STEVAL-DCAC1KCB

Data brief

1500 VA, 48 Vdc to 230 Vac, DC-AC converter for UPS

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

Product summary	
1500 VA, 48 Vdc to 230 Vac, DC-AC converter for UPS	STEVAL-DCAC1KCB
Mainstream Arm Cortex-M4 MCU 170 MHz with 512 Kbytes of Flash memory, Math Accelerator, HR Timer, High Analog level integration	STM32G474RE
N-channel 80 V, 4.0 mOhm typ., 120 A STripFET F7 Power MOSFET in a PowerFLAT 5x6 package	STL120N8F7
Galvanically isolated 4 A half-bridge dual channel gate driver	STGAP2D
N-channel 600 V, 67 mOhm typ., 46 A MDmesh DM6 Power MOSFET in a TO-LL package	STO65N60DM6
Applications	Battery Storage Systems for Home Uninterruptable power supplies (UPS)

Features

- 1500 VA digitally controlled power inverter
- Full bridge LLC + full bridge rectification + H-bridge inverter
  - LLC working in open-loop at resonant frequency to have maximum efficiency of DC-DC stage
- Output voltage: 230 Vac ± 10%
- Output THD: <5% for load >20% of maximum capability (resistive load)
- Input voltage range: 42 – 54 Vdc
- Efficiency: > 93.2% at 50% of load (peak), > 92.1% at 100% of load
- Built-in comprehensive safety mechanisms
  - Low and high input voltage cutoff
  - Low and high output voltage cutoff
  - Output over current/over load protection
  - No-load protection
  - Input reverse polarity protection

Description

The STEVAL-DCAC1KCB is a dual-stage digitally controlled DC-AC power inverter evaluation board.

The modular design approach makes it easier for the user to test and debug the various sections involved.

The system consists of a power inverter board, auxiliary power supply board, and a microcontroller board.

The DC-DC step-up conversion is based on a full bridge LLC resonant topology, while the DC-AC conversion is based on an H-bridge inverter.

The LLC resonant circuit is designed to operate at a fixed resonant frequency without regulating the DC-DC converter output voltage, therefore working in the open-loop operation.

The AC output voltage is regulated by varying the modulation index (MI) of the H-bridge stage.

The fixed operating frequency of the LLC converter ensures maximum efficiency irrespective of battery voltage and extends the battery back-up time. The DC-DC stage open loop operation also means lower computational load on the microcontroller.

1 1500 VA digitally controlled power inverter architecture

The DC-DC converter based on LLC resonant topology starts with a frequency of 250 kHz to have a soft start and settles down at 75 kHz resonant frequency for the steady state operation.

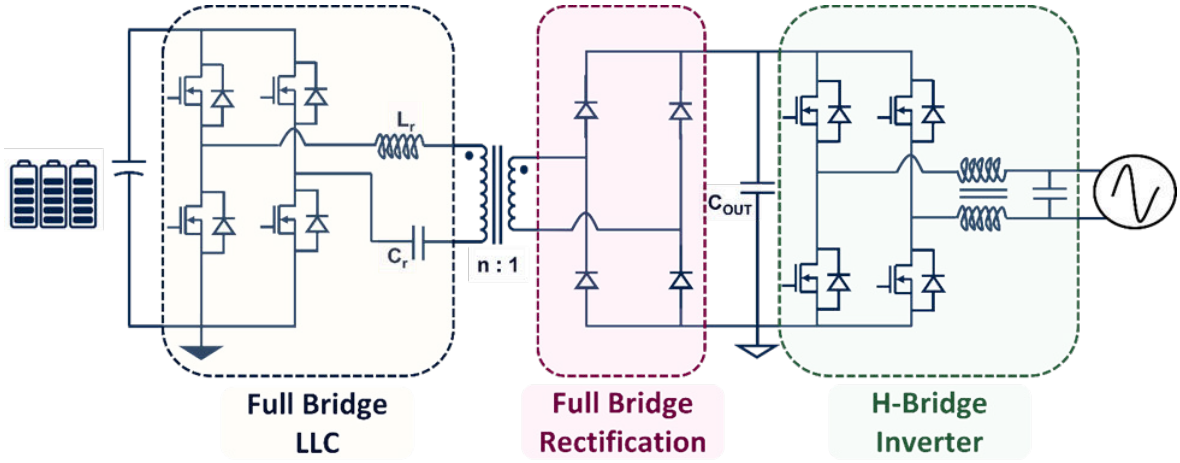
The turns ratio of the LLC transformer has been kept slightly higher to ensure sufficient DC link voltage even when the battery is at 42 V.

The inverter stage is based on an H-bridge topology which takes input from an LLC resonant converter and generates an AC output voltage.

To have a tightly regulated output, it is continuously monitored, and the modulation index (MI) of the H-bridge is adjusted based on the PI control loop implemented within the microcontroller.

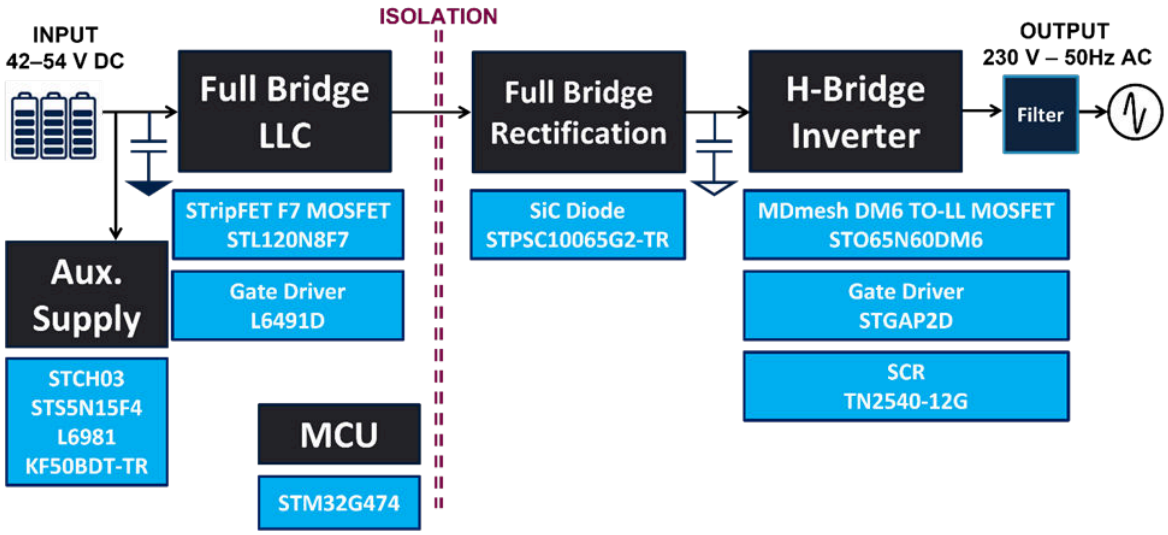
In H-bridge converter one half-bridge works on high frequency while the other half-bridge works on low frequency i.e., output AC voltage frequency required. For low frequency half-bridge, there are only conduction losses while for high frequency half-bridge high switching losses are also present due to hard switching. So, the heat-sink might not be required for the low frequency half-bridge.

Figure 1. 1500 VA power inverter architecture



2 STEVAL-DCAC1KCB block diagram

Figure 2. **STEVAL-DCAC1KCB block diagram with key ST components**



3 Schematic diagrams

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

Figure 3. STEVAL-DCAC1KCB - Circuit schematic

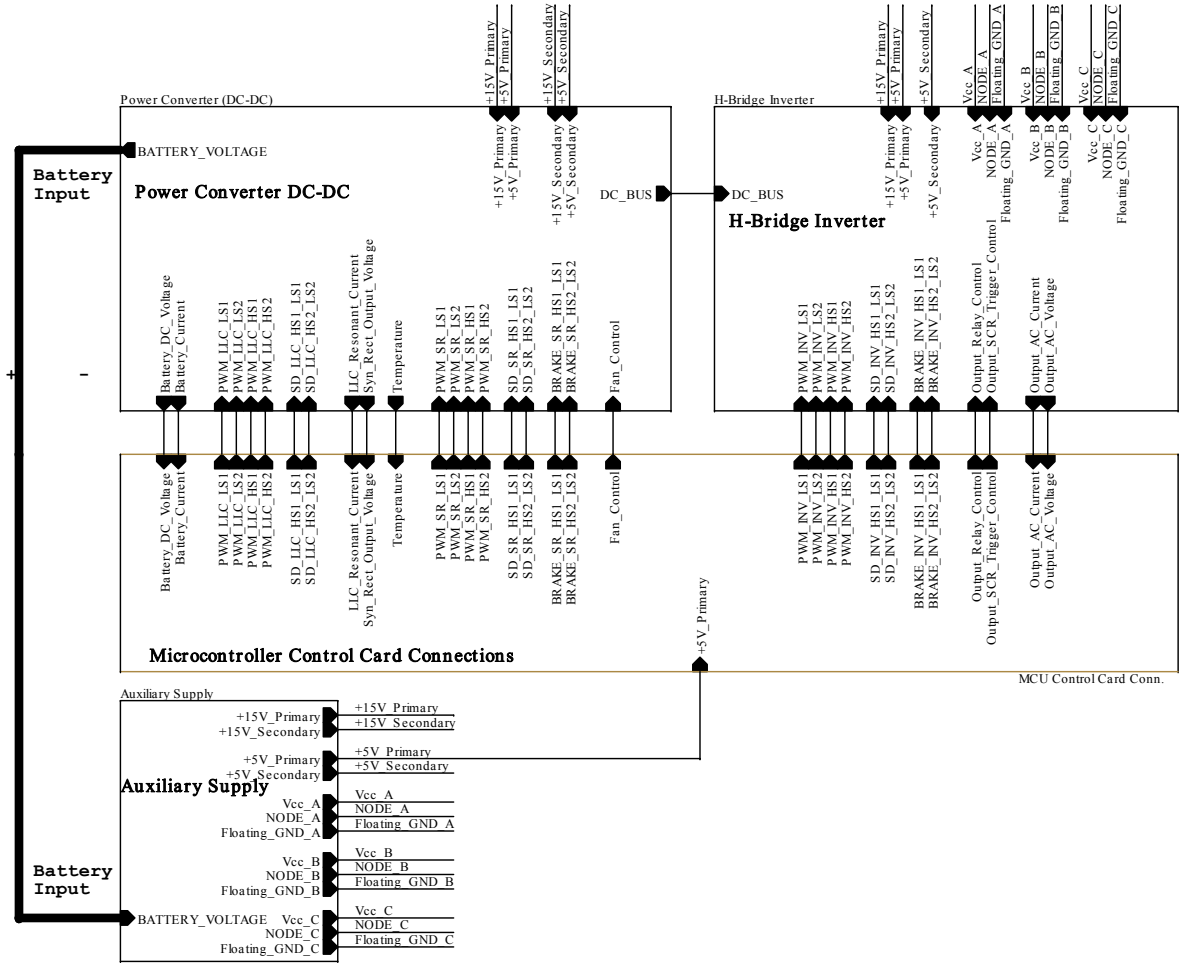


Figure 4. STEVAL-DCAC1KCB: auxiliary supply - Circuit schematic

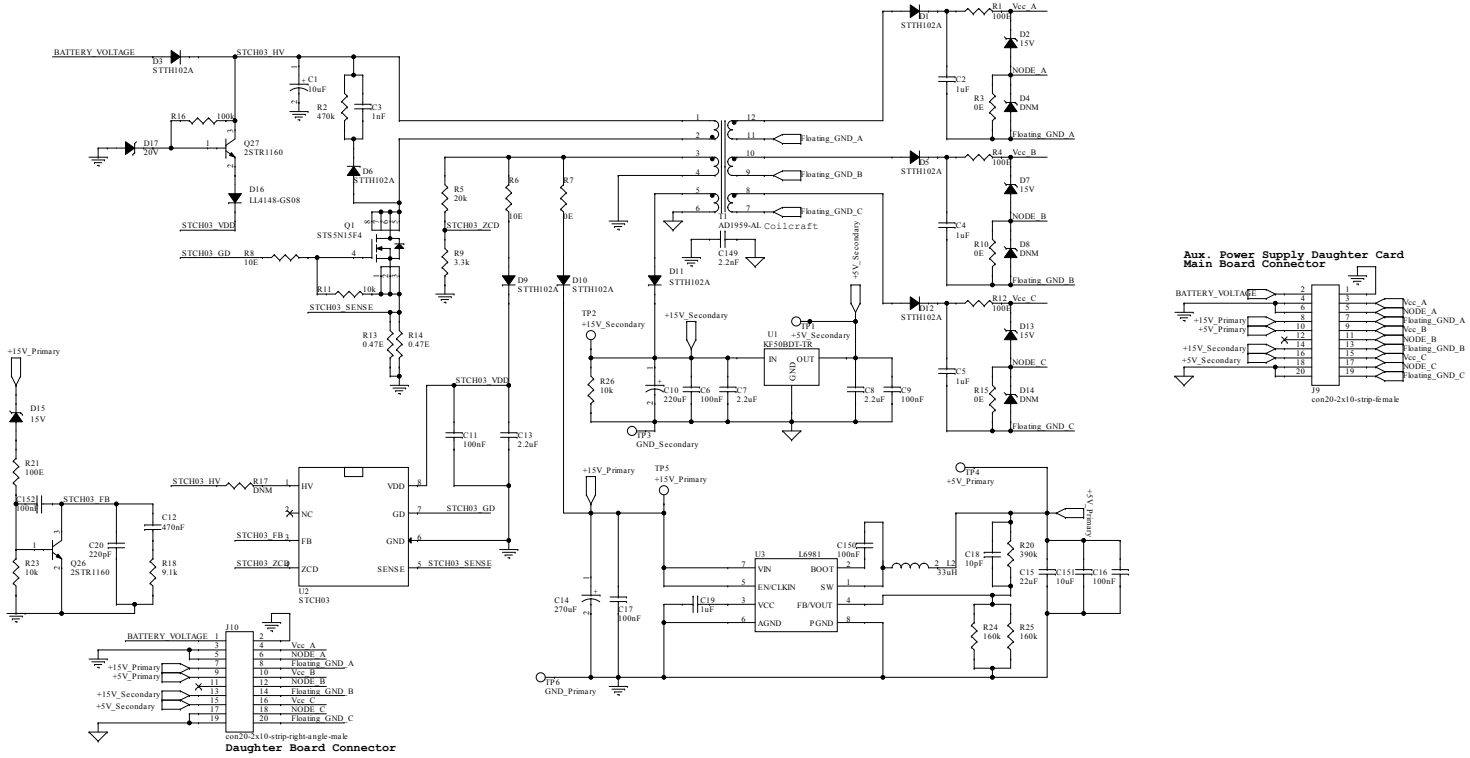


Figure 5. STEVAL-DCAC1KCB: H-bridge inverter - Circuit schematic

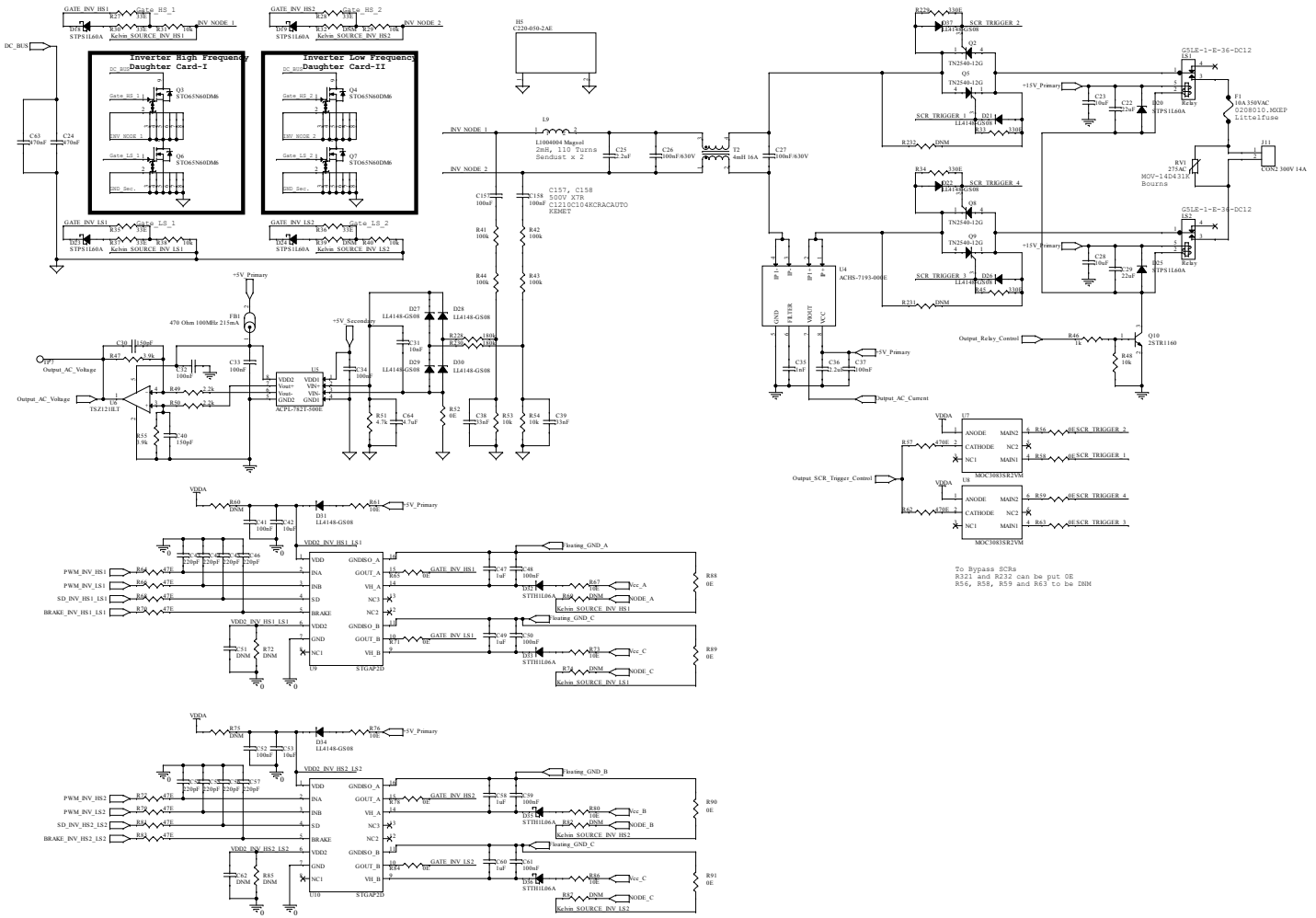


Figure 6. STEVAL-DCAC1KCB: microcontroller control card connections - Circuit schematic

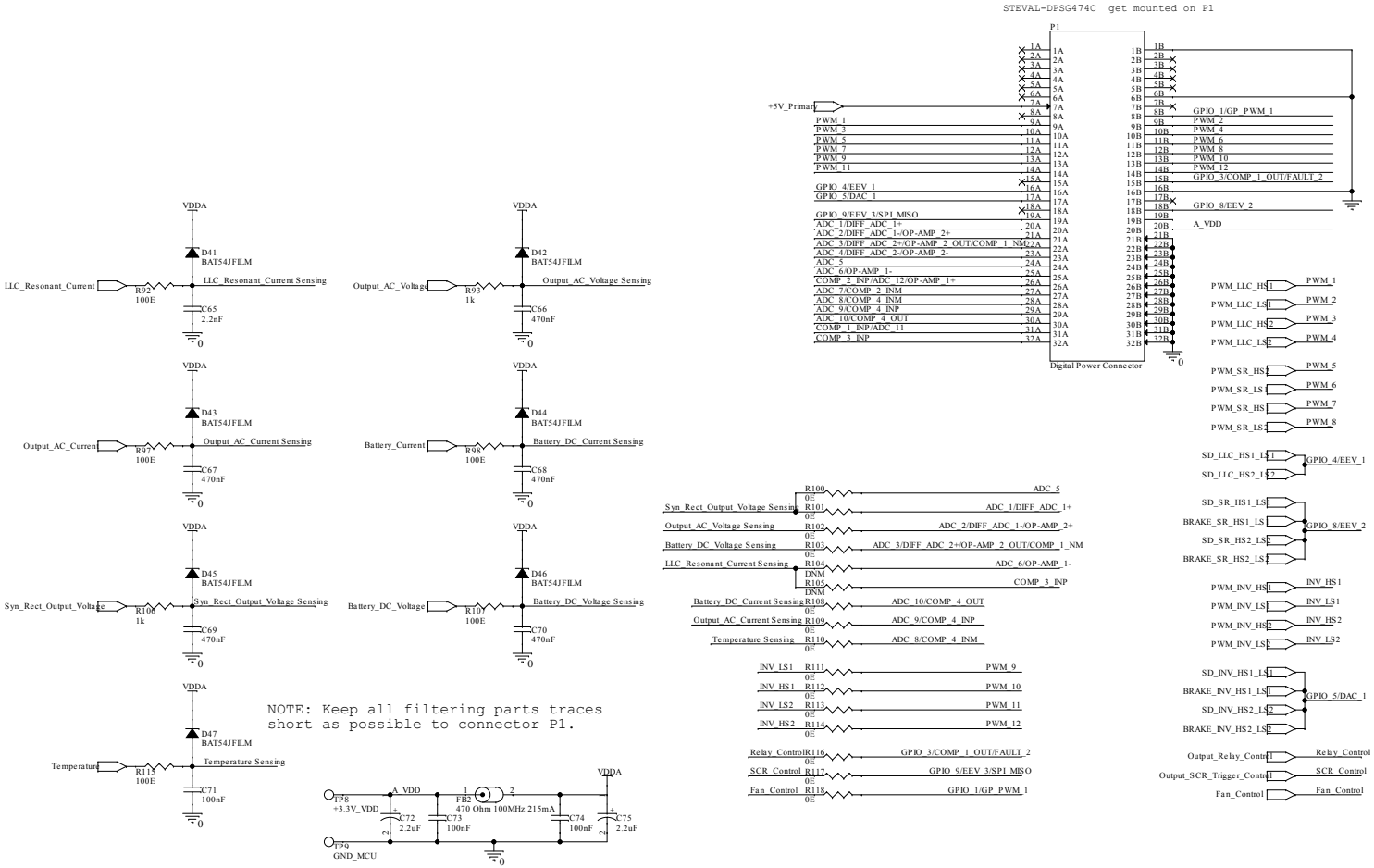


Figure 7. STEVAL-DCAC1KCB: power converter DC-DC - Circuit schematic

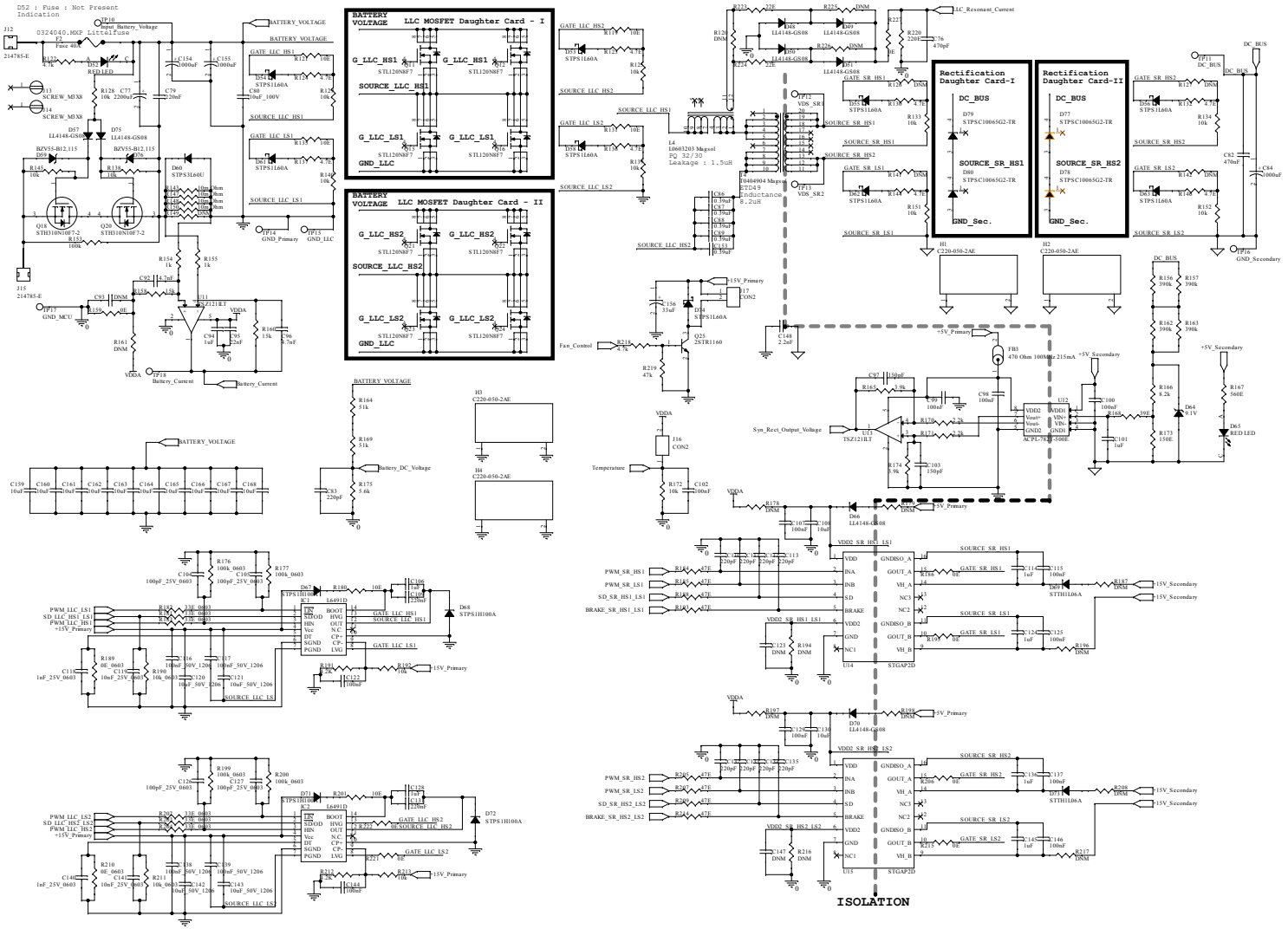


Figure 8. STEVAL-DPSG474: microcontroller card - Circuit schematic (1 of 3)

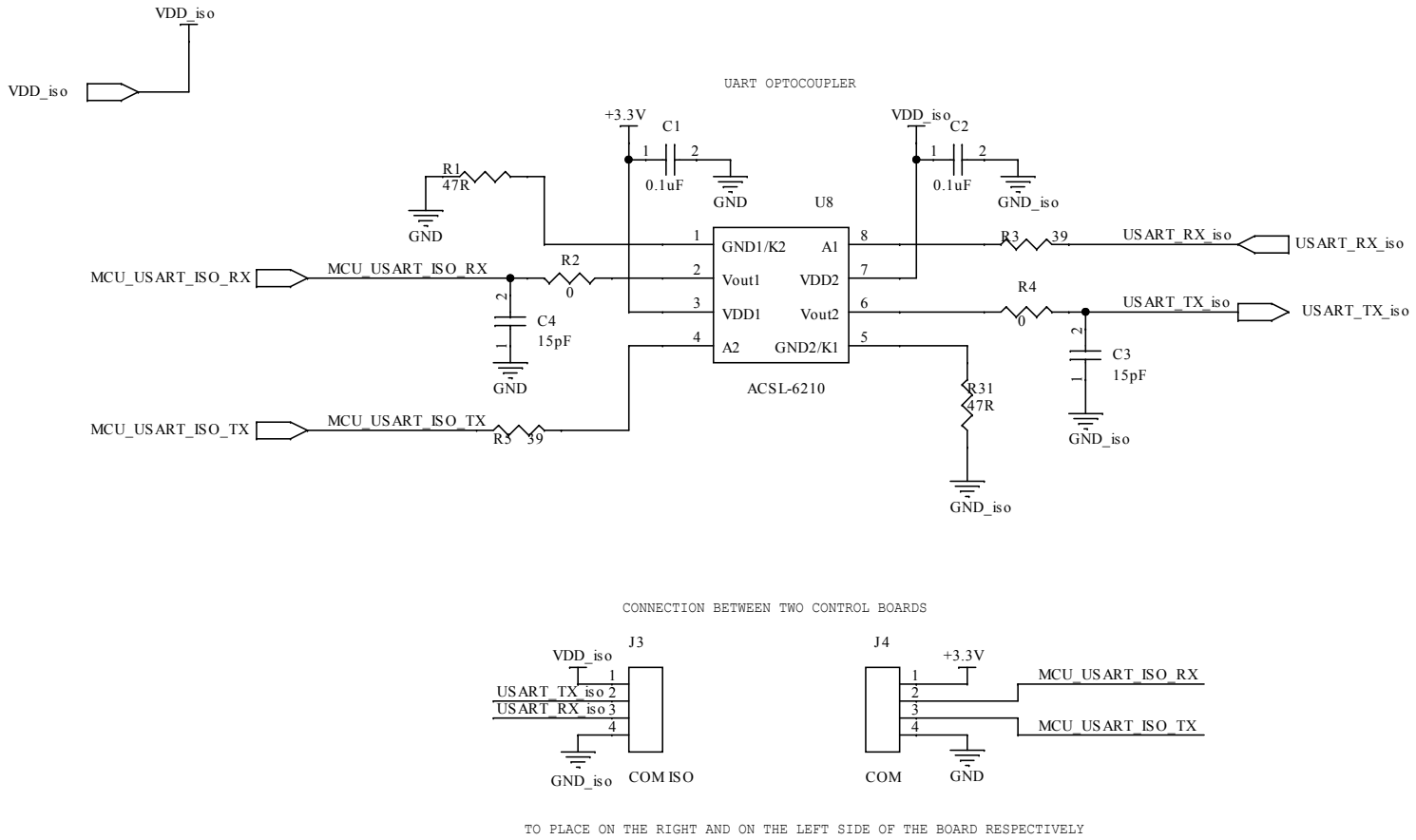


Figure 9. STEVAL-DPSG474: microcontroller card - Circuit schematic (2 of 3)

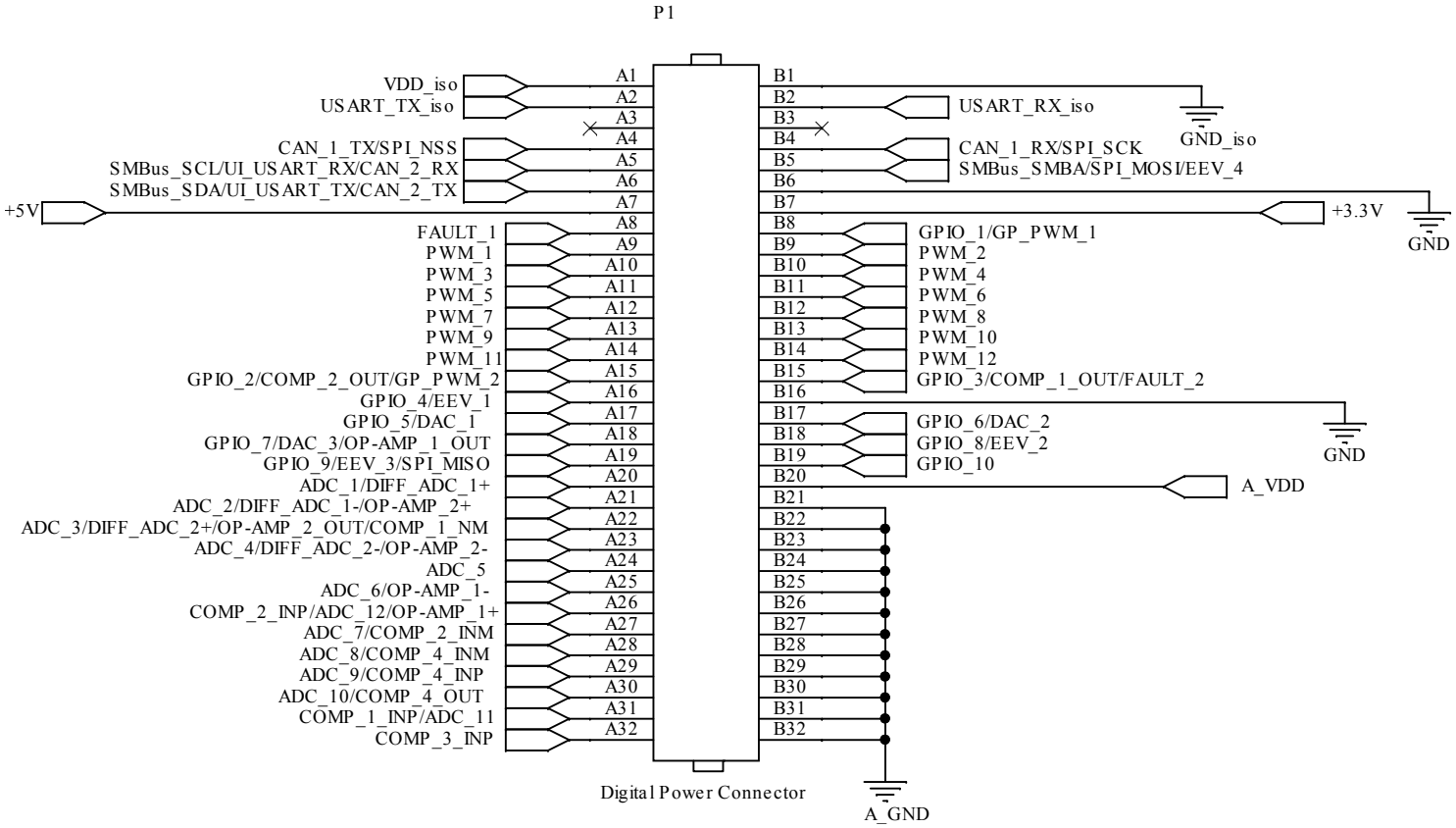
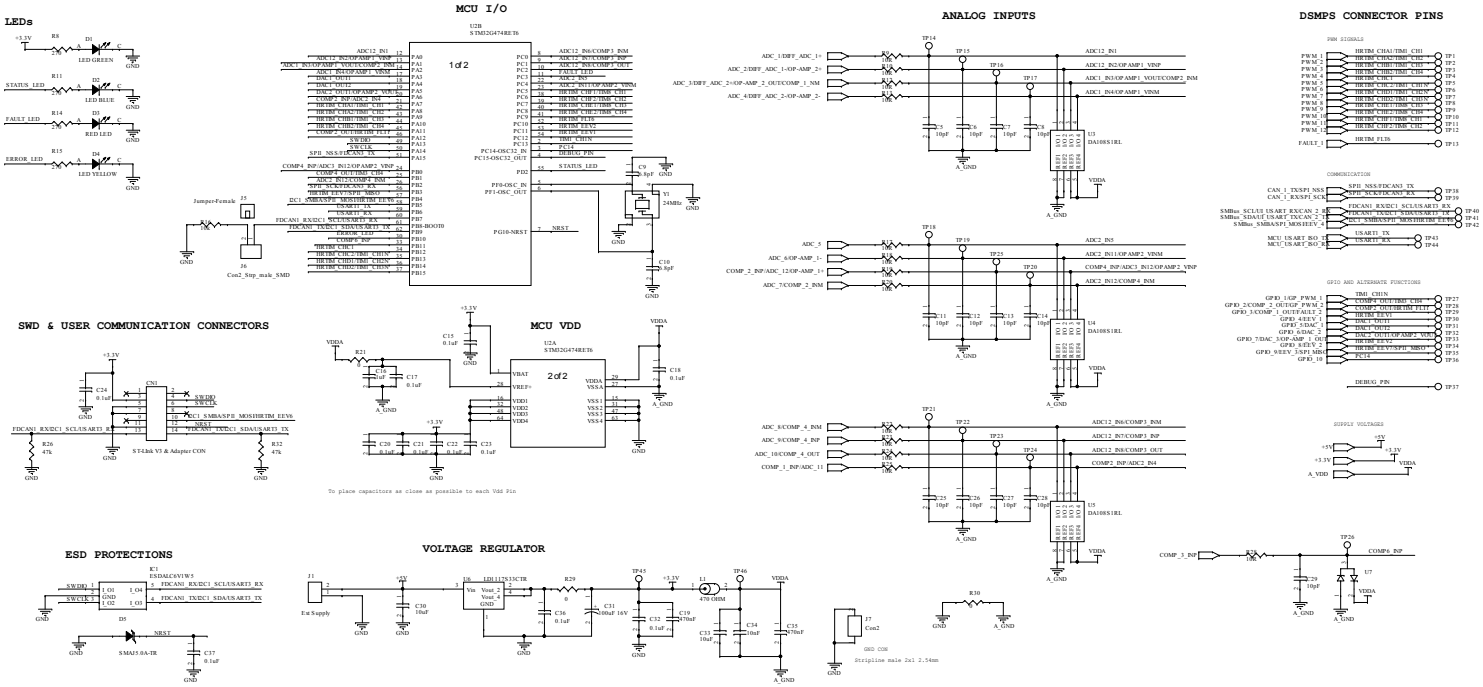


Figure 10. STEVAL-DPSG474: microcontroller card - Circuit schematic (3 of 3)



4 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
05-May-2025	1	Initial release.
11-Sep-2025	2	Updated Product summary and Section 1: 1500 VA digitally controlled power inverter architecture.

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