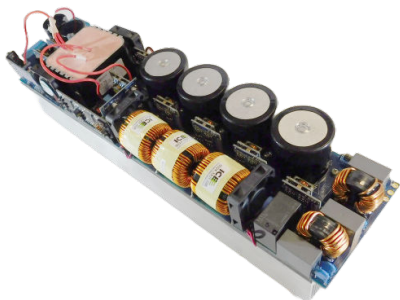


7 kW bidirectional AC-DC converter for ESS and industrial charger, full SiC-based



The picture shown is for illustration purpose only.
Actual product may vary depending on buyer's selection and availability.

Features

- Open-frame power density: 4 kW/l (66 W/inch³)
- Cooling: natural air convection

Electrical Specifications

- AC voltage range: 90 – 265 Vac
- AC line frequency range: 47 – 63 Hz
- DC side max current: 9 Adc
- AC side max current: 32 Arms
- Input max power: 7.2 kW
- DC voltage range: 550 – 850 Vdc
- THD < 3 % and PF > 0.99 at full power
- Switching frequency of PFC: 65 kHz
- Resonance frequency of CLLC: 200 kHz
- Peak efficiency: 97.1 %

Description

The **STEVAL-7BIDIRCB** is a solution for a 7 kW bidirectional charger, consisting of two stages:

1) bidirectional three-channel interleaved totem pole PFC working at fixed frequency in continuous conduction mode (CCM). The three-channel interleaved PFC architecture guarantees the highest efficiency in a wide load range.

2) bidirectional resonant full bridge CLLC with synchronous rectification. The CLLC uses frequency modulation to regulate the output.

The two stages are digitally controlled by two STM32G474RET6 microcontrollers that are mounted in a single control card.

The power stage is fully composed by ST's SiC power MOSFETs, driven by STGAP SiC dedicated gate drivers with galvanic isolation. Thanks to a modular system architecture in combination with the HU3PAK package, a power density of 4 kW/l is achieved.

The PFC operates at a switching frequency of 65 kHz and the CLLC operates at variable frequency from 130 kHz to 350 kHz.

Thanks to the excellent switching performance of the SiC GEN3 and its Rds(on) temperature stability, a peak efficiency of 97.1 % is achieved in charger mode.

The solution is also suitable to implement a solar integrated ESS, thanks to provision for MPPT stage connection.

Product summary	
7 kW bidirectional AC-DC converter for ESS and industrial charger, full SiC-based	STEVAL-7BIDIRCB
Automotive-grade silicon carbide Power MOSFET 650 V, 40 mOhm typ., 30 A in an HU3PAK package	SCT040HU65G3AG
Mainstream Arm Cortex-M4 MCU 170 MHz with 512 Kbytes of Flash memory	STM32G474RET6
Galvanically isolated 4 A single gate driver for SiC MOSFETs	STGAP2SiCSN STGAP2SiCSAC STGAP2SiCSANC
Automotive 38 V, 5 W synchronous iso-buck converter	A69861TR
Automotive 38 V, 1.5 A synchronous step-down switching regulator with 30 µA quiescent current	A6986F3V3 A6986F5V
Applications	Battery Storage Systems for Home On Board Charger (OBC)

1 Schematic diagrams

Notice: These schematics are for illustration purpose only. Actual product may vary depending on buyer's selection and availability.

Figure 1. STEVAL-7BIDIRCB - Power board (1 of 5)

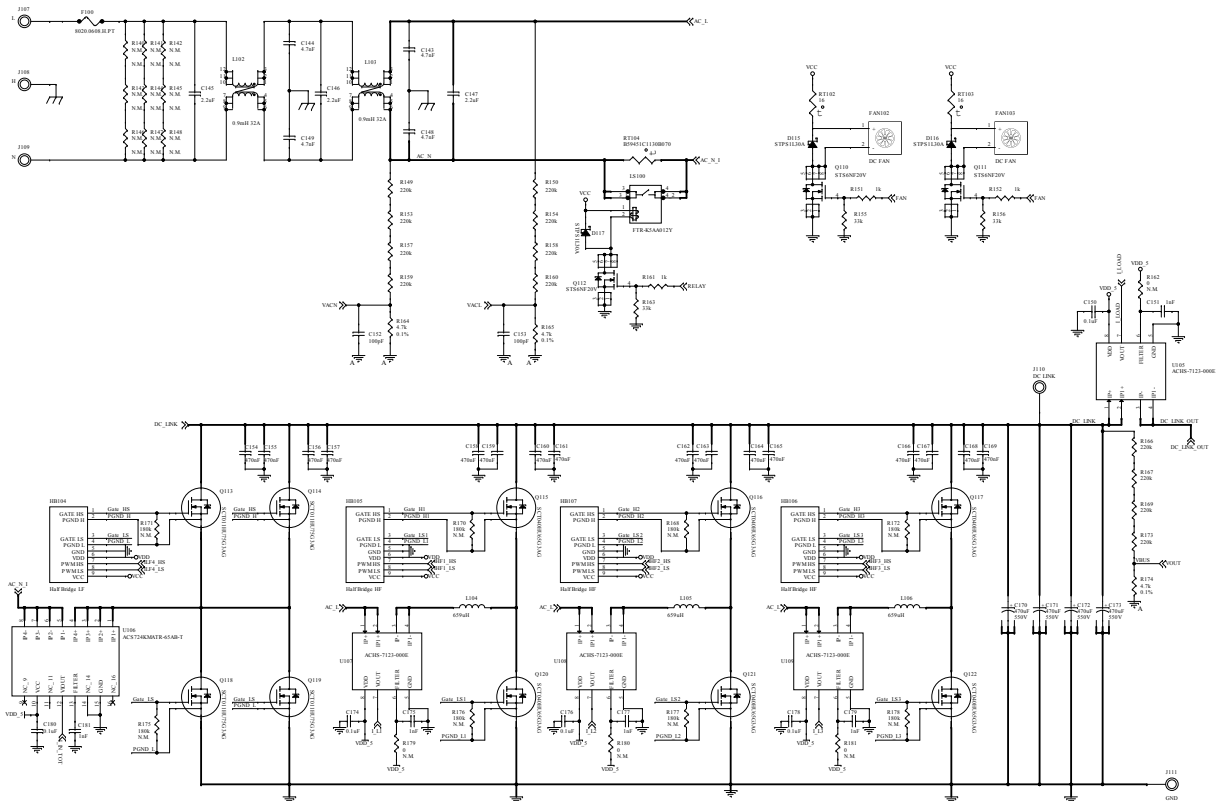


Figure 3. STEVAL-7BIDIRCB - Power board (3 of 5)

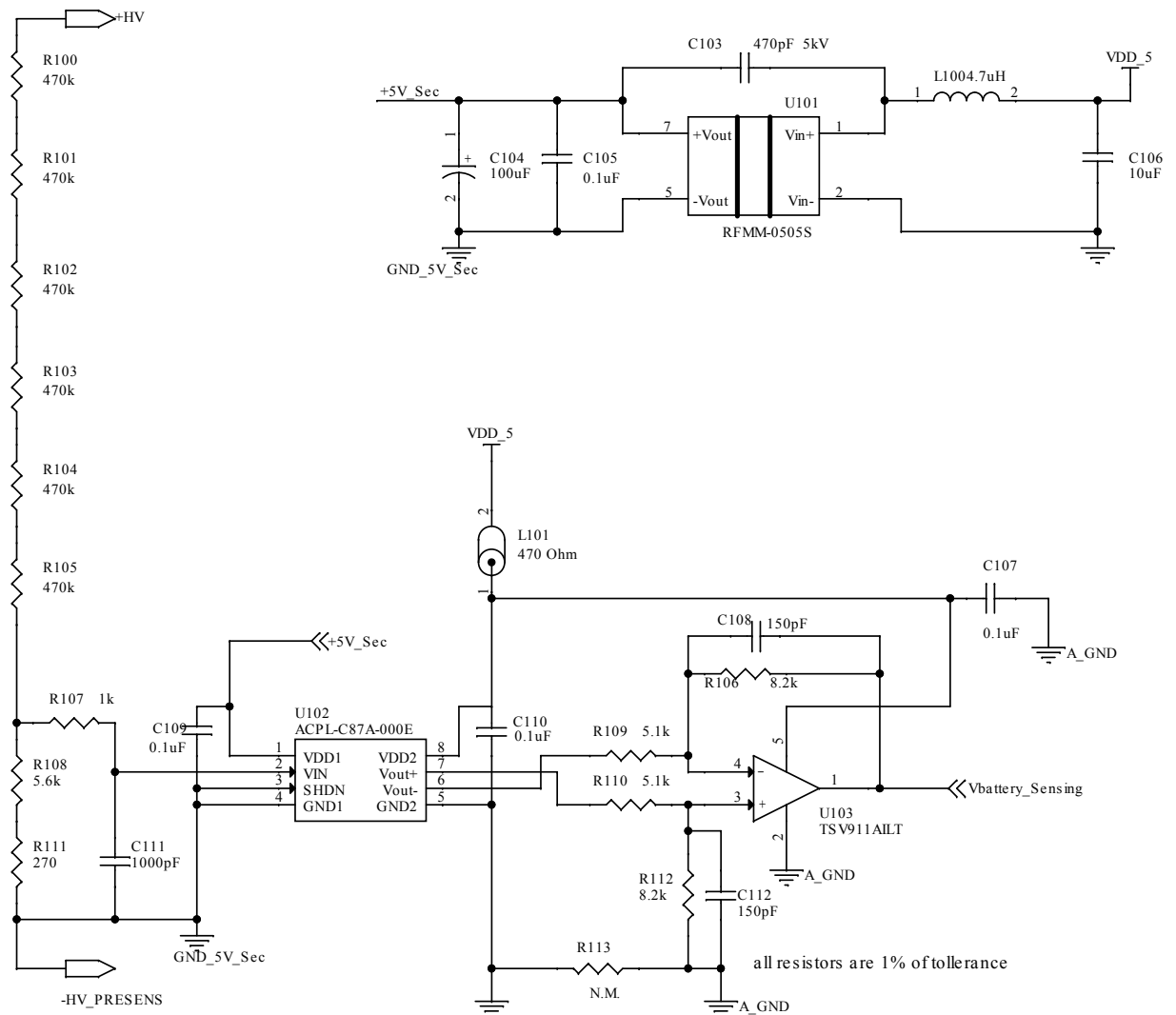
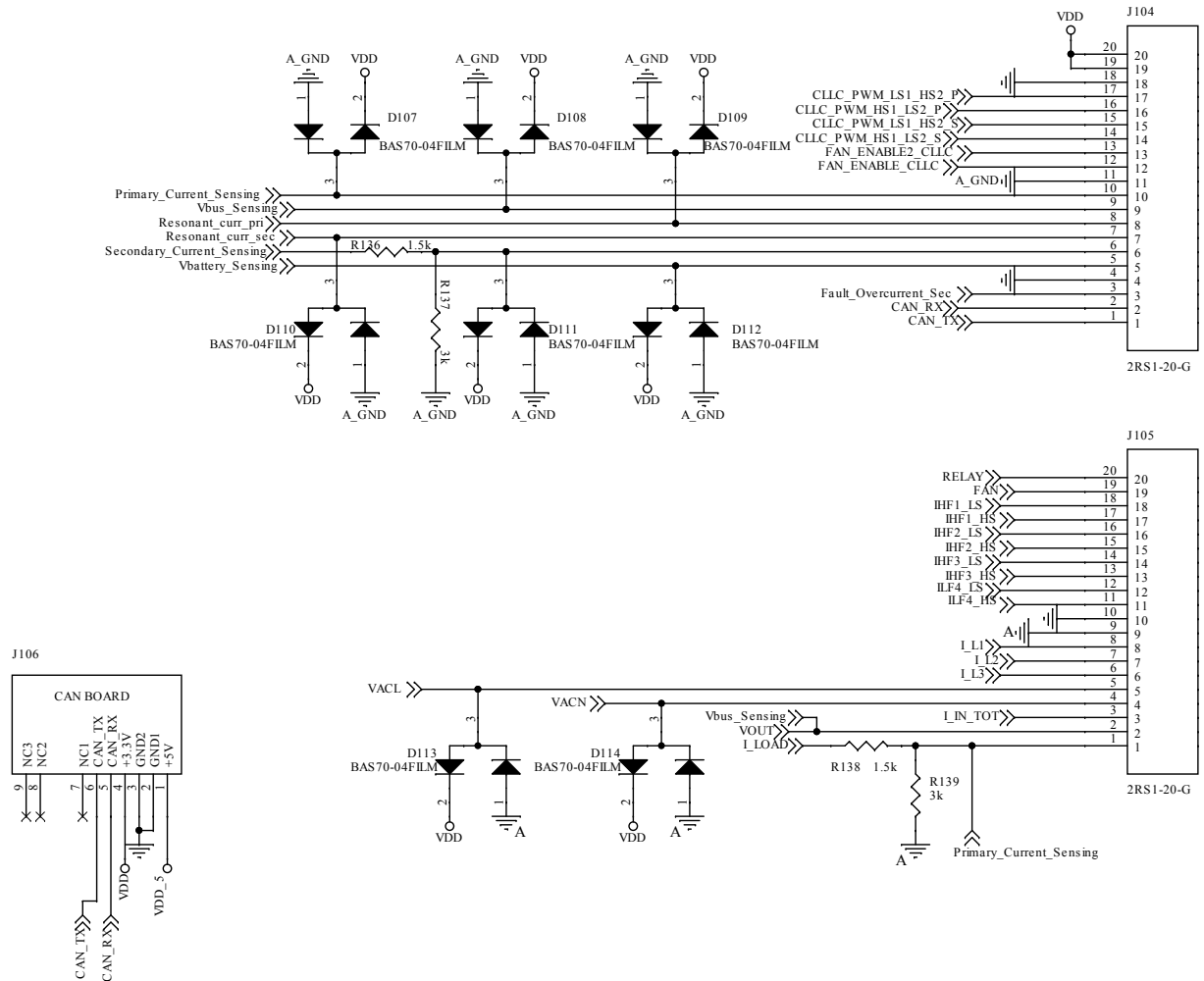


Figure 4. STEVAL-7BIDIRCB - Power board (4 of 5)

Figure 5. STEVAL-7BIDIRCB - Power board (5 of 5)

EXTERNAL 12V SUPPLY VOLTAGE

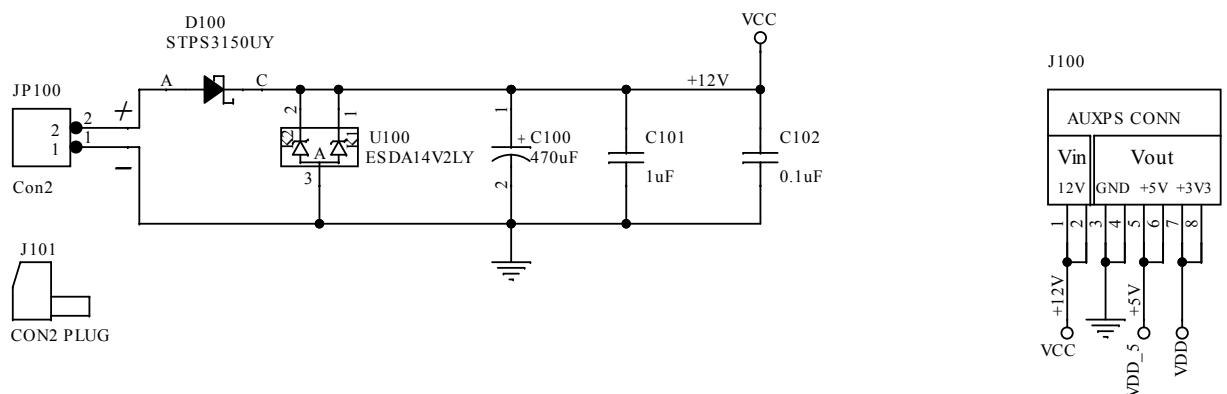


Figure 6. STEVAL-7BIDIRCB - Control board (1 of 2)

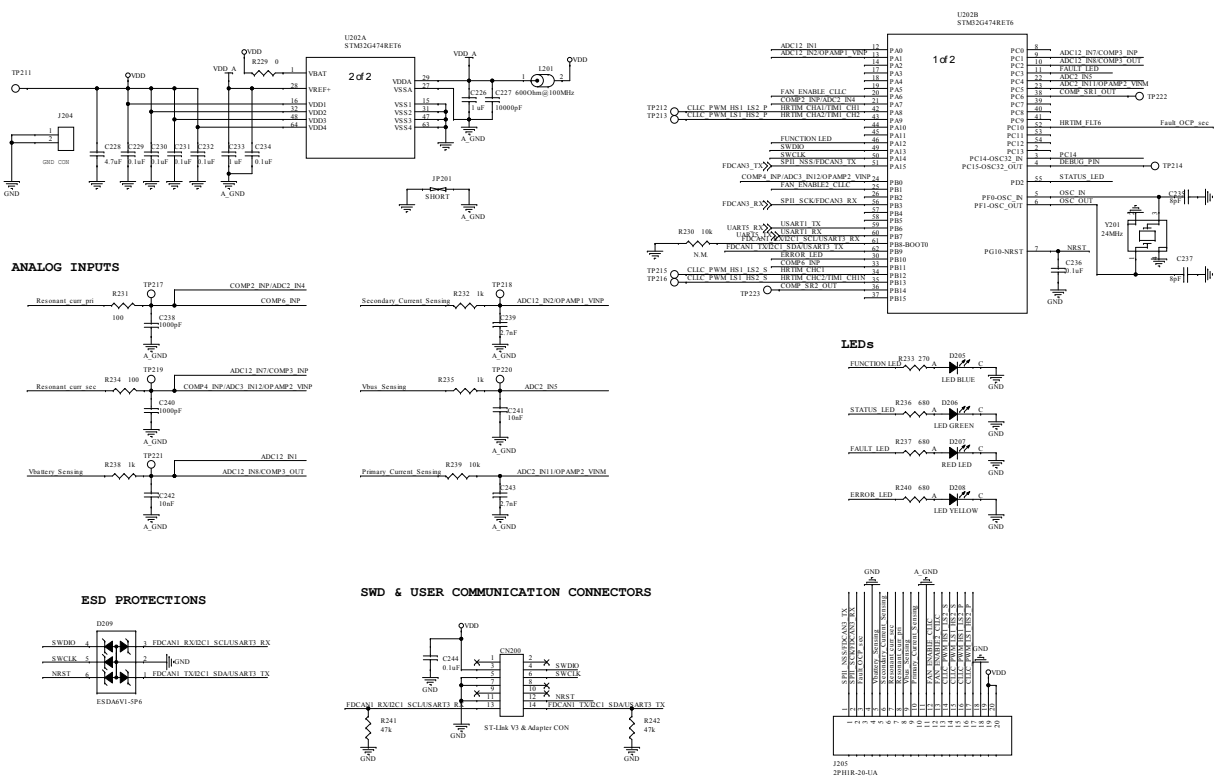


Figure 7. STEVAL-7BIDIRCB - Control board (2 of 2)

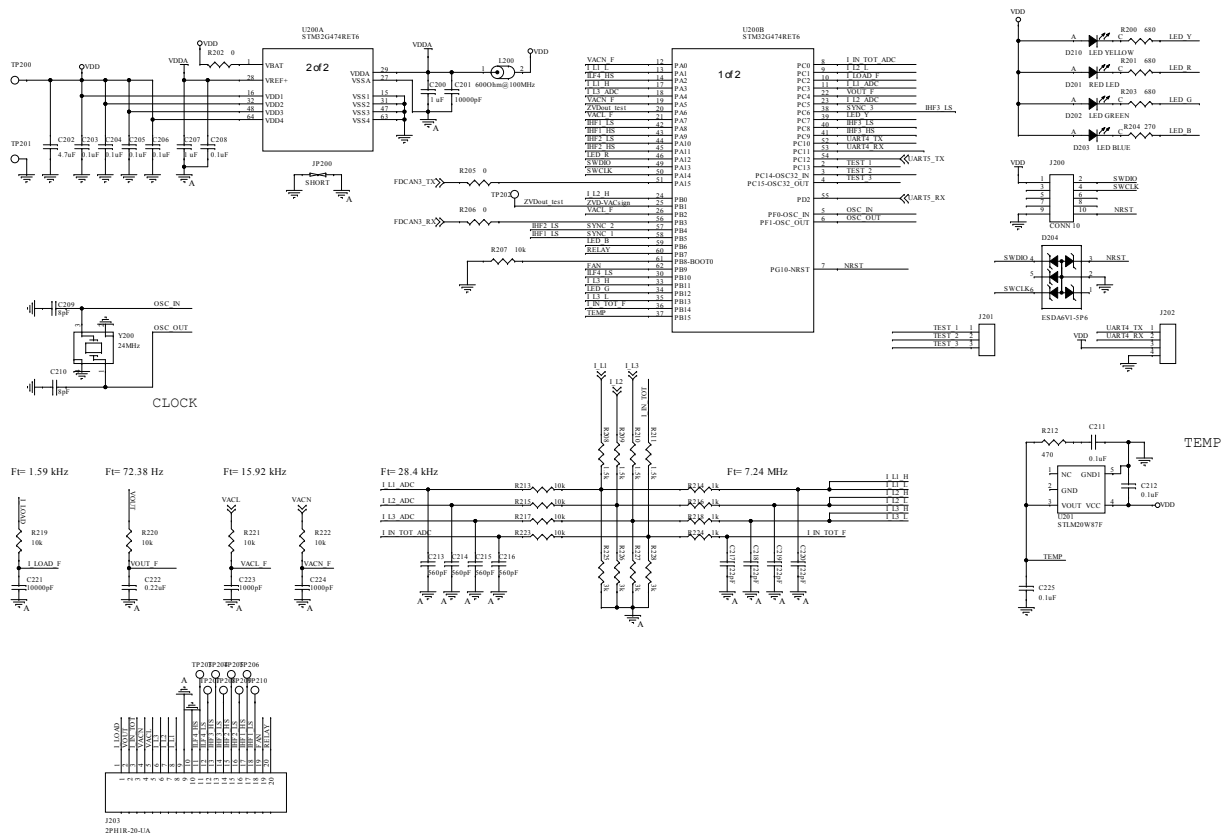


Figure 8. STEVAL-7BIDIRCB - CAN module

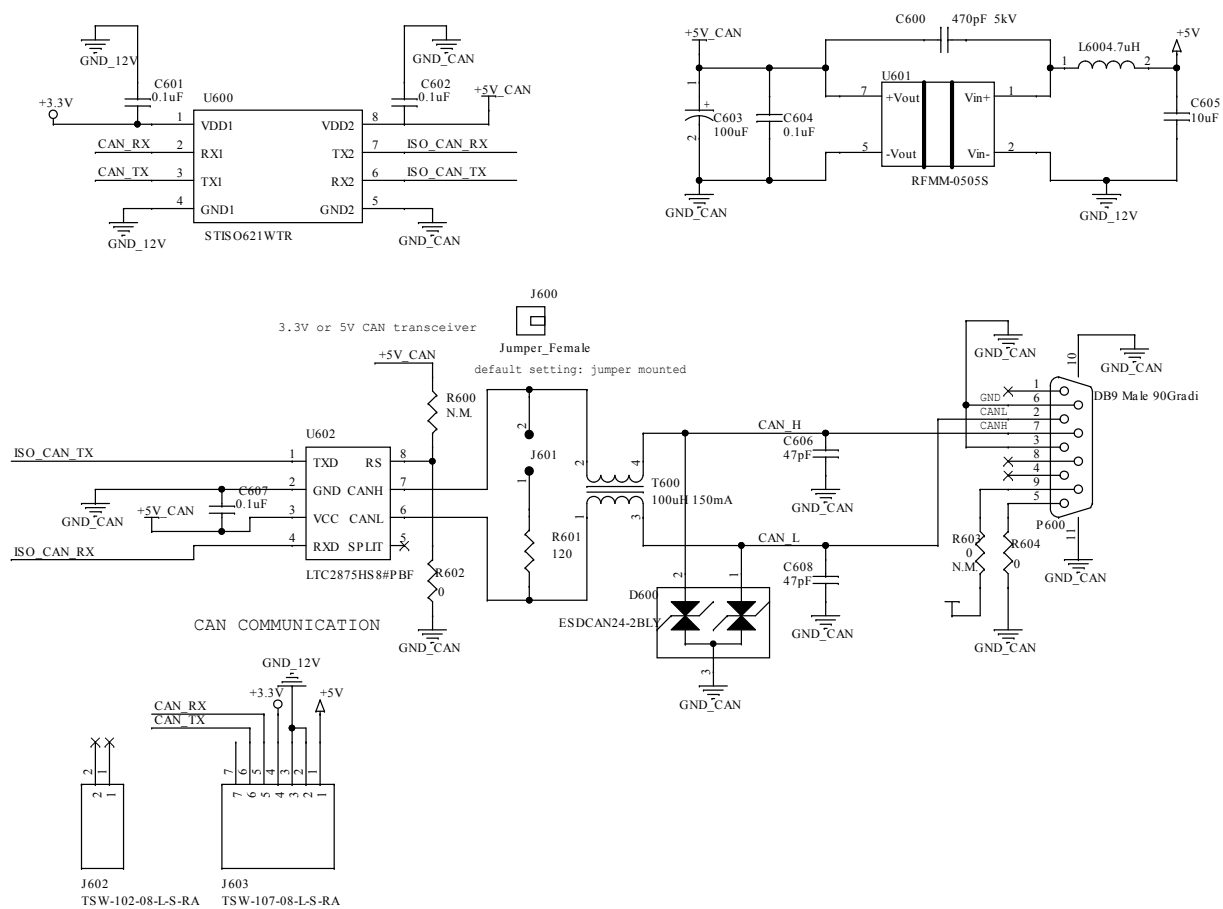


Figure 9. STEVAL-7BIDIRCB - Auxiliary power supply

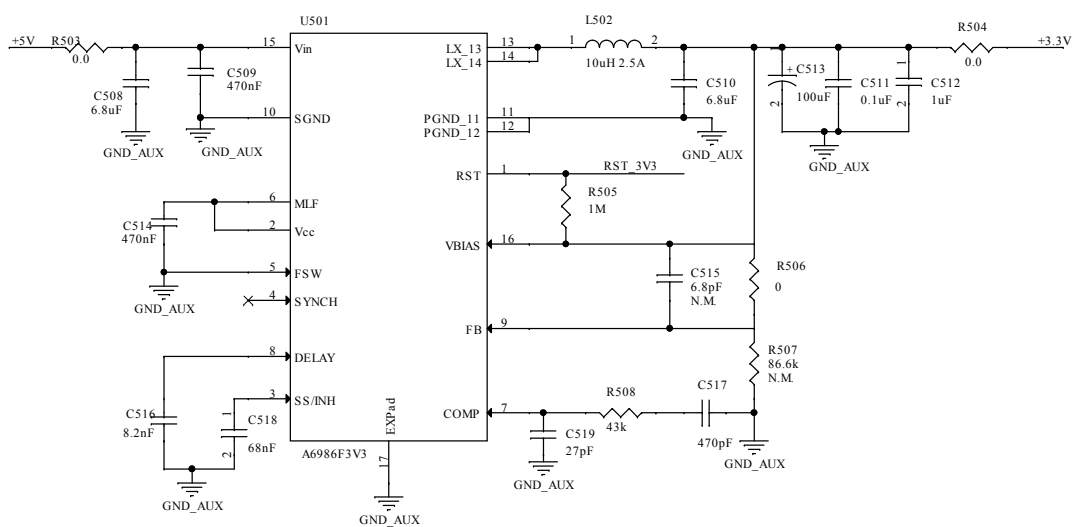
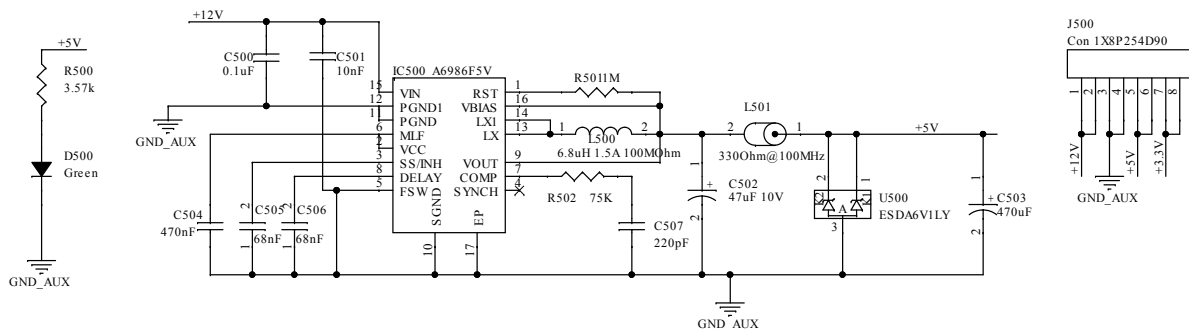


Figure 10. STEVAL-7BIDIRCB - Gate driver auxiliary power supply

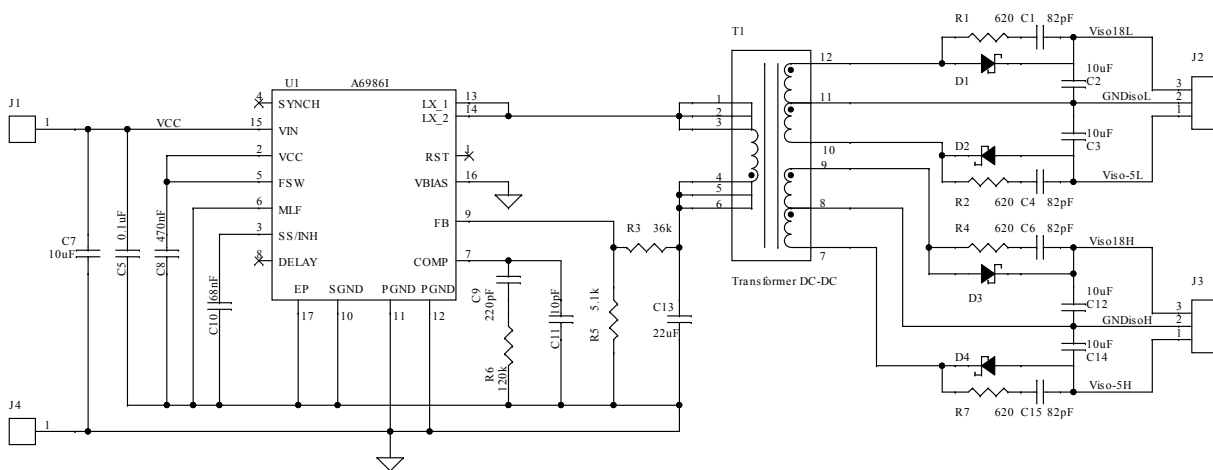


Figure 11. STEVAL-7BIDIRCB - Low frequency half bridge gate driver

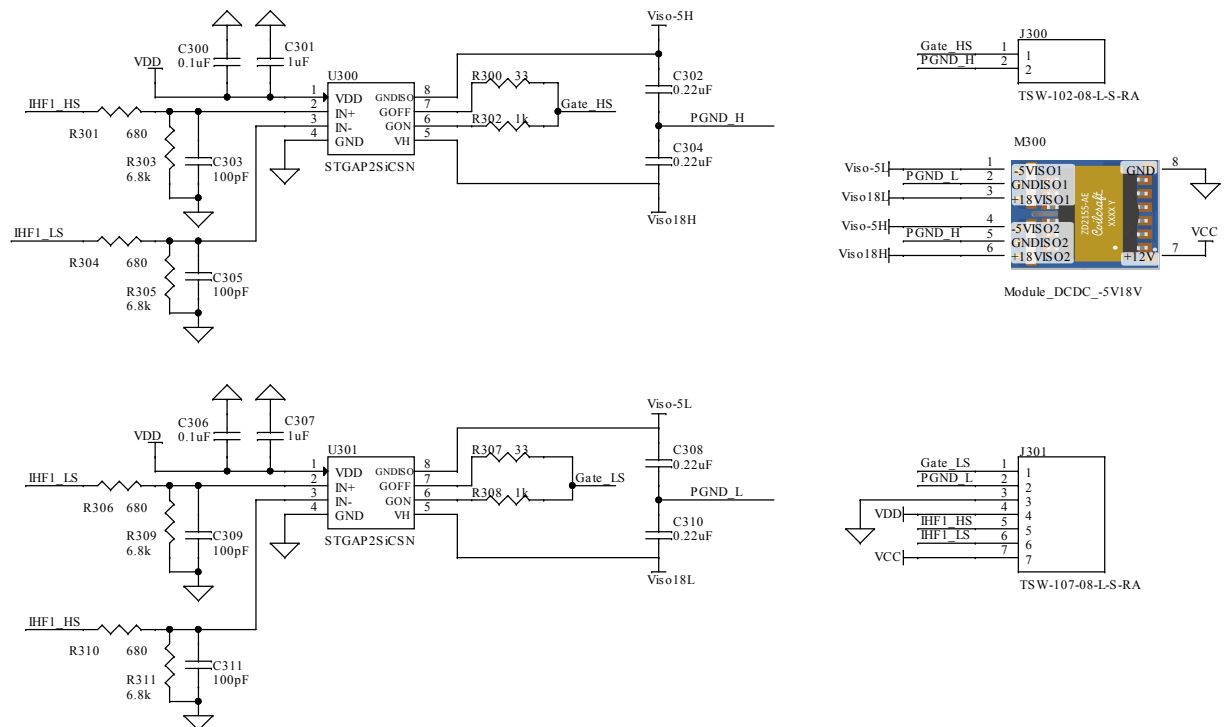


Figure 12. STEVAL-7BIDIRCB - High frequency half bridge gate driver

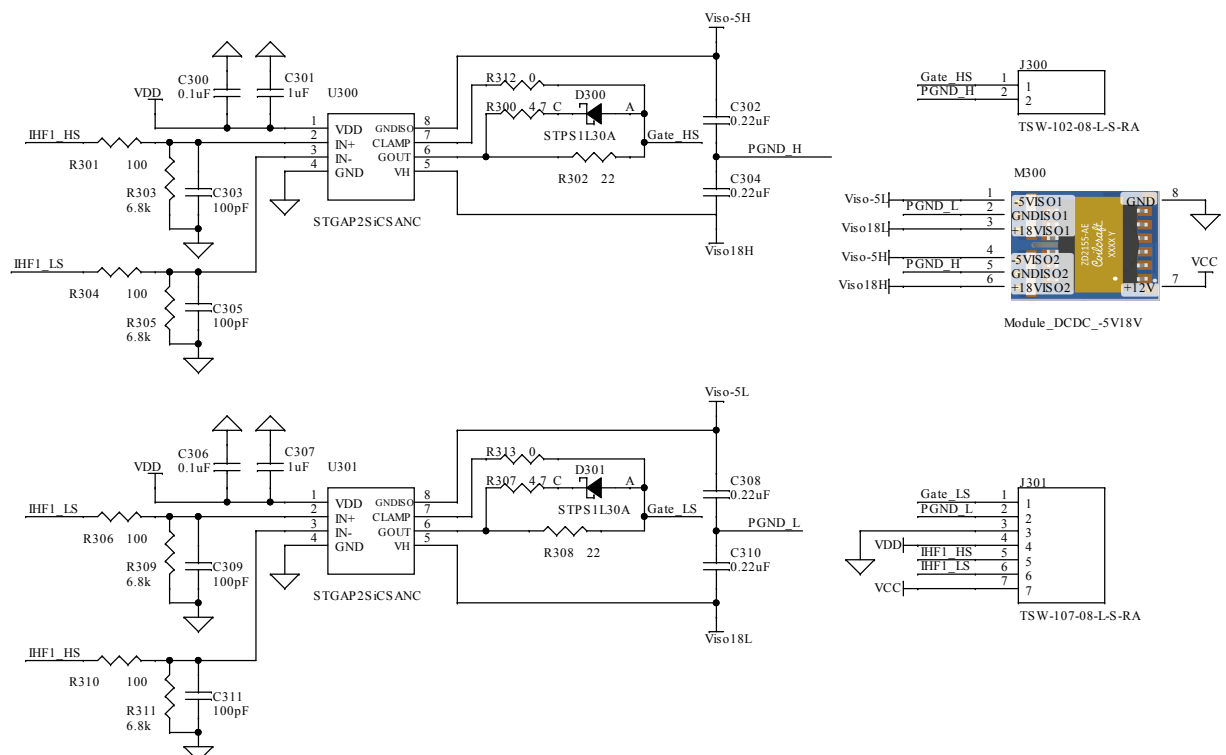
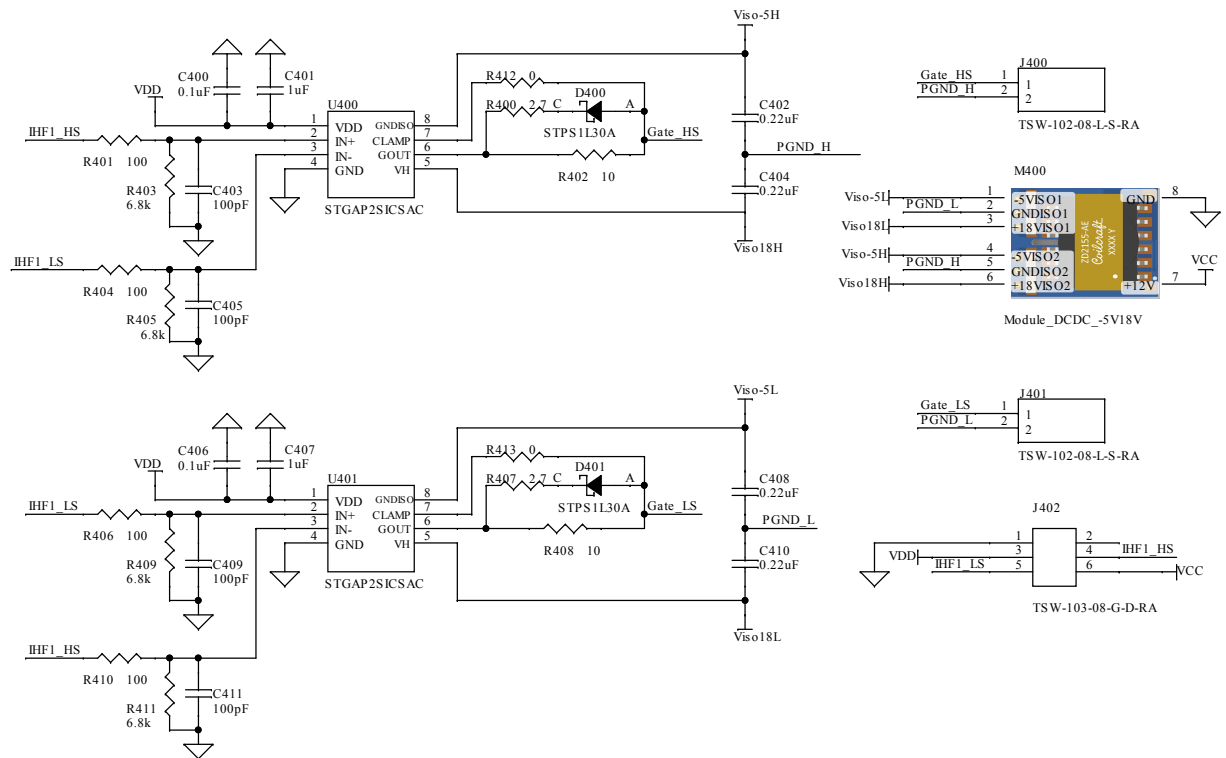


Figure 13. STEVAL-7BIDIRCB - High voltage half bridge gate driver



2 Custom evaluation boards information

Notice: *These evaluation boards are custom designed and built, in small quantities, according to specific requests from customers and are destined for evaluation and testing of ST products in a research and development setting. Please contact ST to provide your specific requests and get your custom built board(s).*

Revision history

Table 1. Document revision history

Date	Version	Changes
07-Dec-2023	1	Initial release.
25-Jul-2024	2	Updated Features and Description.
22-Oct-2024	3	Updated Features and Description.
30-Oct-2025	4	Updated Schematics diagrams.

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