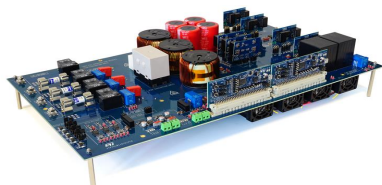


11 kW bidirectional battery charger based on three phase two level PFC and isolated DC-DC converter



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

Features

- PFC stage 3-phase, 2-level bidirectional AC-DC power converter:
 - Rated nominal AC voltage: 400 VAC at 50 Hz
 - Rated nominal DC voltage: 800 VDC
 - Nominal power: 11 kW
 - Rectifier mode: power factor: PF >0.99, inrush current control and soft startup
 - Inverter mode: active and reactive power control, integrated grid connection solution
- DC-DC stage dual active bridge (DAB) power converter:
 - Nominal DC input voltage 800 V
 - Nominal DC output voltage 550 to 850 V
 - DAB: switching frequency 100 kHz
- Power section based on SiC power modules:
 - ACEPACK DMT-32 power module for high integration level
 - High frequency operation for weight and size reduction
 - Bidirectional capabilities
 - DAB soft switching behavior enabled by enhanced modulation techniques management

Description

The **STEVAL-11BID1KCB** is an 11 kW bidirectional battery charger and represents a complete solution for high voltage charging in both the industrial and automotive fields.

It consists of two power stages: a PFC and an isolated DC-DC stage.

The PFC is based on a three-phase full-bridge topology.

The DC-DC section is Dual Active Bridge (DAB) topology.

Both stages are based on the ACEPACK DMT-32 SiC power module.

The board uses two control boards for the PFC and DC-DC stages respectively. The control board is based on the **STM32G474RE** microcontroller.

The PFC stage operating frequency is 70 kHz. The DC-DC stage is operating at a fixed switching frequency of 100 kHz.

A peak system efficiency of 96% was achieved for the design.

Product summary	
11 kW bidirectional battery charger based on three phase two level PFC and isolated DC-DC converter	STEVAL-11BID1KCB
Firmware for STEVAL-11BID1KCB	STSW-11BID1KCB
Automotive-grade ACEPACK DMT-32 power module, fourpack topology	M1F45M12W2-1LA
Automotive-grade ACEPACK DMT-32 power module, sixpack topology	M1P45M12W2-1LA
Mainstream Arm Cortex-M4 MCU 170 MHz	STM32G474RET3
Galvanically isolated 4 A dual gate driver	STGAP2SiCD
Application	Battery charger/ Battery storage systems for home/ On board charger (OBC)

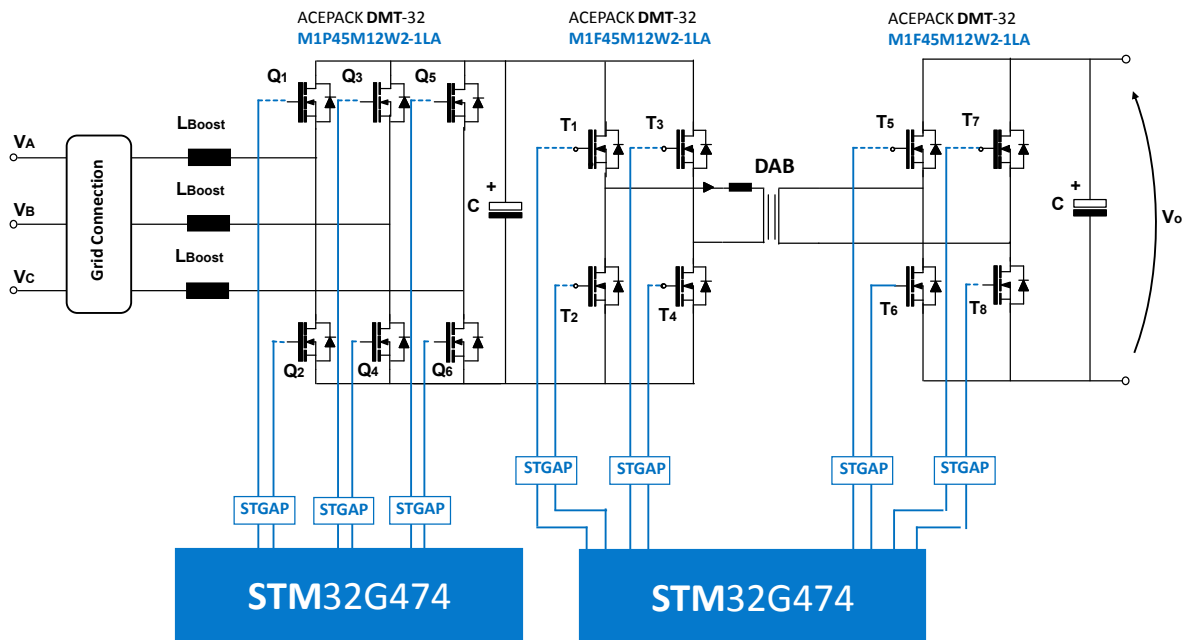
1 Block diagram

The **STEVAL-11BID1KCB** consists of two power stages and an 11 kW single magnetic component, including the isolation transformer and the leakage inductance.

The hardware modular structure consists of the following building blocks:

- A main power board with ACEPACK DMT-32 SiC power modules, sixpack topology **M1P45M12W2-1LA** for PFC stage, and two **M1F45M12W2-1LA** for the two sides of DC-DC stage. In addition to the power modules, bulk capacitor, sensing sections and auxiliary power supply are also present.
- A driver board for full bridge and sixpack ACEPACK DMT-32 SiC power modules based on **STGAP2SiCD** galvanically isolated 4 A dual gate driver for SiC MOSFETs.
- A control board based on the **STM32G474RE** series of microcontrollers with connectors for communication and programming, test points and status indicators for debugging and monitoring.

Figure 1. Block diagram for high visual impact



2

Schematic diagrams

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

Figure 2. STEVAL-11BID1PCB circuit schematic (1 of 17)

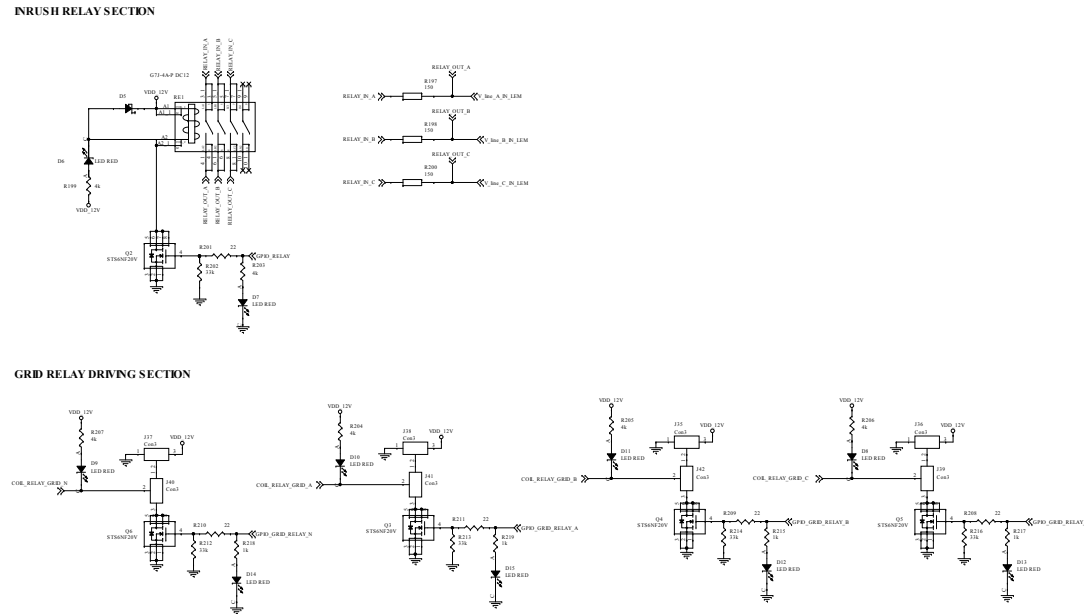


Figure 3. STEVAL-11BID1PCB circuit schematic (2 of 17)

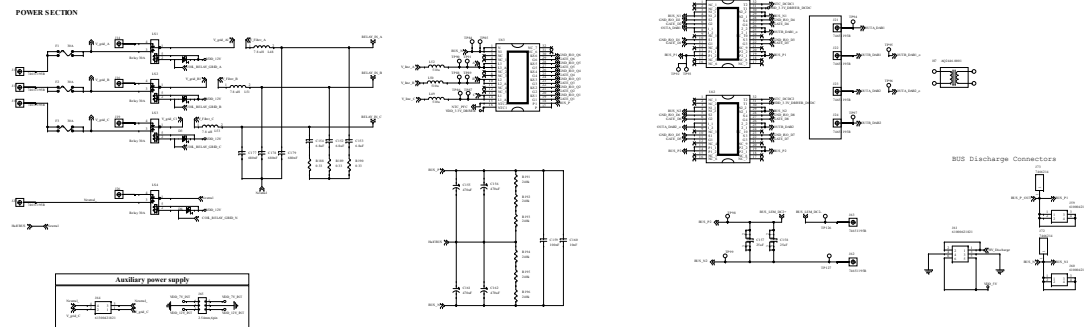


Figure 4. STEVAL-11BID1PCB circuit schematic (3 of 17)

LINE VOLTAGE SENSING

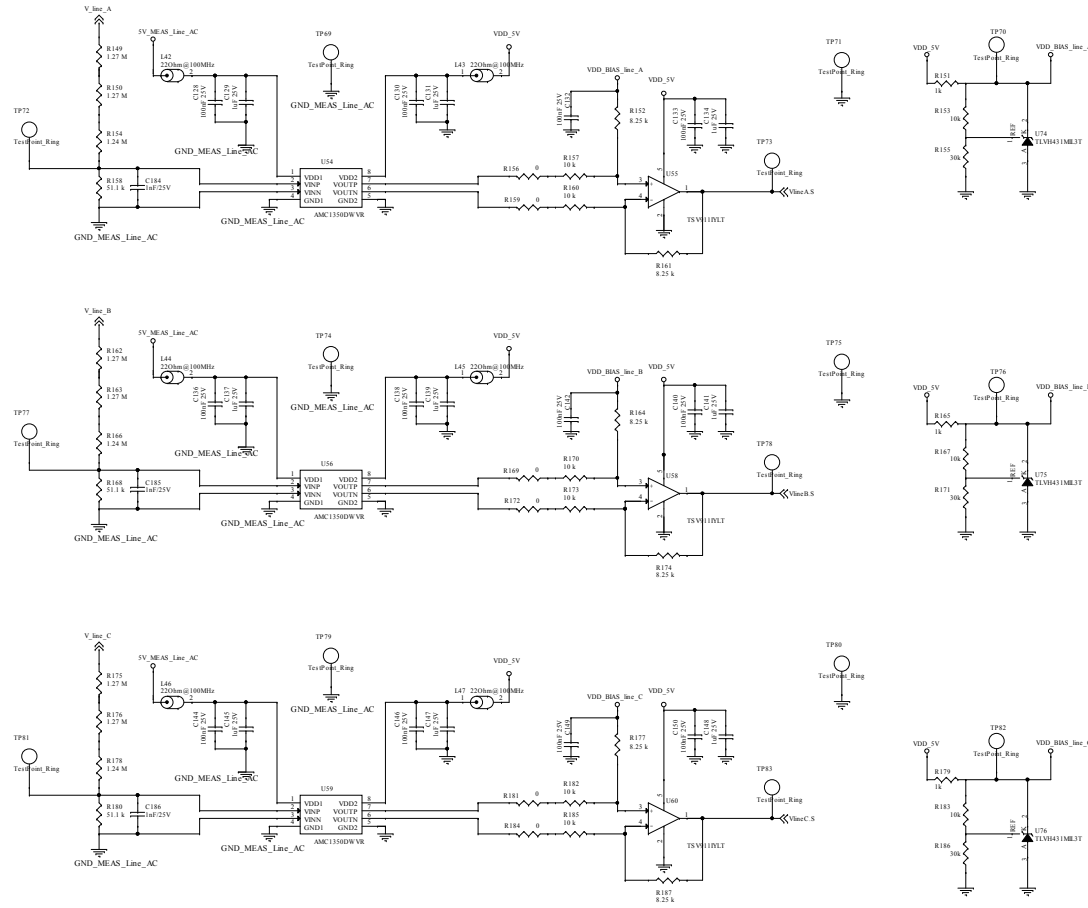


Figure 5. STEVAL-11BID1PCB circuit schematic (4 of 17)

GRID VOLTAGE SENSING

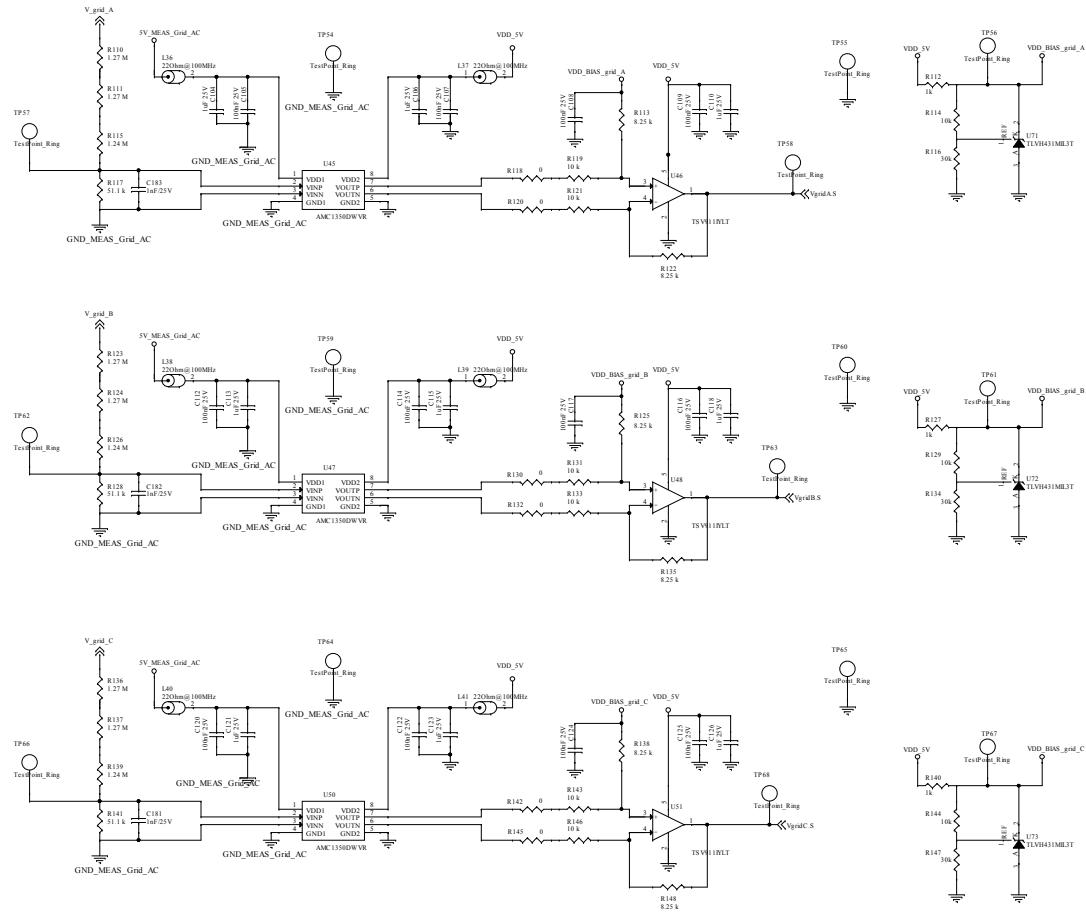


Figure 6. STEVAL-11BID1PCB circuit schematic (5 of 17)

GRID CURRENT SENSING

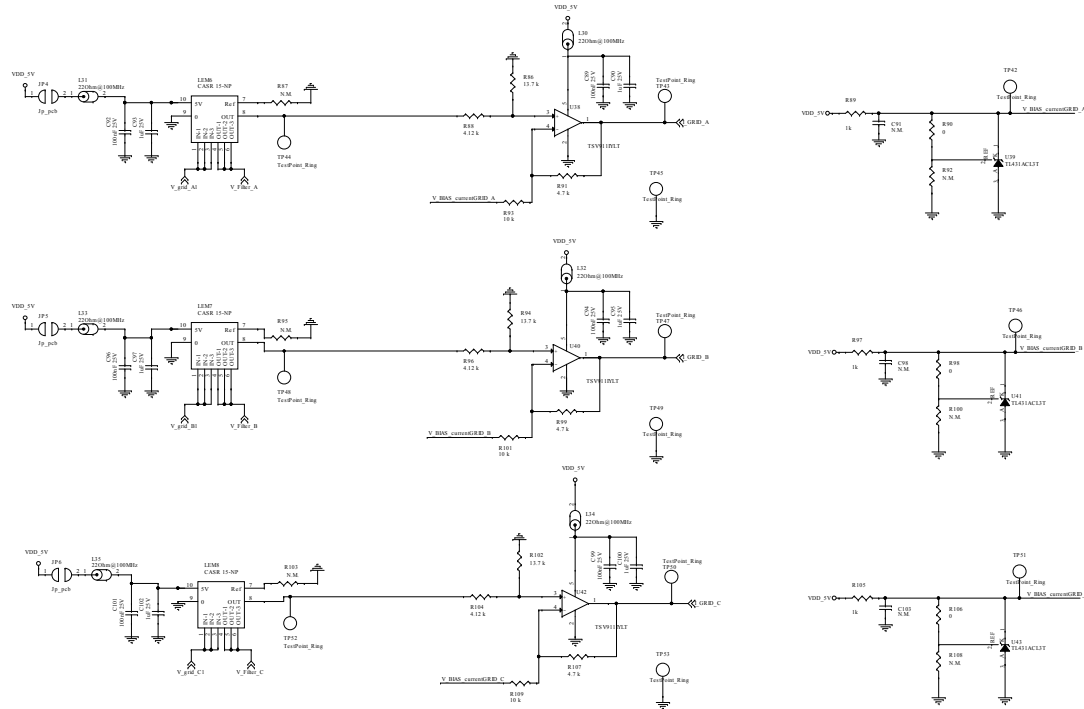
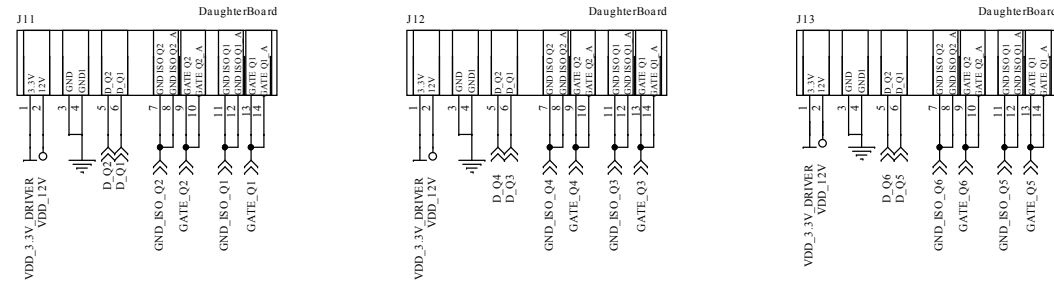


Figure 7. STEVAL-11BID1PCB circuit schematic (6 of 17)

DRIVER BOARD



PULLDOWN RESISTANCES

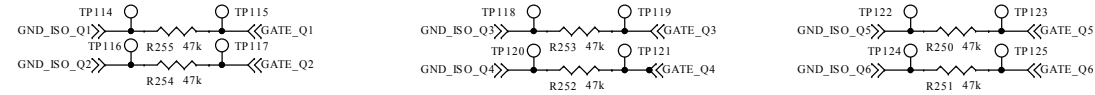
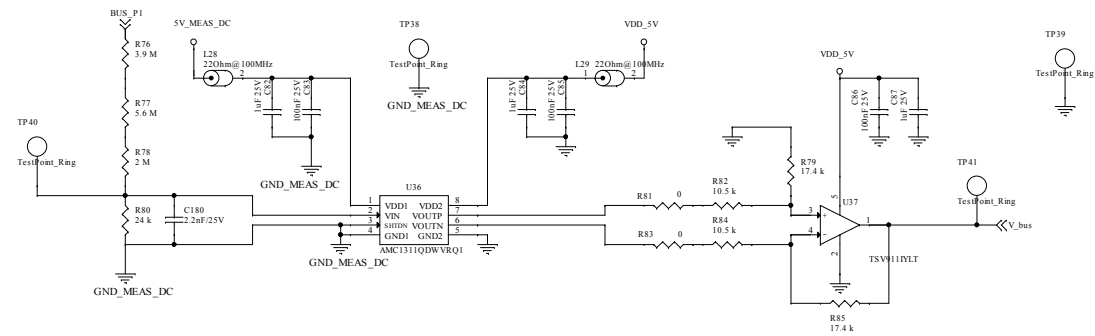


Figure 8. STEVAL-11BID1PCB circuit schematic (7 of 17)

PFC DC VOLTAGE SENSING



PFC DC CURRENT SENSING

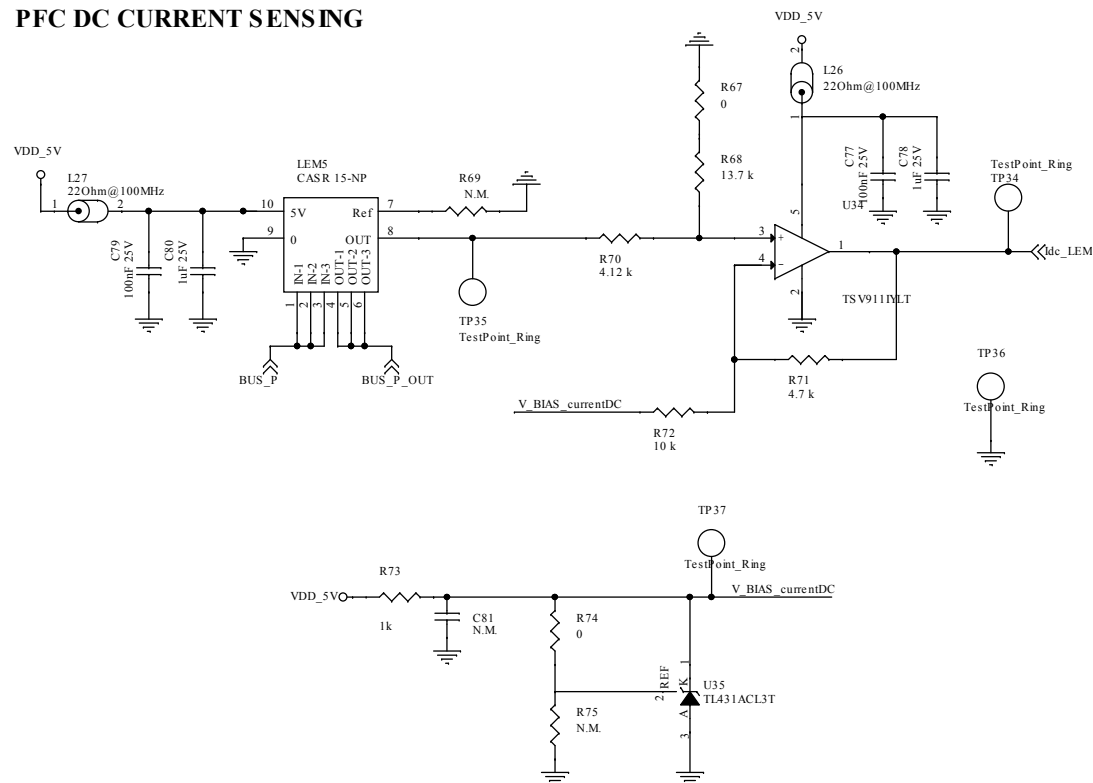
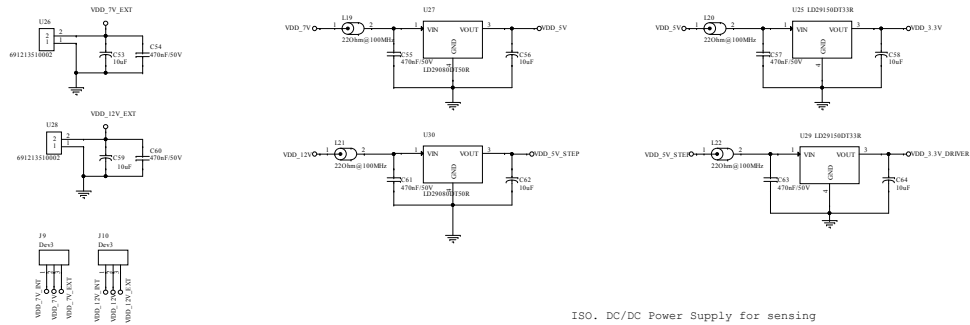


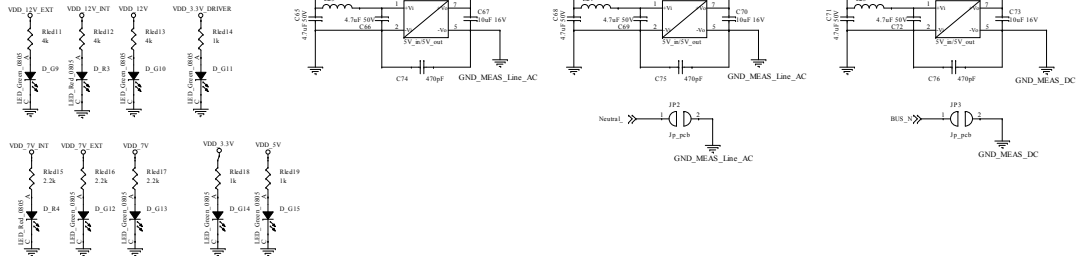
Figure 10. STEVAL-11BID1PCB circuit schematic (9 of 17)

PFC AUXILIARY POWER SUPPLY



ISO. DC/DC Power Supply for sensing

LED STATUS





STEVAL-11BID1KCB

Schematic diagrams

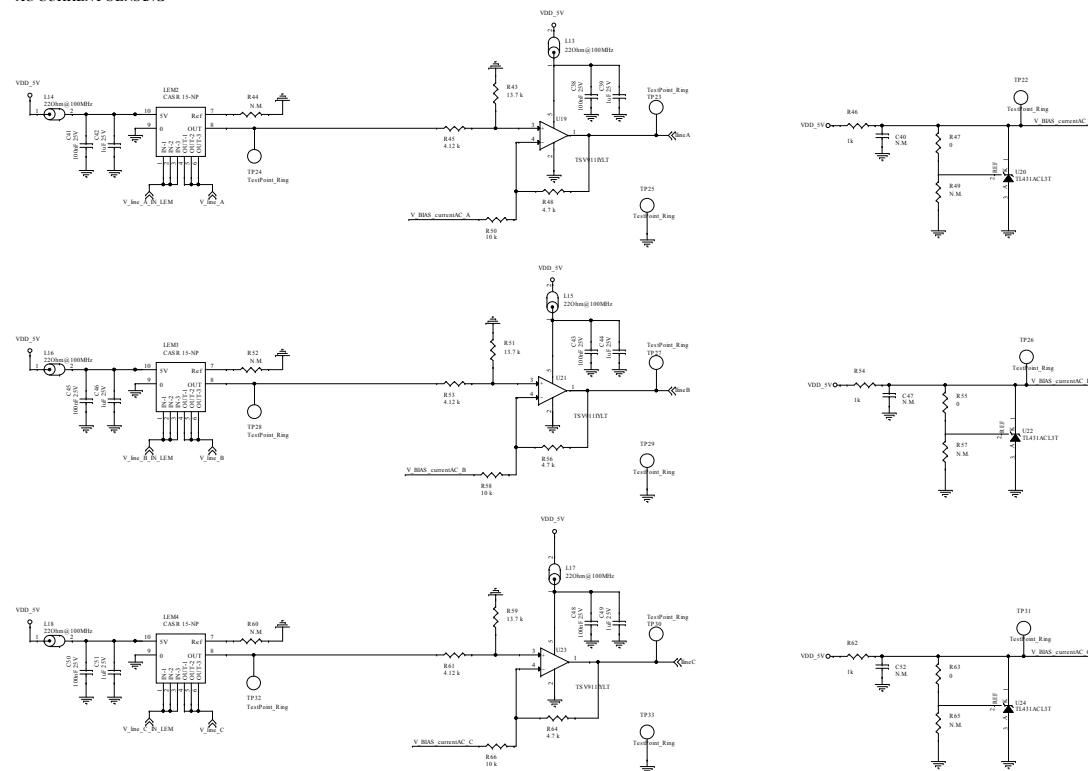


Figure 12. STEVAL-11BID1PCB circuit schematic (11 of 17)

TEMPERATURE SENSING

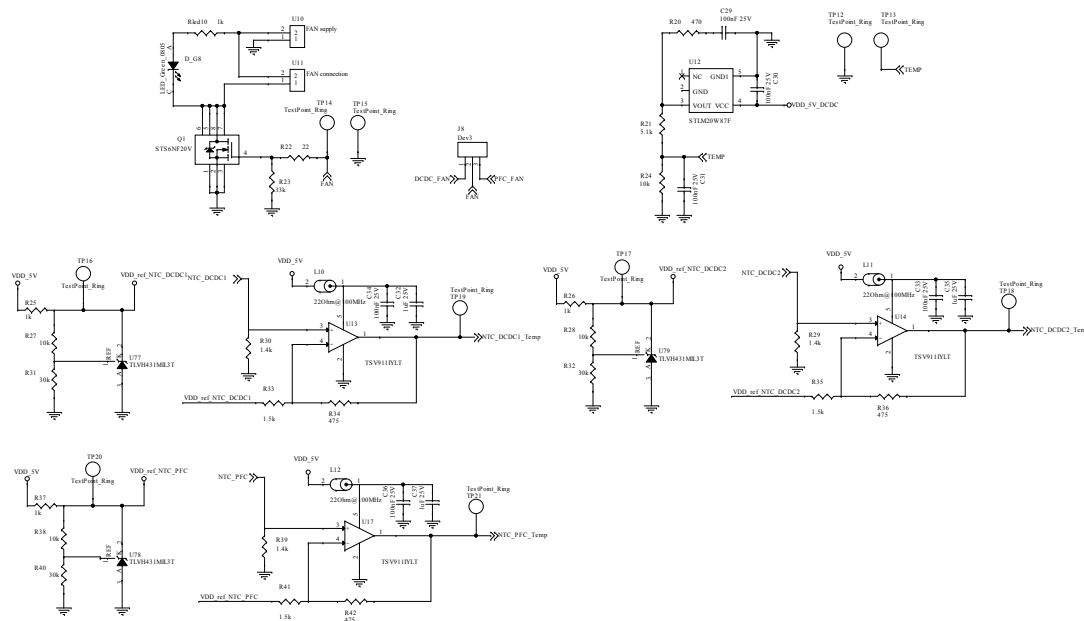


Figure 13. STEVAL-11BID1PCB circuit schematic (12 of 17)

DCDC VOLTAGE SENSING

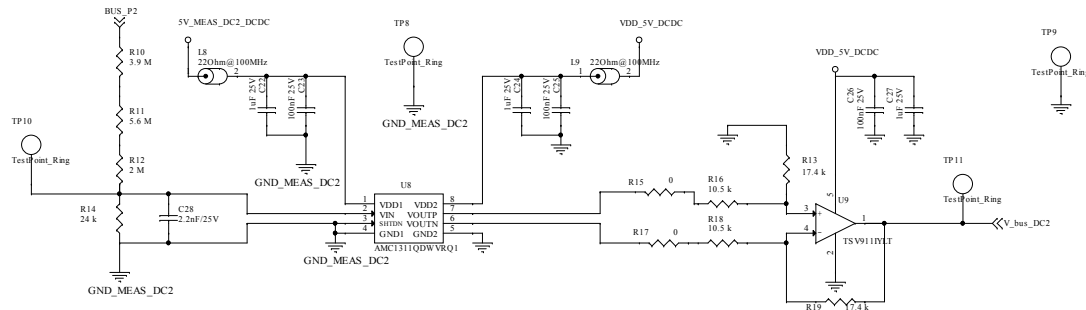
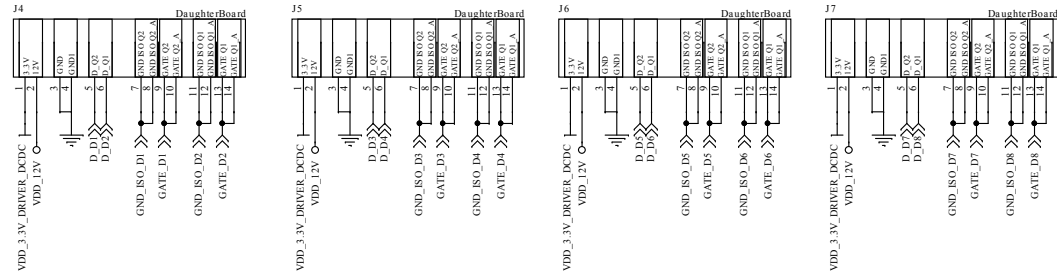


Figure 14. STEVAL-11BID1PCB circuit schematic (13 of 17)

DRIVER BOARD



PULLDOWN RESISTANCES

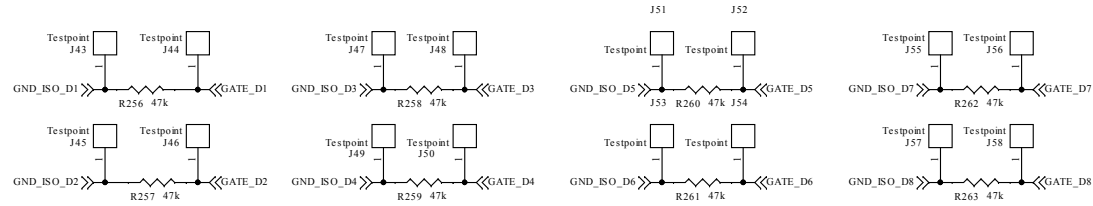


Figure 15. STEVAL-11BID1PCB circuit schematic (14 of 17)

DCDC CURRENT SENSING

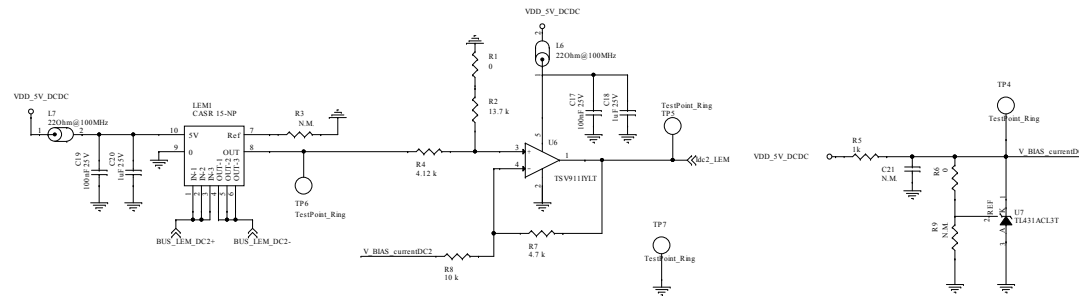
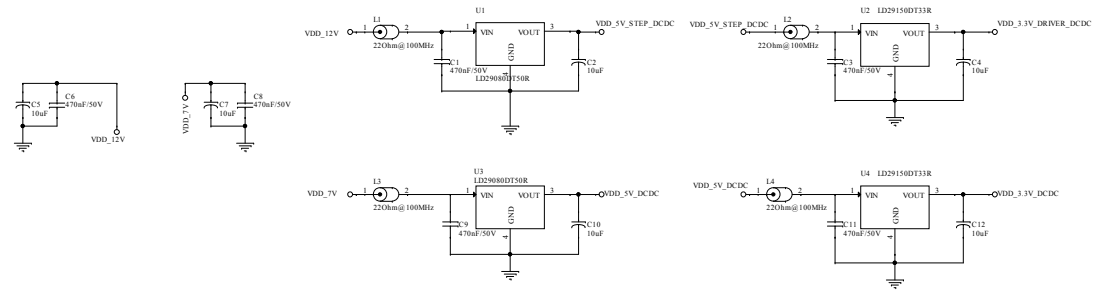


Figure 16. STEVAL-11BID1PCB circuit schematic (15 of 17)

DCDC AUXILIARY POWER SUPPLY



LED STATUS

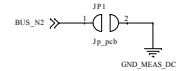
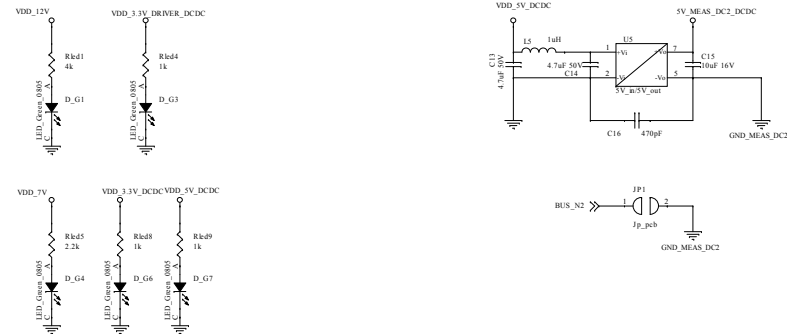
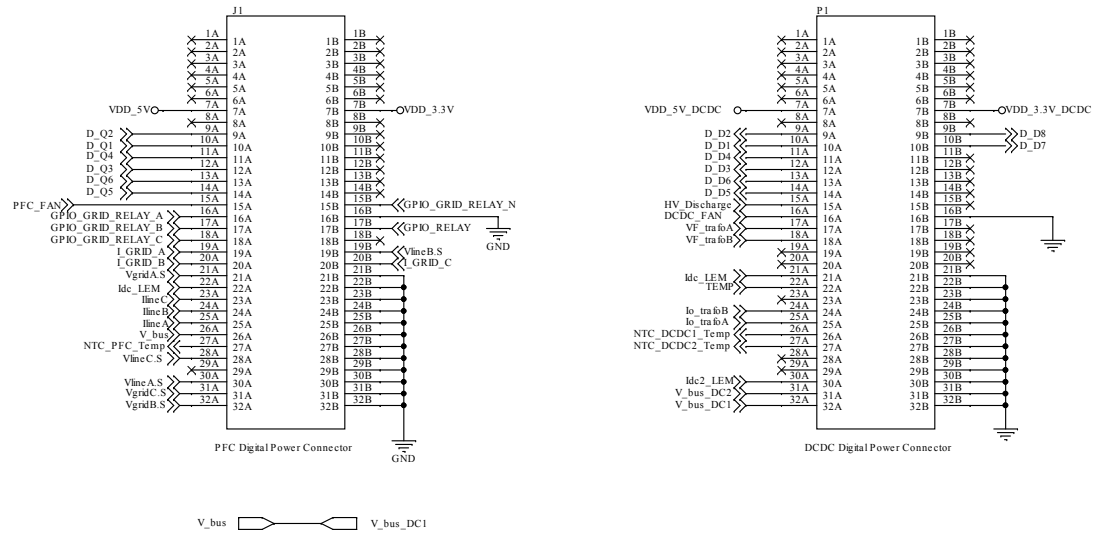


Figure 17. STEVAL-11BID1PCB circuit schematic (16 of 17)

EXTERNAL CONNECTORS



TRANSFORMER CURRENT SENSING



Figure 19. STEVAL-G474V1CB circuit schematic

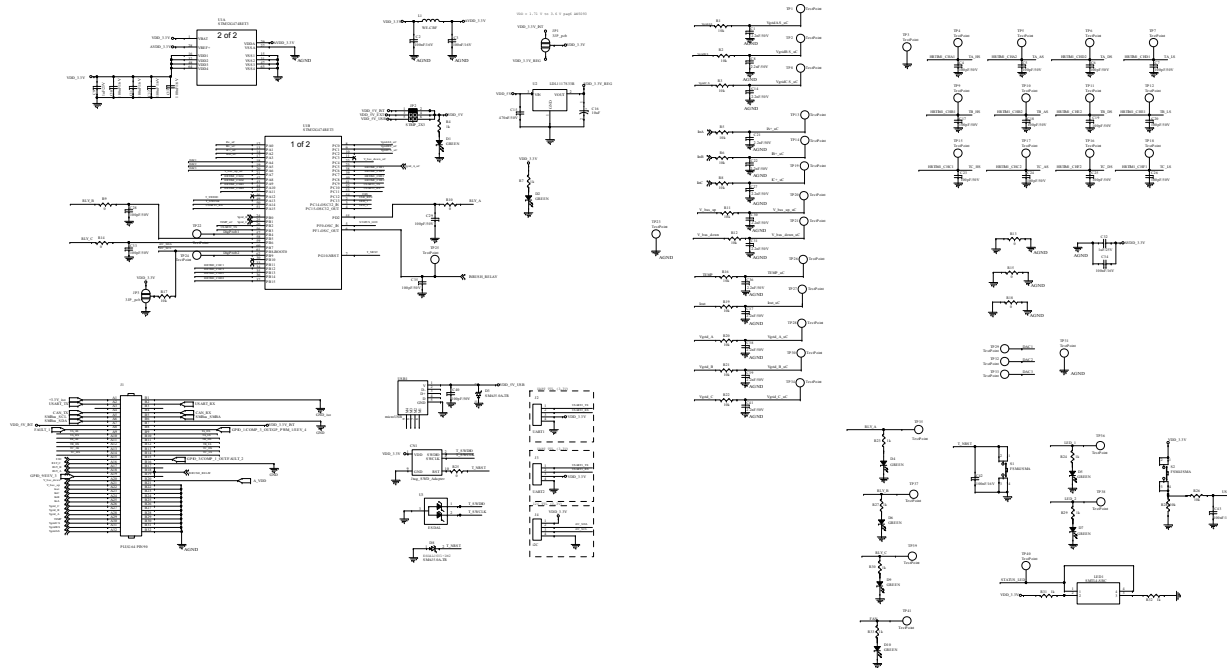
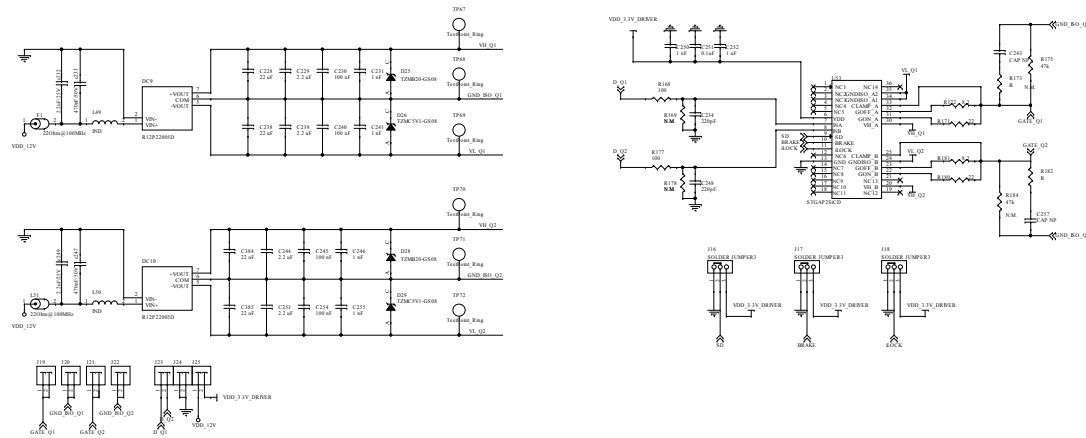


Figure 20. STEVAL-GAP2SICB circuit schematic



3 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	Revision	Changes
24-Mar-2025	1	Initial release.
01-Oct-2025	2	Updated cover image and Section Description .
28-Oct-2025	3	Features updated to improve readability.

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