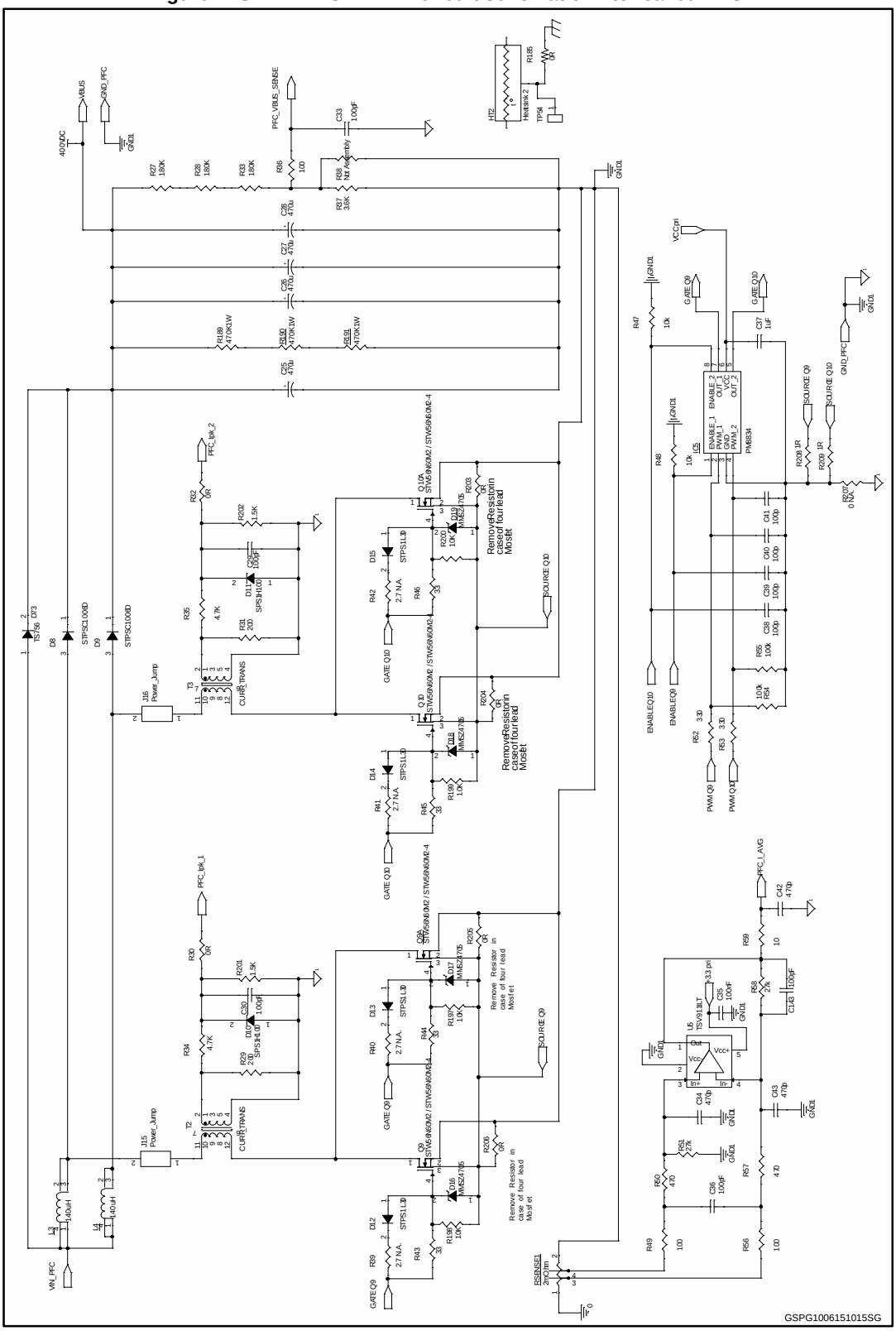


Figure 3: STEVAL-ISA172V1 circuit schematic: phase shift DC-DC converter

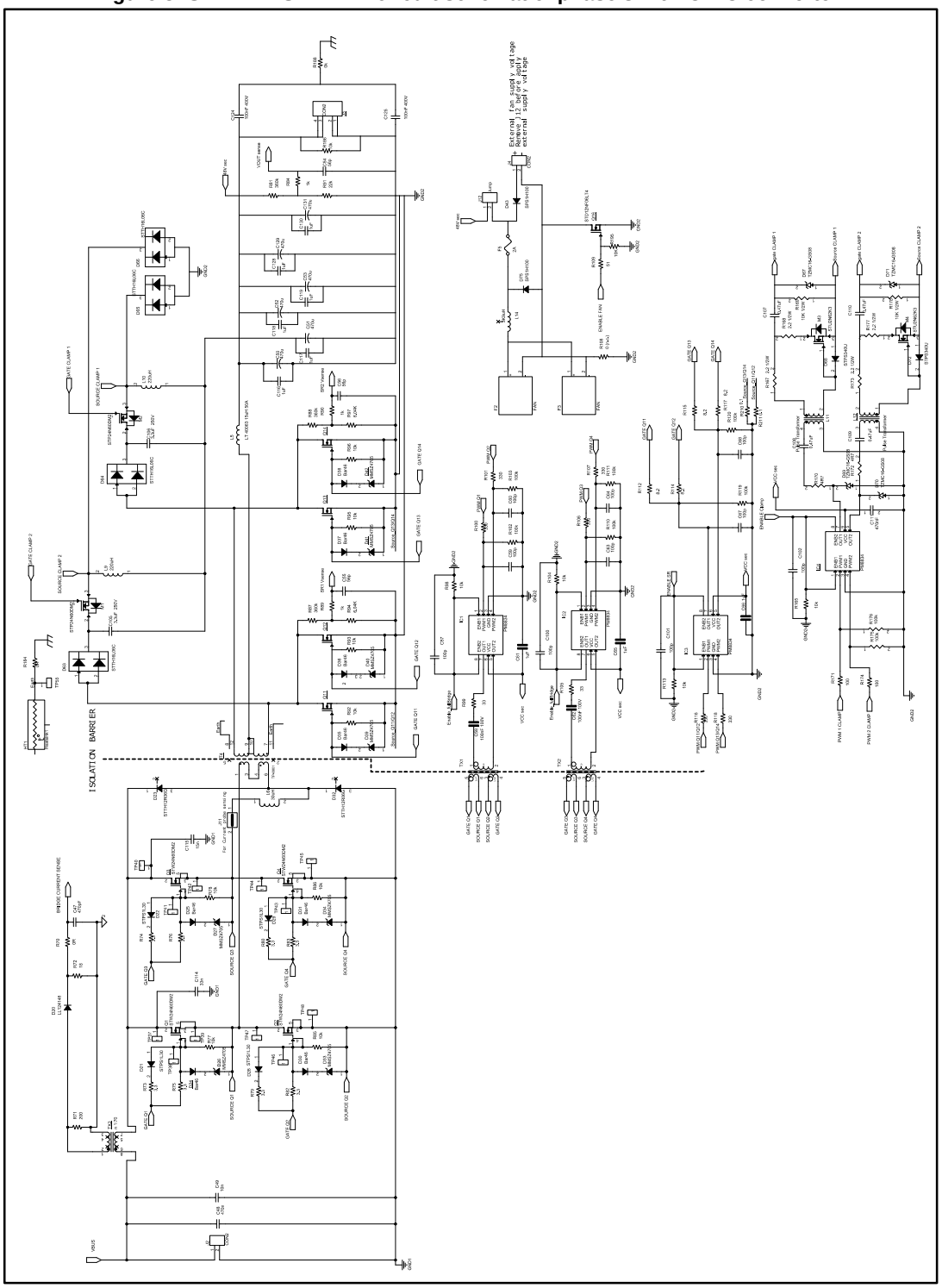


Figure 4: STEVAL-ISA172V1 circuit schematic: secondary MCU

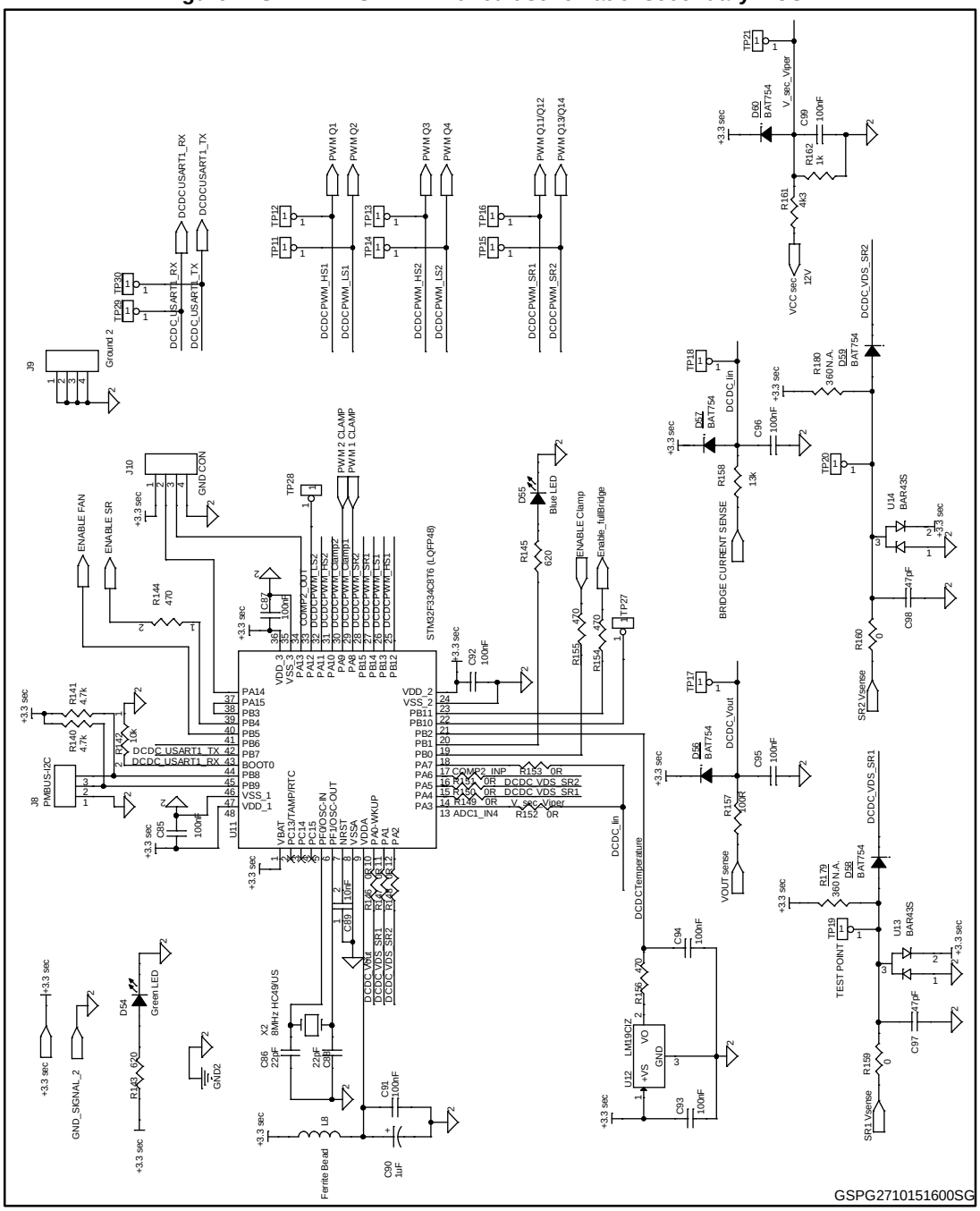


Figure 5: STEVAL-ISA172V1 circuit schematic: primary MCU

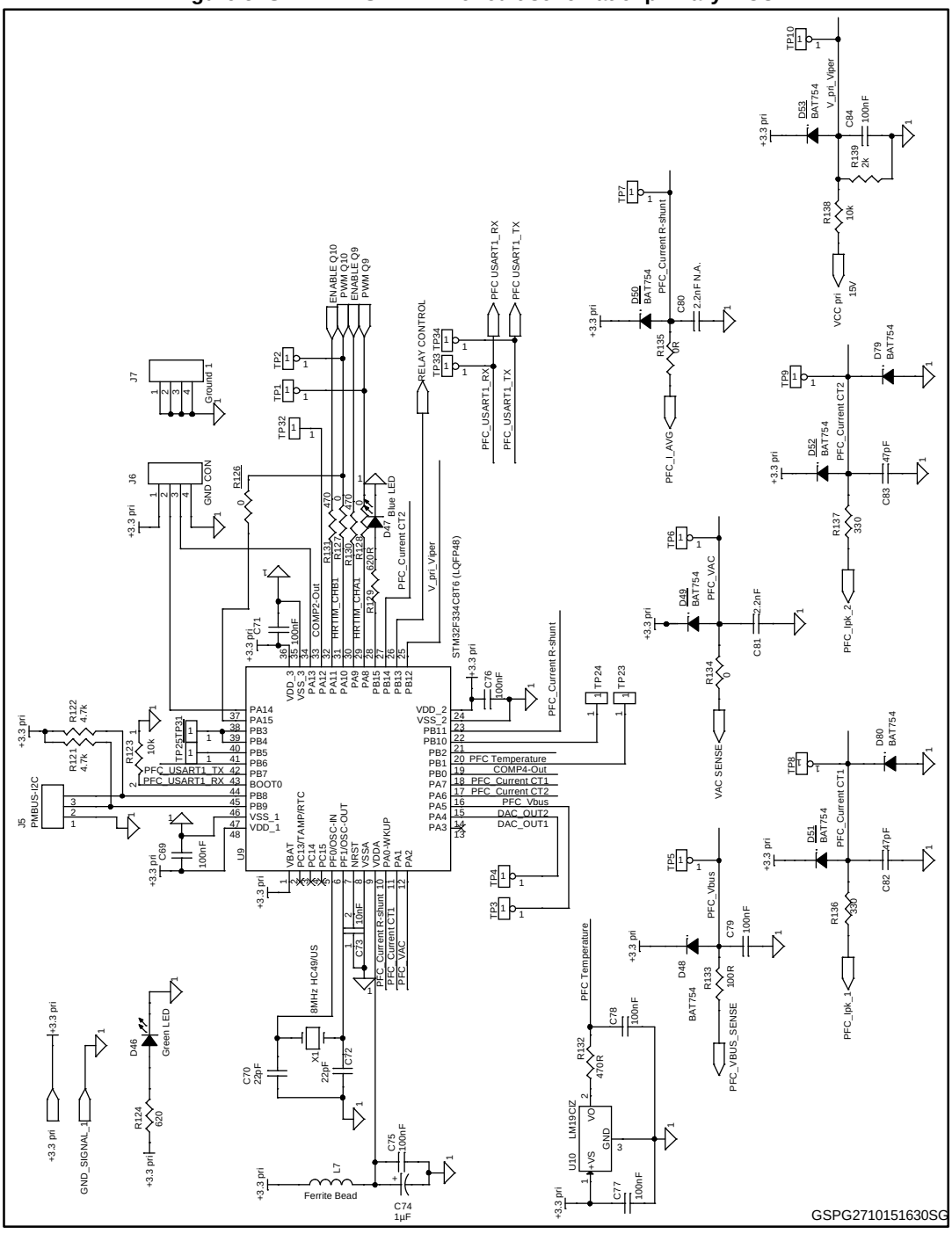


Figure 6: STEVAL-ISA172V1 circuit schematic: auxiliary power supply

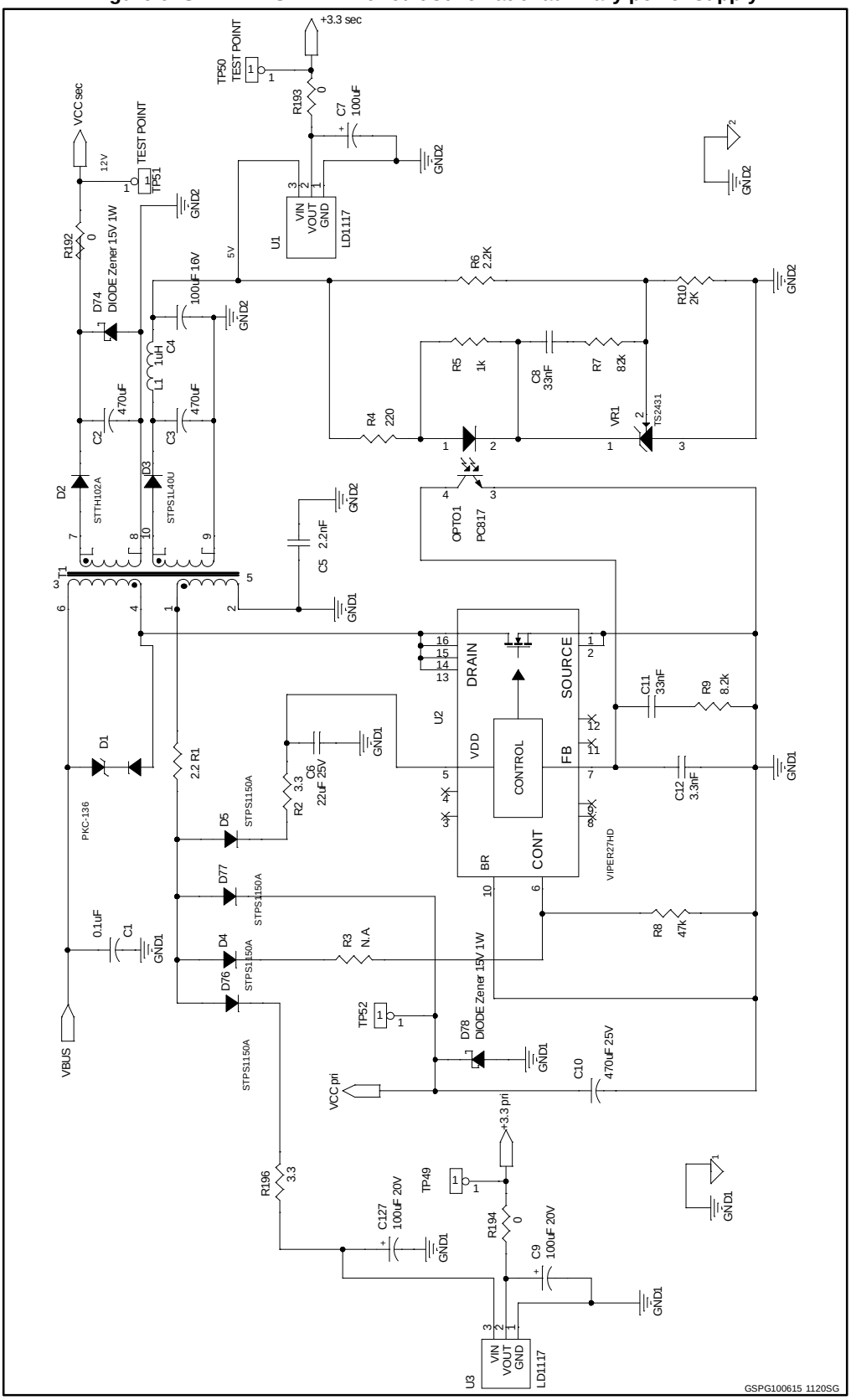
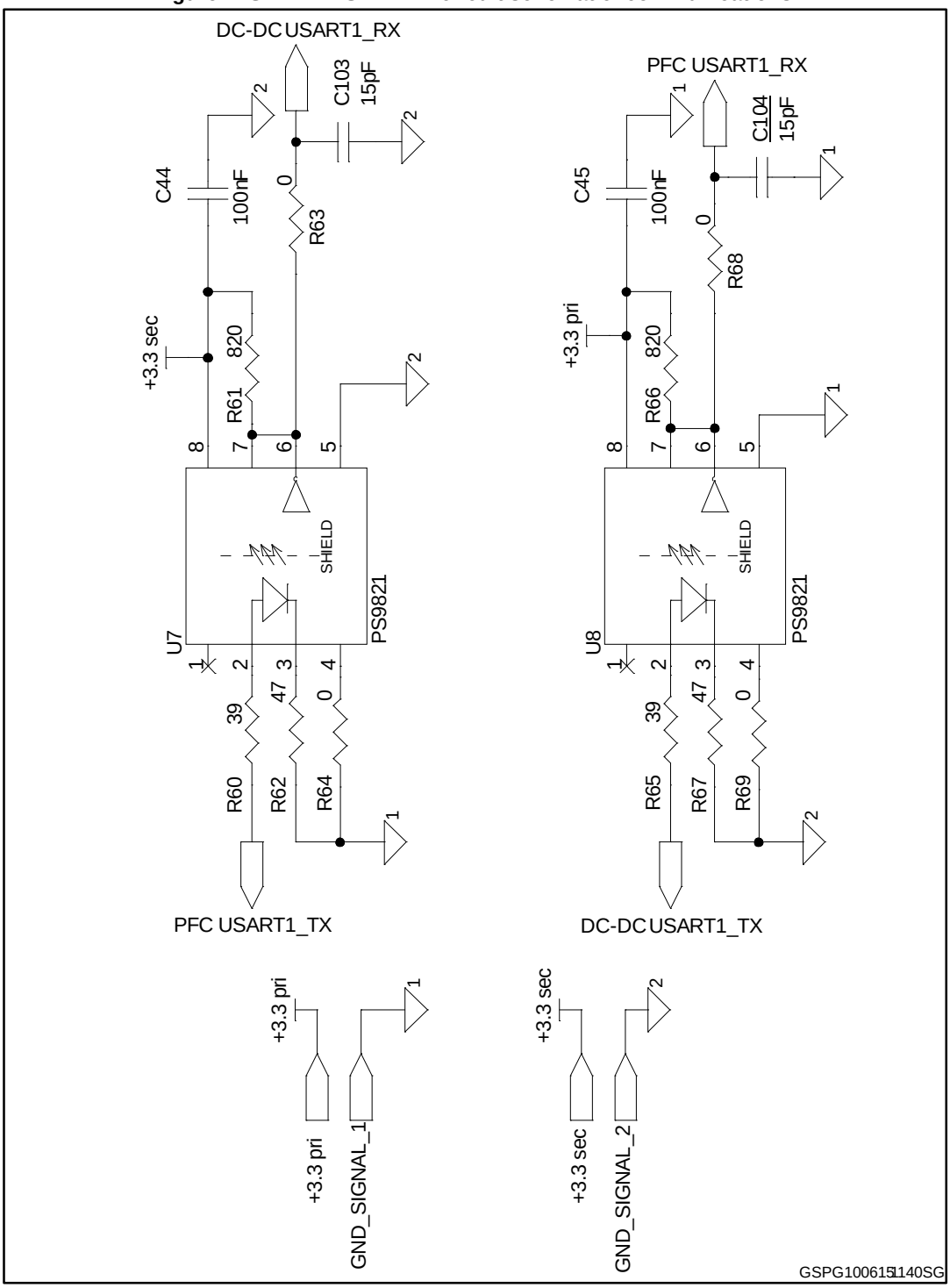


Figure 7: STEVAL-ISA172V1 circuit schematic: communications



2 Revision history

Table 1: Document revision history

Date	Version	Changes
18-Jun-2015	1	Initial release.
26-Jun-2015	2	Updated: Features on the cover page.
29-Oct-2015	3	Updated: STEVAL-ISA172V1 circuit schematic: secondary MCU and STEVAL-ISA172V1 circuit schematic: primary MCU.
29-Jan-2016	4	Updated: *Figure 3: "STEVAL-ISA172V1 circuit schematic: phase shift DC-DC converter"*.

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