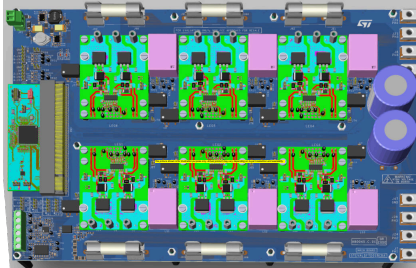


1.5 kW, 400 Vdc fault tolerant six-phase motor drive



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

Features

- A single solution based on a Control Board, a Main back-bone board and six Leg Power Boards
- Modular fault-tolerant solution for a six-phase AC Motor Drive
- Each Leg Board hosts:
 - Two [STGB20M65DF2](#) trench gate field-stop, 650 V, 20 A, M series low-loss IGBTs D²PAK-2 package
 - One [STGAP2D](#) half-bridge gate driver, 4 A capability, and rail-to-rail outputs
 - One NTC thermistor for overheat protection
 - An insulated metal substrate (IMS)
- The Main Board hosts:
 - A 164 position female PCI express connector as interface with the Control Board
 - Six fast-acting fuses for leg short circuit protection
 - Six NTC sensing networks
 - An auxiliary power supply based on two [L6902D013](#) step-down switching regulators
 - The support to six insulated Current sensors (ICS) for phase current reading
 - Support to quadrature incremental encoder, hall-effect rotor position, and resolver sensors
 - Six relays for motor terminal disconnection
 - The support to phase voltage sensing network
- The Control Board hosts:
 - A [STM32G473QB](#) microcontroller
 - A STLinkV3 14-pins connector for MCU programming and serial communication
 - A 164 pins PCI-Express PCB connector

Product summary	
Fault-tolerant six-phase industrial inverter	STEVAL-FTD01KCB
Trench gate field-stop, 650 V, 20 A, M series low-loss IGBTs D ² PAK-2 package	STGB20M65DF2
Arm Cortex-M4 MCU 170 MHz with 128 Kbytes of Flash memory, Math Accelerator	STM32G473QB
Up to 1 A switching regulator with adjustable current limit	L6902D013
half-bridge gate driver, 4 A capability and rail-to-rail outputs	STGAP2D
Applications	Industrial electrical drives (e.g., manufacturing processes, industrial transportation, aircraft)

Description

The [STEVAL-FTD01KCB](#) evaluation kit is designed to provide a complete and modular fault-tolerant solution for a six-phase AC motor drive. The kit consists of the [STEVAL-FTD01ACB](#) Control Board, the [STEVAL-FTD01BCB](#) Main Board, and six [STEVAL-FTD01CCB](#) leg Power Boards.

The Control Board has been designed as a 164 pins PCI Express® ready PCB, it hosts a [STM32G473QB](#) microcontroller (based on the Arm Cortex-M4 MCU, 170 MHz with 128 Kbytes of flash memory, math accelerator, high analog level integration), an STLINK V3 connector to program the MCU and make a serial communication with the PC.

The Main Board represents the core part of the modular approach of this fault tolerant solution, in fact it is composed by six square holes where the Leg Boards could be mechanically fitted, it hosts a 164 pin female PCI Express® connector, six NTC sensing networks for inverter leg thermal protection, six fuses for short circuits protection, and six relays for phase opening, phase current and phase voltage sensing features. Moreover, the Main Board hosts two L6902D013 step-down switching regulators as an auxiliary power supply and the support for rotor position sensors (hall effect, incremental quadrature encoder and resolver).

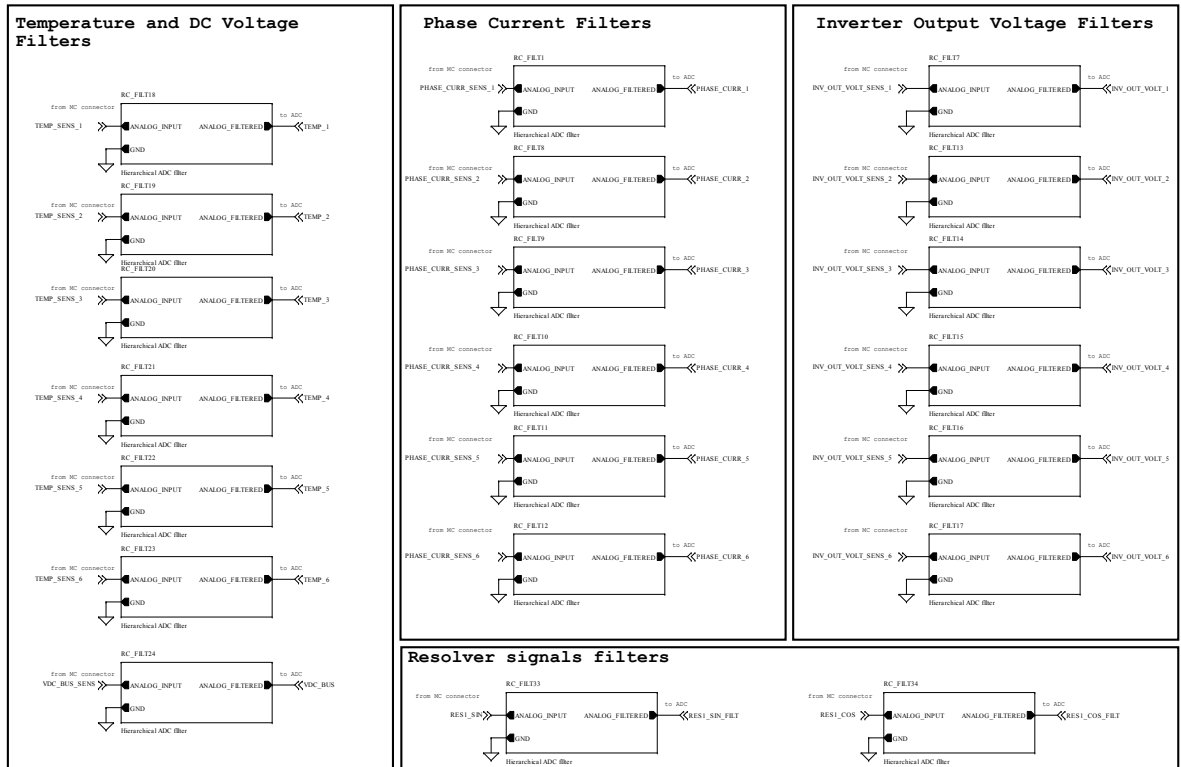
Each inverter Leg Board features the [STGAP2D](#), a half-bridge gate driver to isolate the gate driving channels from the low voltage control and interface circuitry. The gate driver is characterized by 4 A capability and rail-to-rail outputs, making the device also suitable for high power inverter applications such as motor drivers in industrial applications. Moreover, the Leg Board hosts the trench gate field-stop, 650 V, 20 A, M series low-loss IGBT (STGB20M65DF2).

The overall system is designed to be galvanically isolated between the MCU and power stages.

1 Schematic diagrams

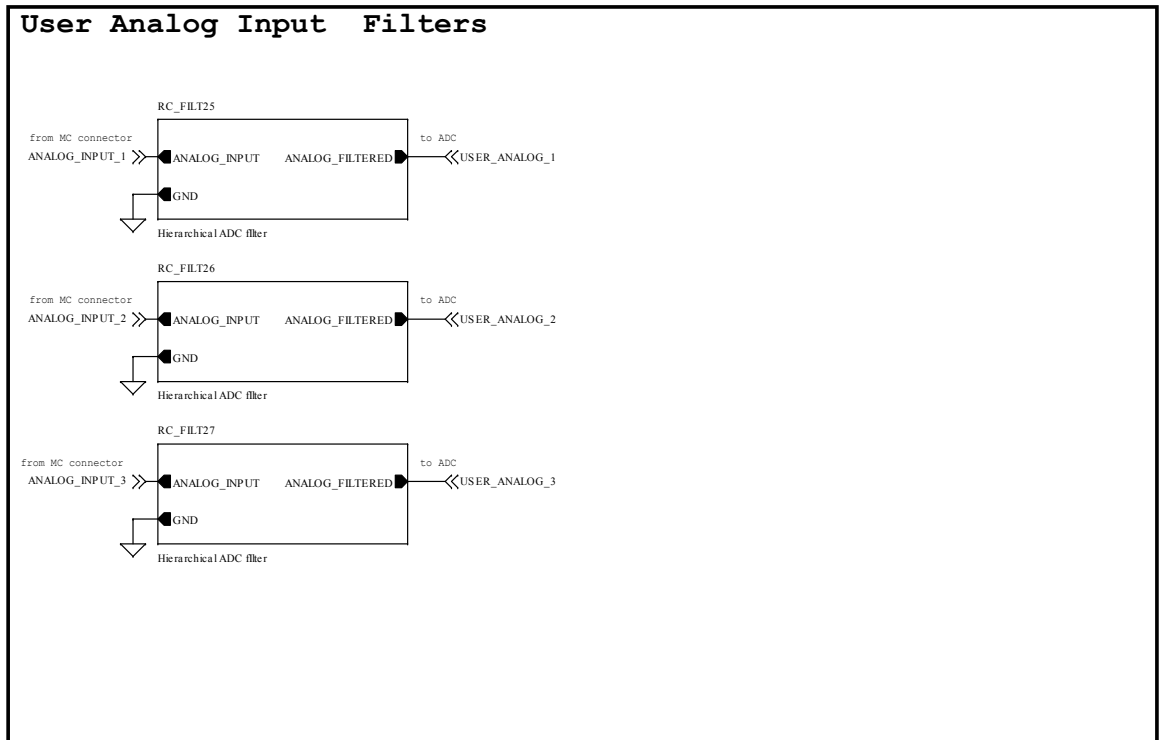
Important: These schematics are for illustration purpose only. Actual product may vary depending on buyer's selection and availability.

Figure 1. STEVAL-FTD01ACB circuit schematic (1 of 28)



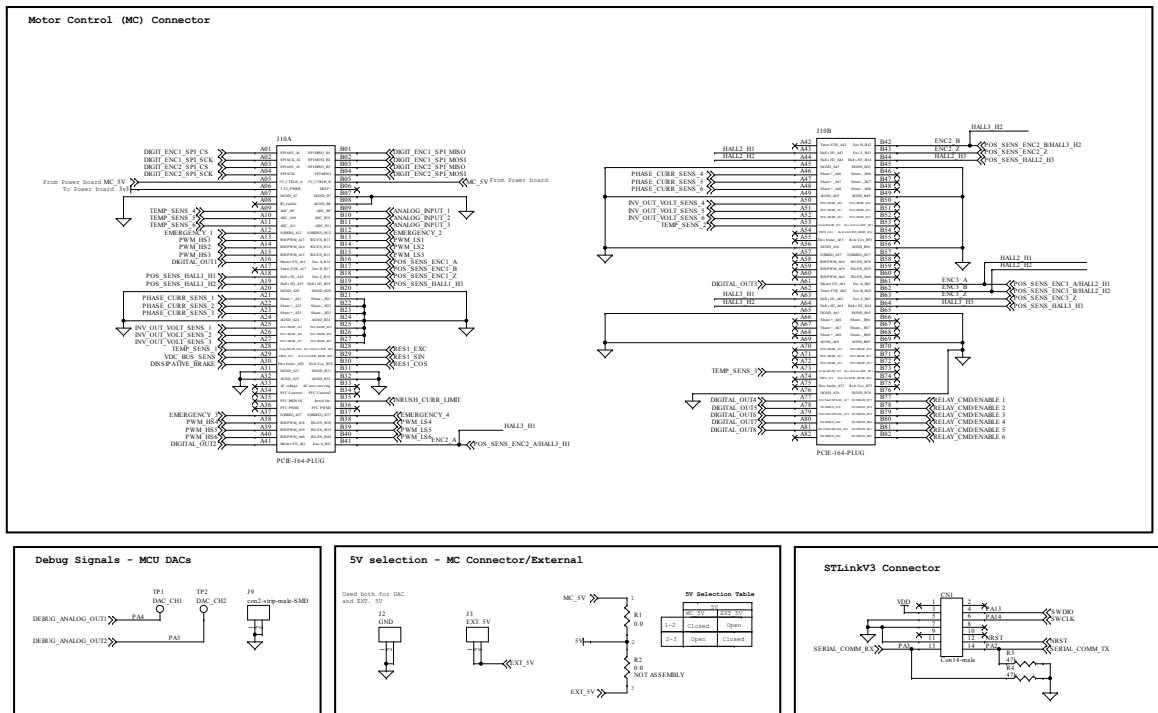
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Figure 2. STEVAL-FTD01ACB circuit schematic (2 of 28)



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Figure 3. STEVAL-FTD01ACB circuit schematic (3 of 28)



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Figure 4. STEVAL-FTD01ACB circuit schematic (4 of 28)

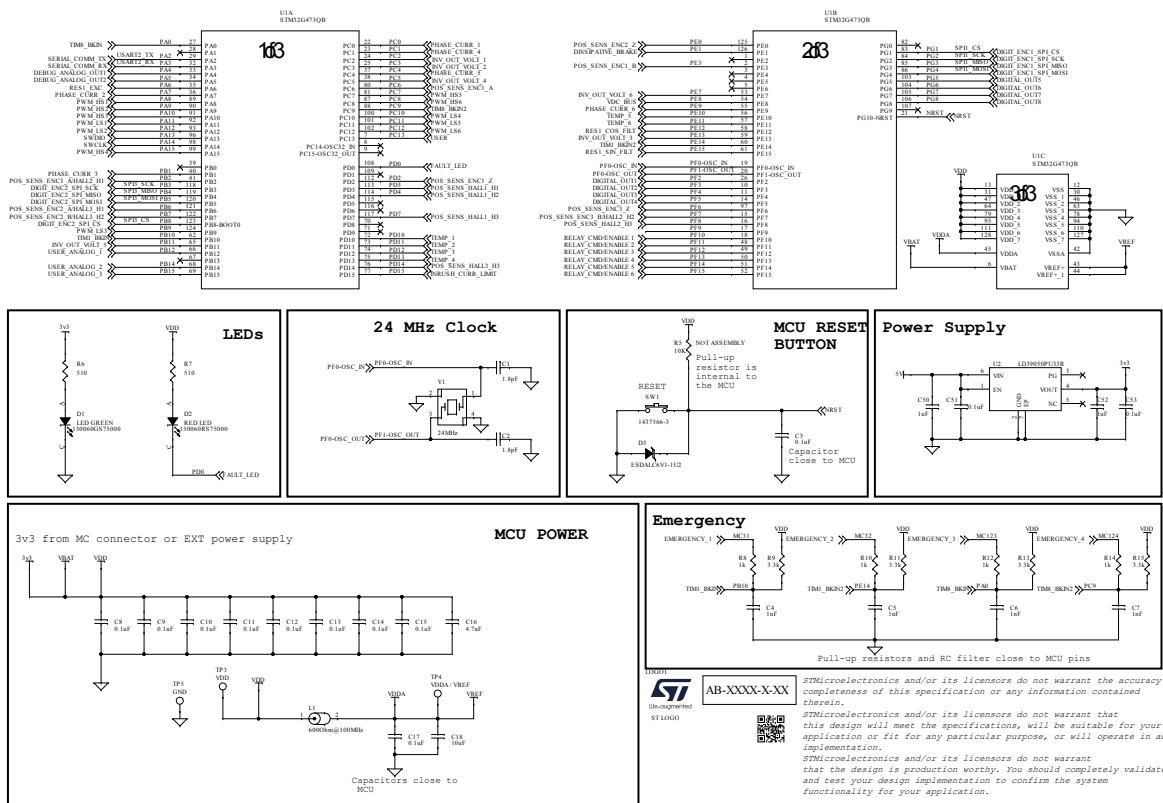
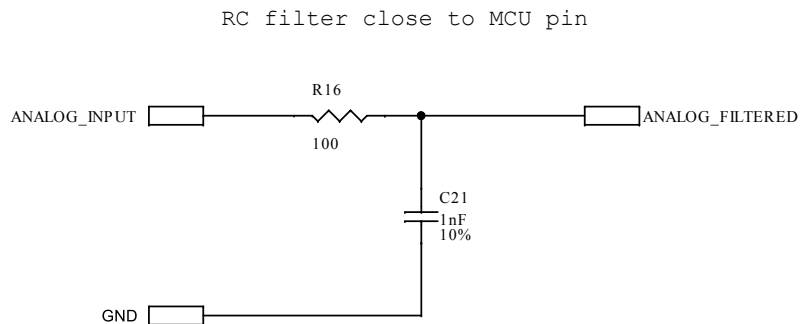


Figure 5. STEVAL-FTD01ACB circuit schematic (5 of 28)

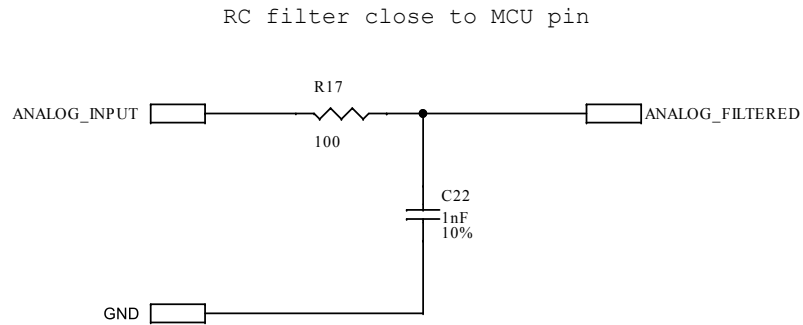


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Figure 6. STEVAL-FTD01ACB circuit schematic (6 of 28)

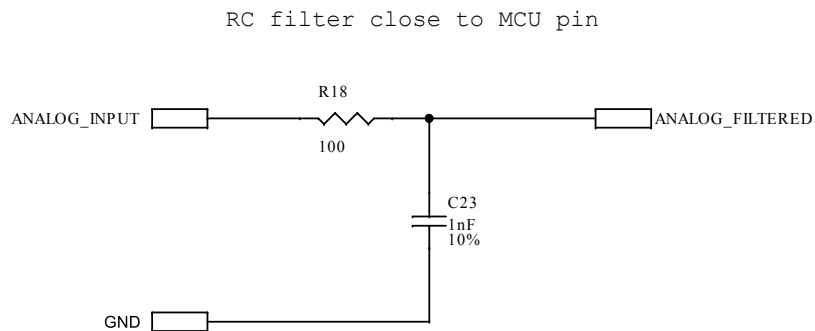


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Figure 7. STEVAL-FTD01ACB circuit schematic (7 of 28)

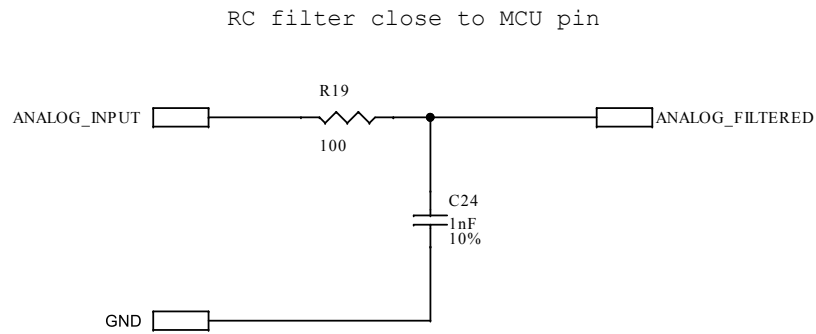


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Figure 8. STEVAL-FTD01ACB circuit schematic (8 of 28)

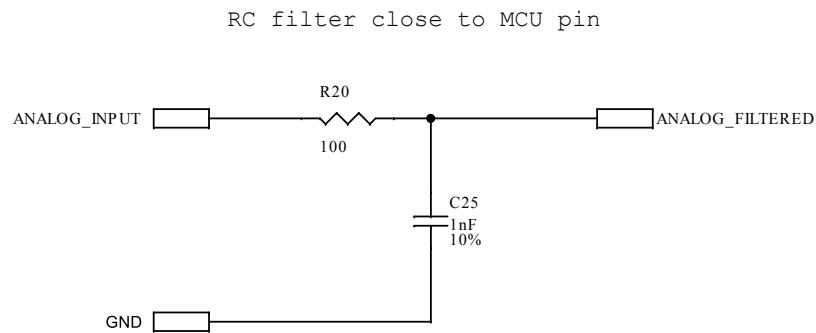


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Figure 9. STEVAL-FTD01ACB circuit schematic (9 of 28)

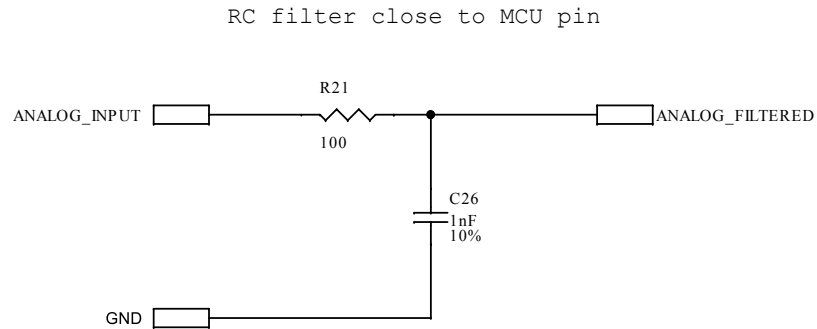


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Figure 10. STEVAL-FTD01ACB circuit schematic (10 of 28)

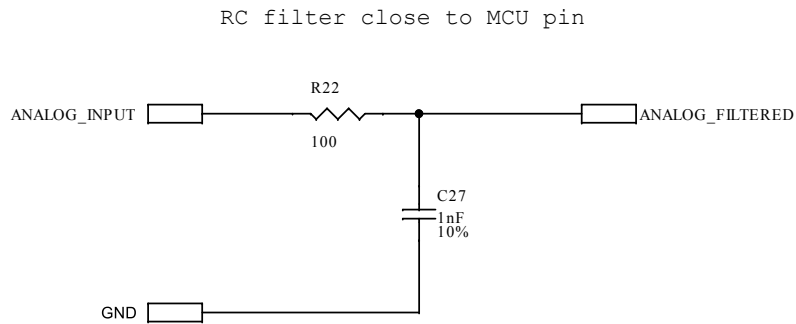


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Figure 11. STEVAL-FTD01ACB circuit schematic (11 of 28)



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Figure 12. STEVAL-FTD01ACB circuit schematic (12 of 28)

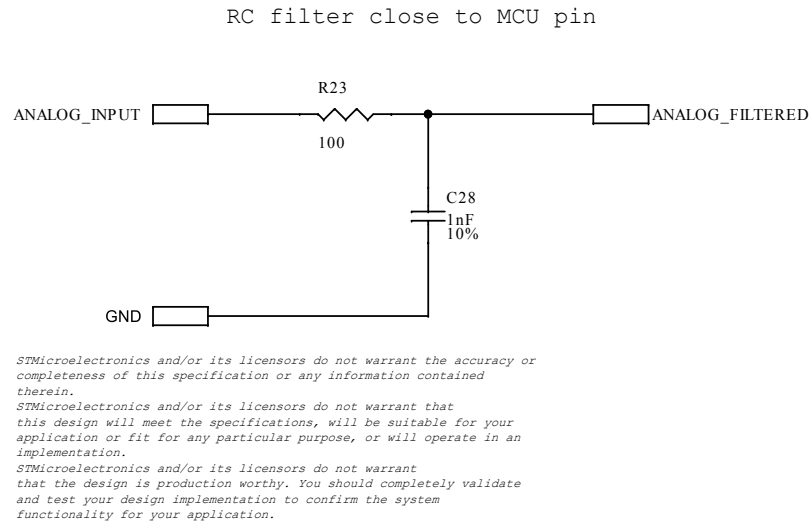


Figure 13. STEVAL-FTD01ACB circuit schematic (13 of 28)

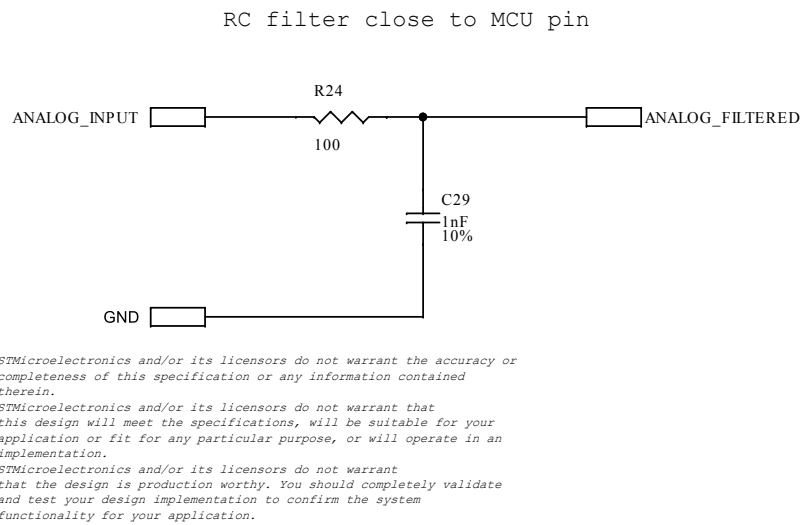


Figure 14. STEVAL-FTD01ACB circuit schematic (14 of 28)

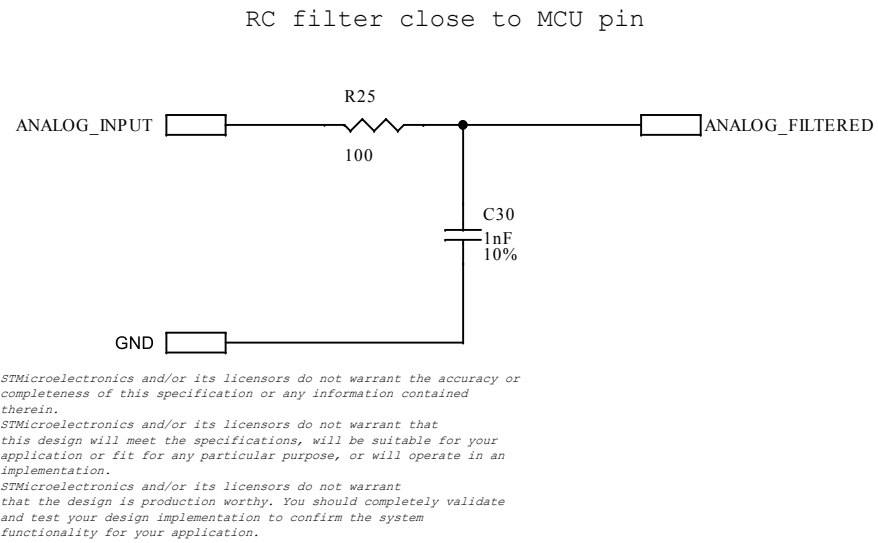


Figure 15. STEVAL-FTD01ACB circuit schematic (15 of 28)

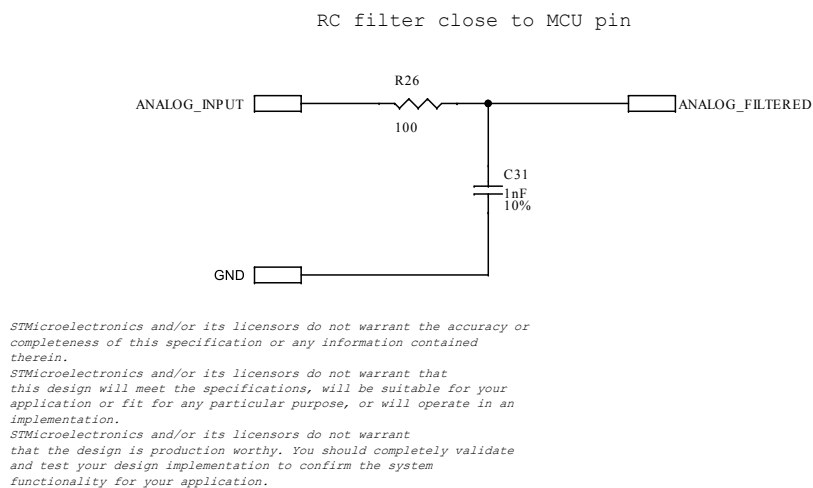
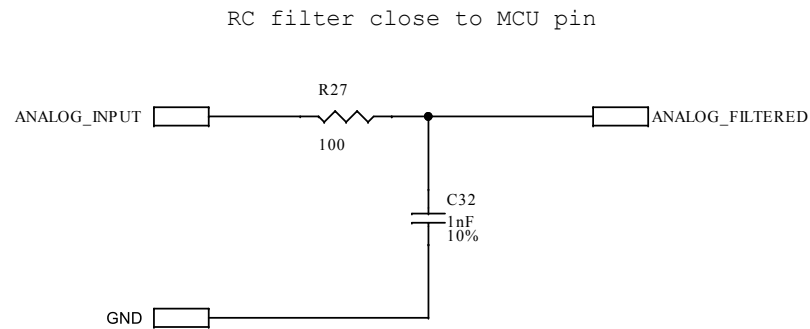


Figure 16. STEVAL-FTD01ACB circuit schematic (16 of 28)

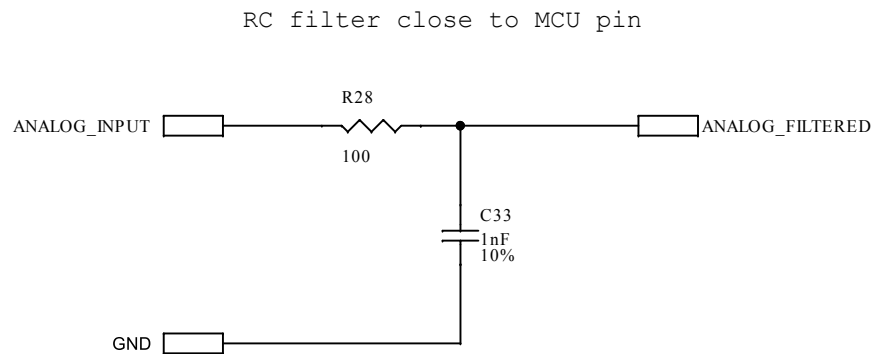


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Figure 17. STEVAL-FTD01ACB circuit schematic (17 of 28)

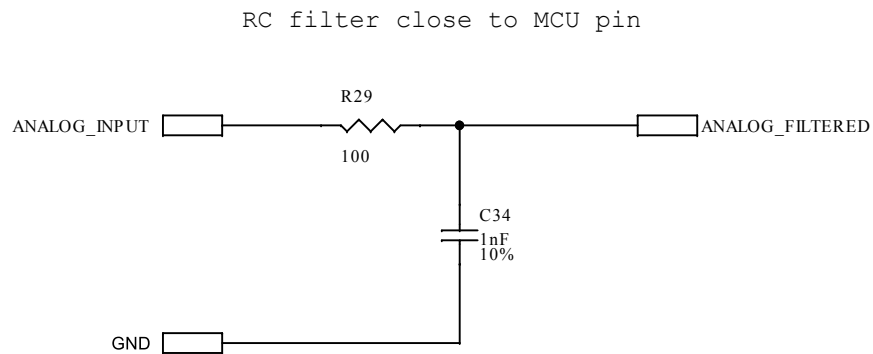


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Figure 18. STEVAL-FTD01ACB circuit schematic (18 of 28)

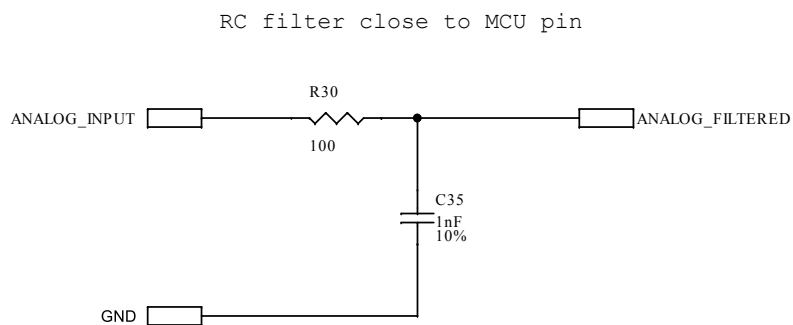


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Figure 19. STEVAL-FTD01ACB circuit schematic (19 of 28)

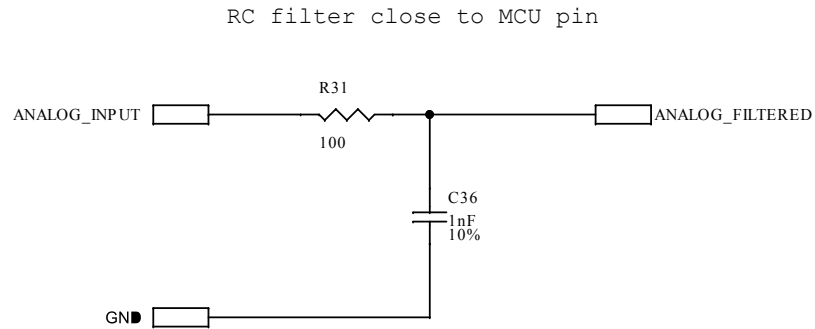


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Figure 20. STEVAL-FTD01ACB circuit schematic (20 of 28)

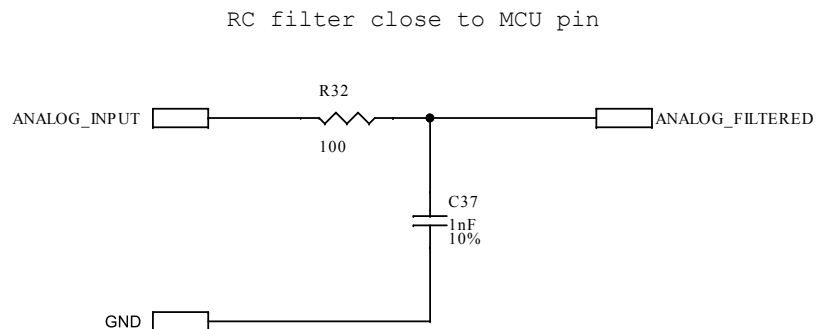


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Figure 21. STEVAL-FTD01ACB circuit schematic (21 of 28)

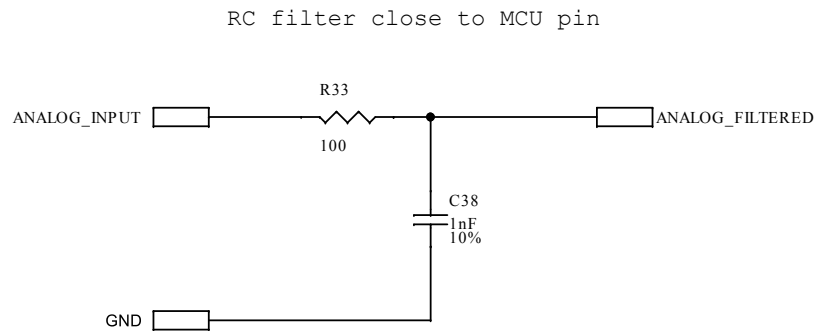


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Figure 22. STEVAL-FTD01ACB circuit schematic (22 of 28)

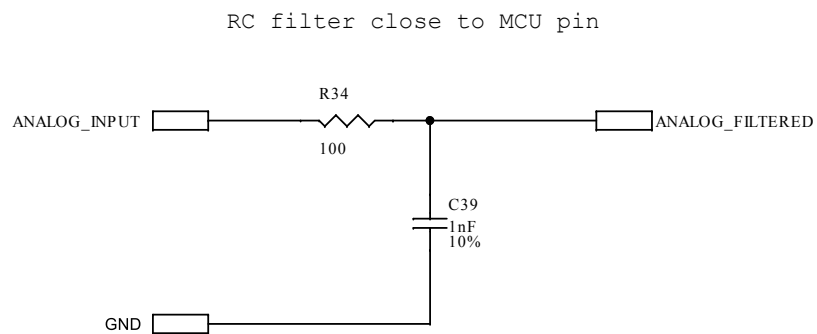


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Figure 23. STEVAL-FTD01ACB circuit schematic (23 of 28)

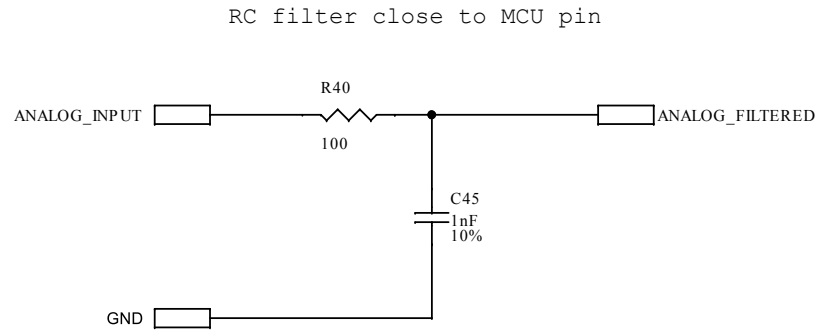


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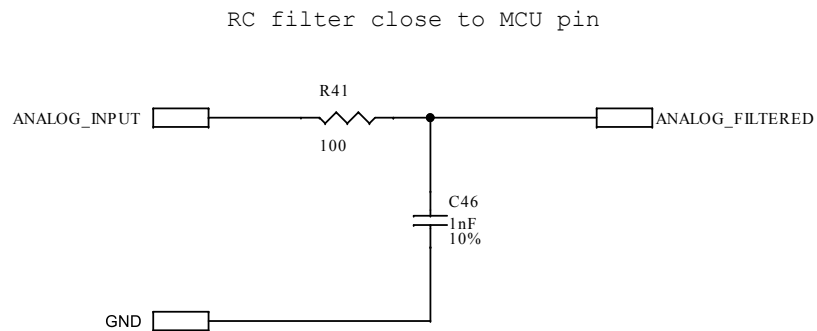
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Figure 24. STEVAL-FTD01ACB circuit schematic (24 of 28)



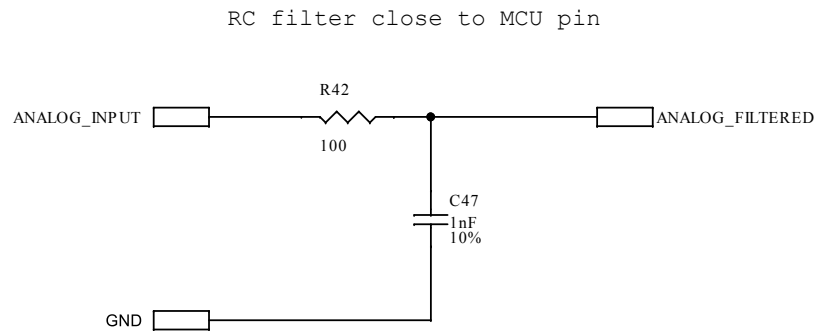
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Figure 25. STEVAL-FTD01ACB circuit schematic (25 of 28)



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Figure 26. STEVAL-FTD01ACB circuit schematic (26 of 28)

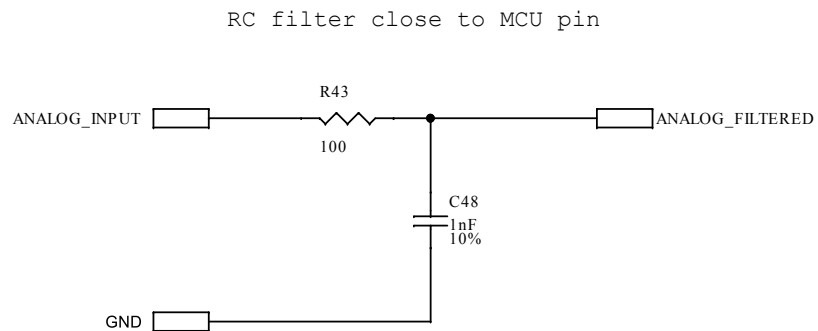


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Figure 27. STEVAL-FTD01ACB circuit schematic (27 of 28)

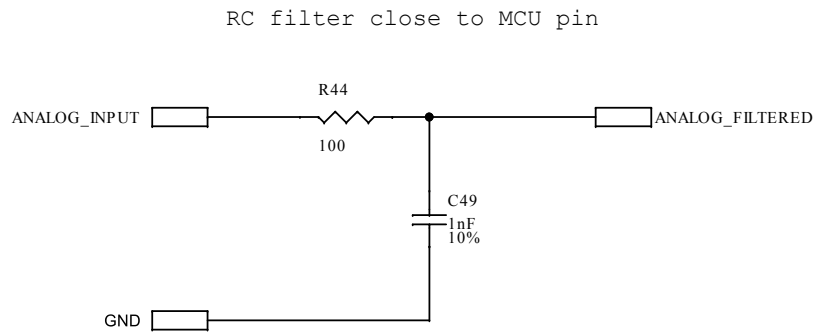


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Figure 28. STEVAL-FTD01ACB circuit schematic (28 of 28)

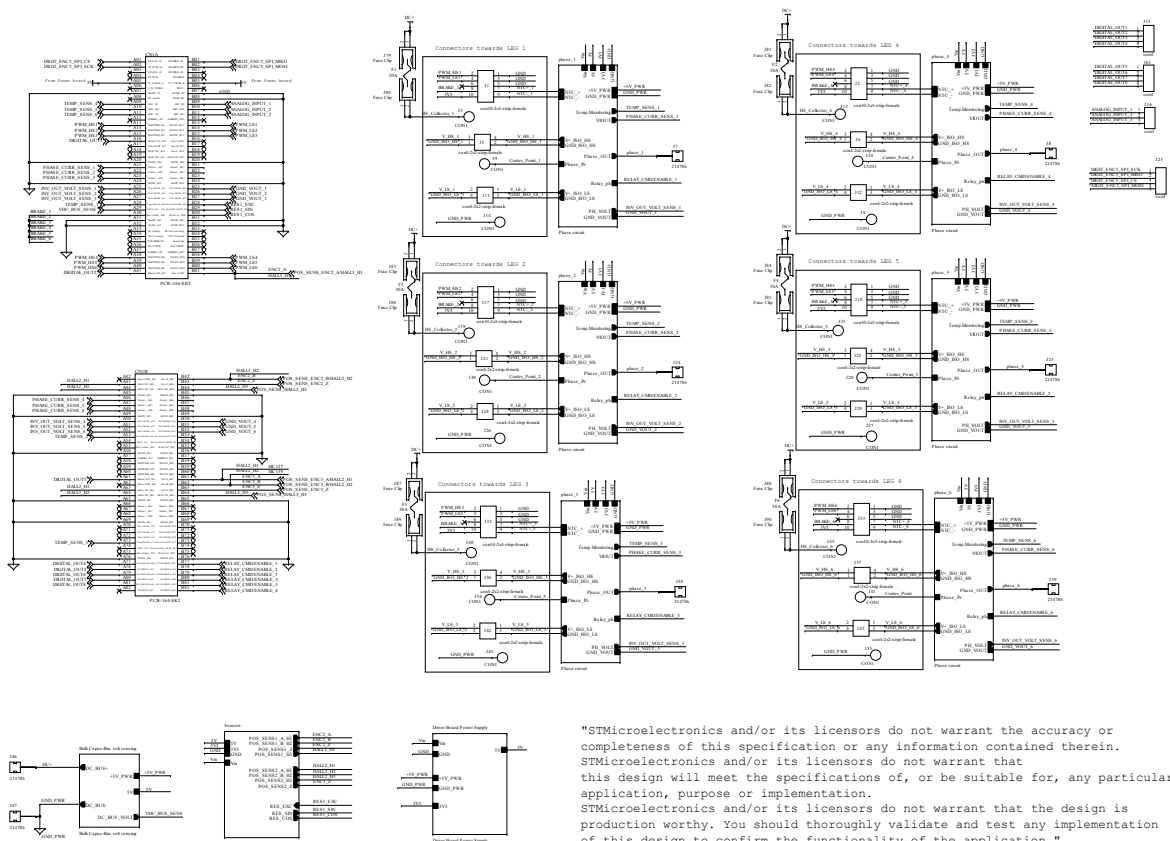


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Figure 29. STEVAL-FTD01BCB circuit schematic (1 of 23)



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Figure 30. STEVAL-FTD01BCB circuit schematic (2 of 23)

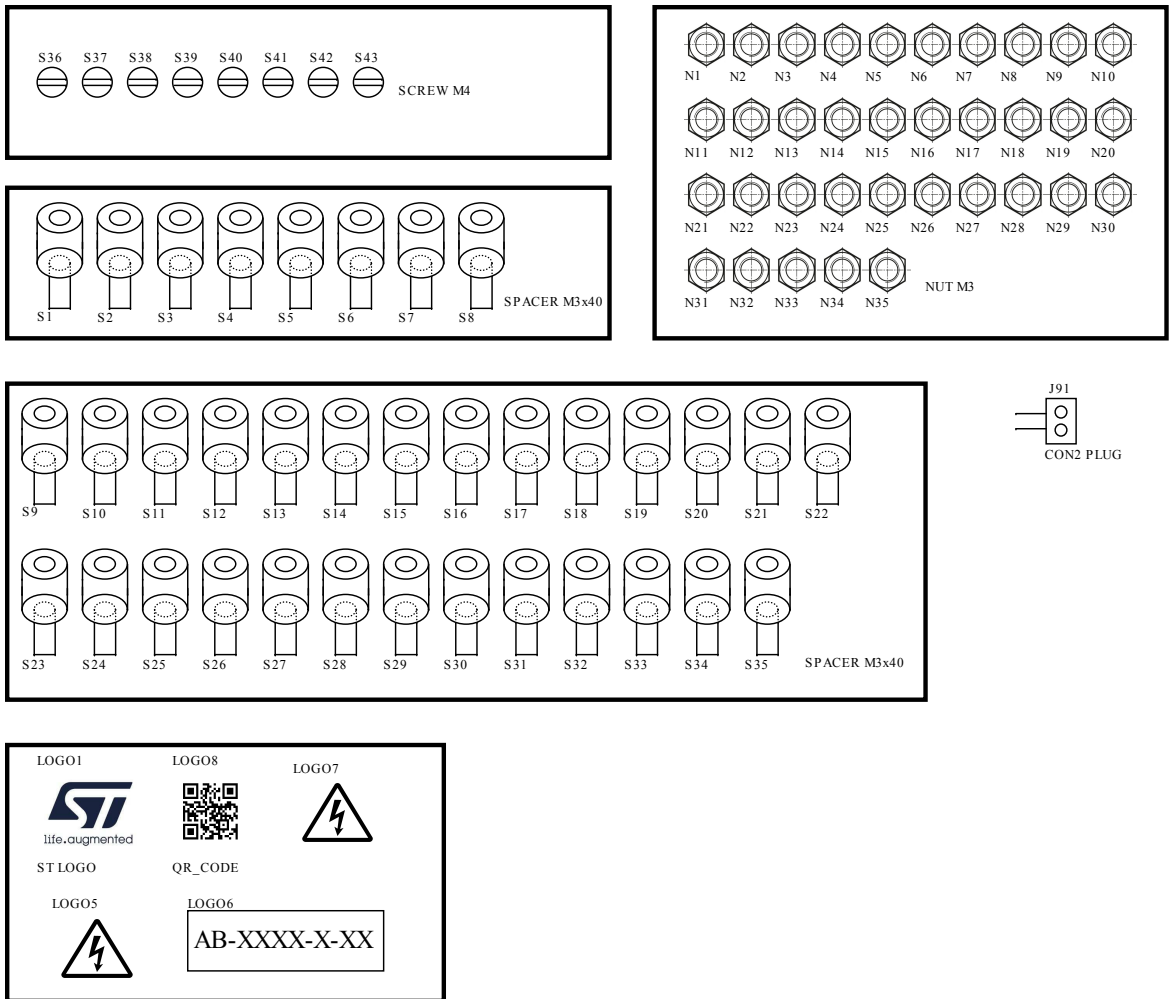
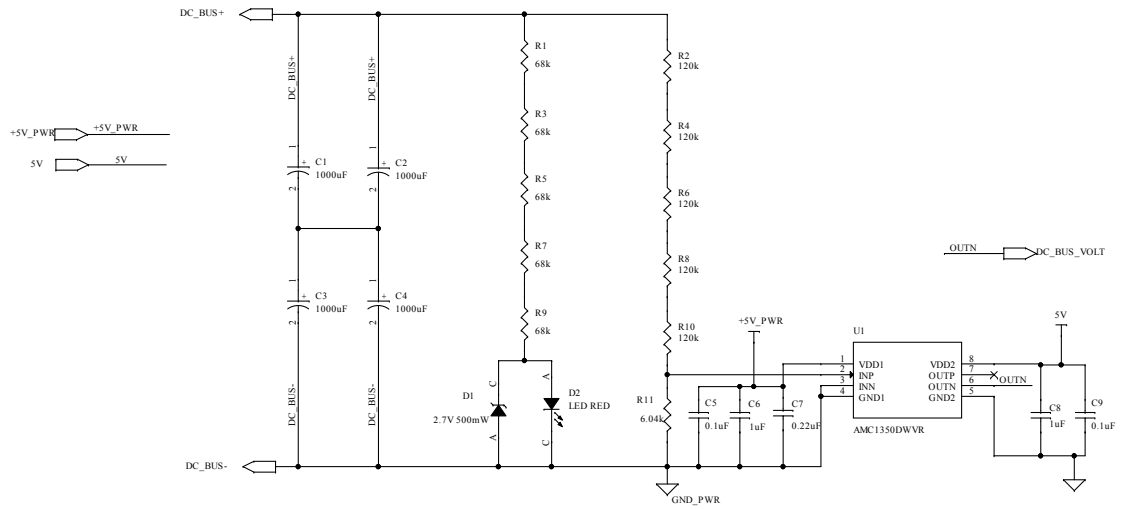


Figure 31. STEVAL-FTD01BCB circuit schematic (3 of 23)



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Figure 32. STEVAL-FTD01BCB circuit schematic (4 of 23)

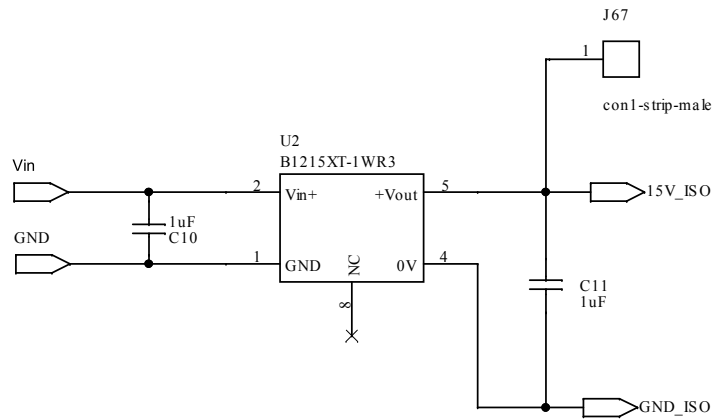


Figure 33. STEVAL-FTD01BCB circuit schematic (5 of 23)

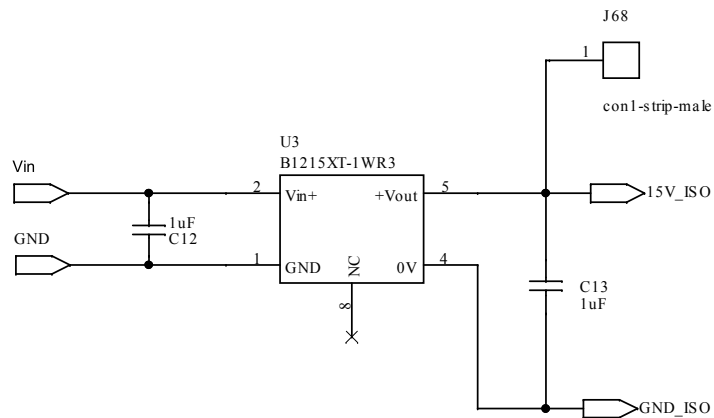


Figure 34. STEVAL-FTD01BCB circuit schematic (6 of 23)

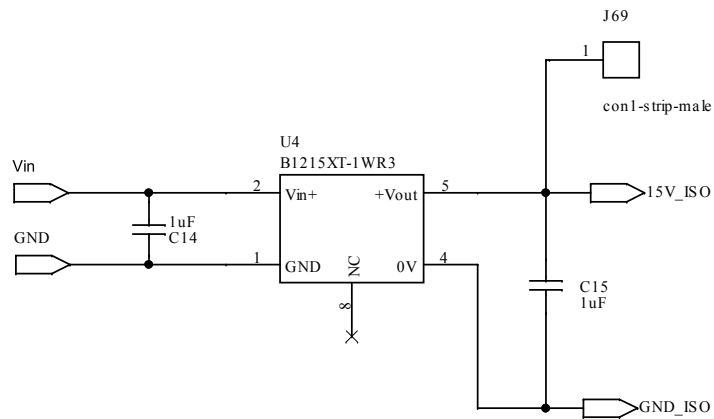


Figure 35. STEVAL-FTD01BCB circuit schematic (7 of 23)

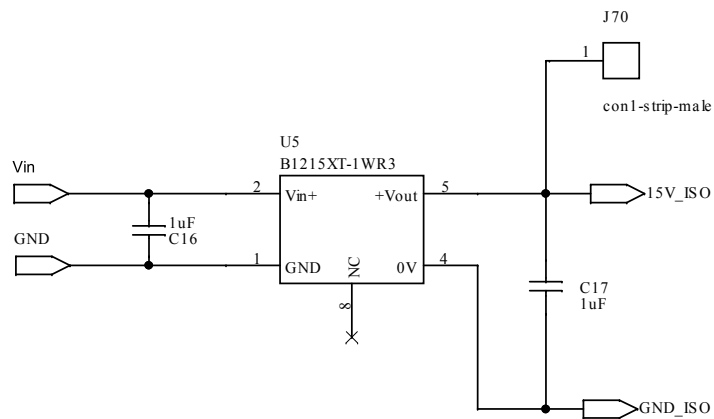


Figure 36. STEVAL-FTD01BCB circuit schematic (8 of 23)

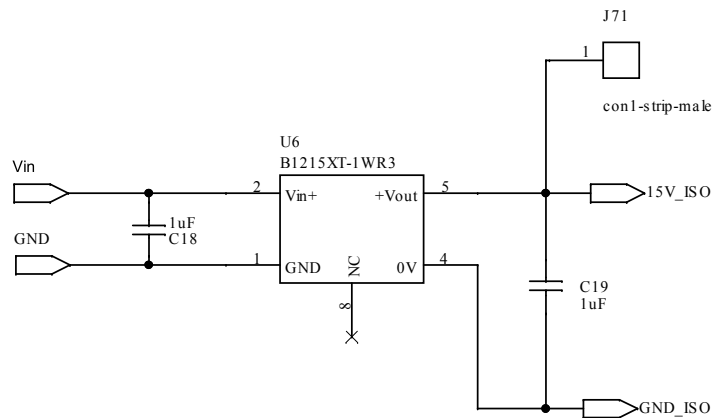


Figure 37. STEVAL-FTD01BCB circuit schematic (9 of 23)

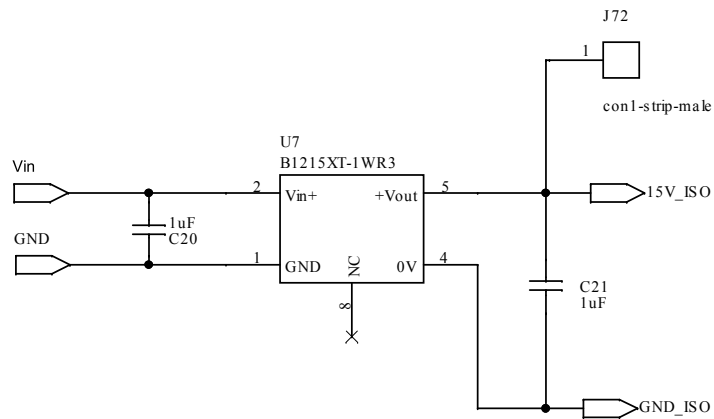


Figure 38. STEVAL-FTD01BCB circuit schematic (10 of 23)

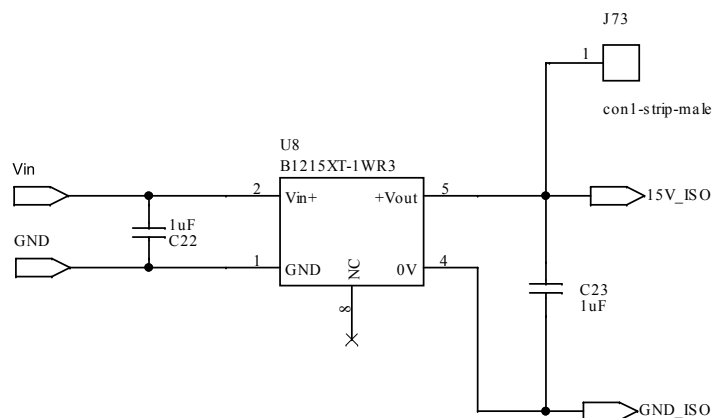


Figure 39. STEVAL-FTD01BCB circuit schematic (11 of 23)

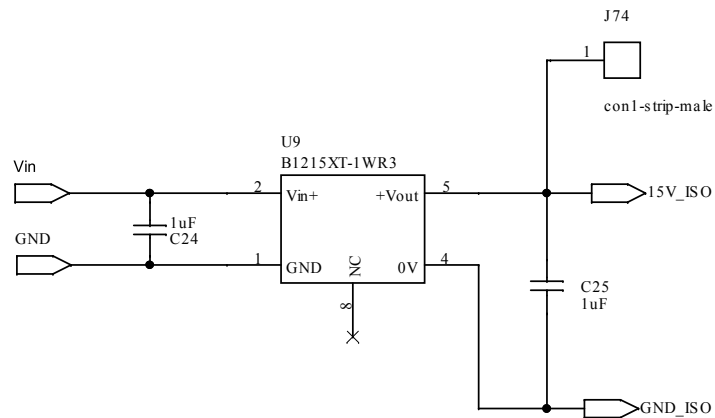


Figure 40. STEVAL-FTD01BCB circuit schematic (12 of 23)

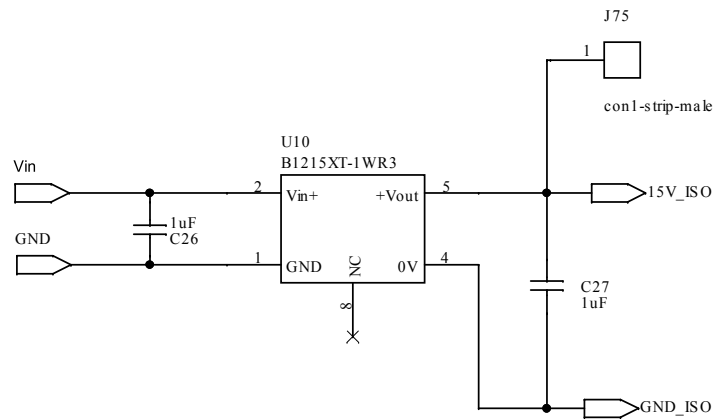


Figure 41. STEVAL-FTD01BCB circuit schematic (13 of 23)

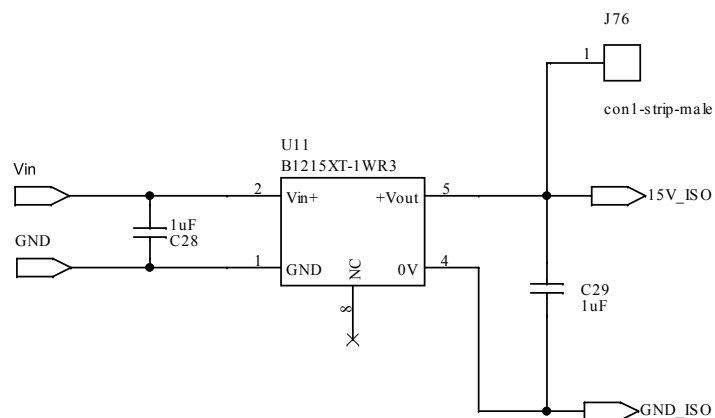


Figure 42. STEVAL-FTD01BCB circuit schematic (14 of 23)

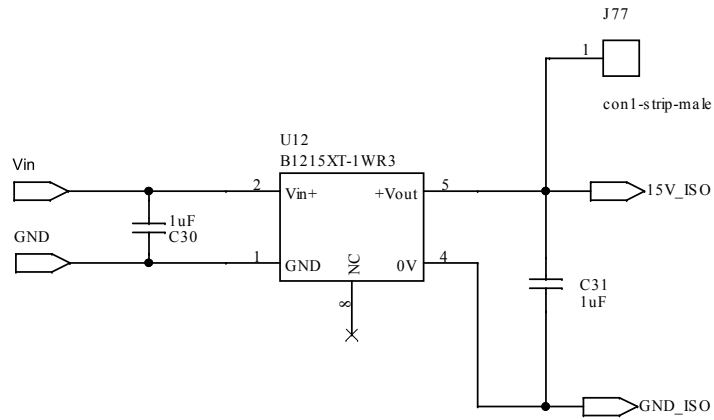


Figure 43. STEVAL-FTD01BCB circuit schematic (15 of 23)

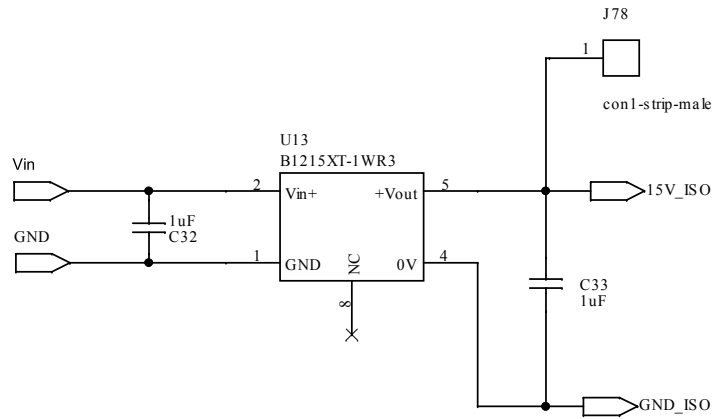


Figure 44. STEVAL-FTD01BCB circuit schematic (16 of 23)

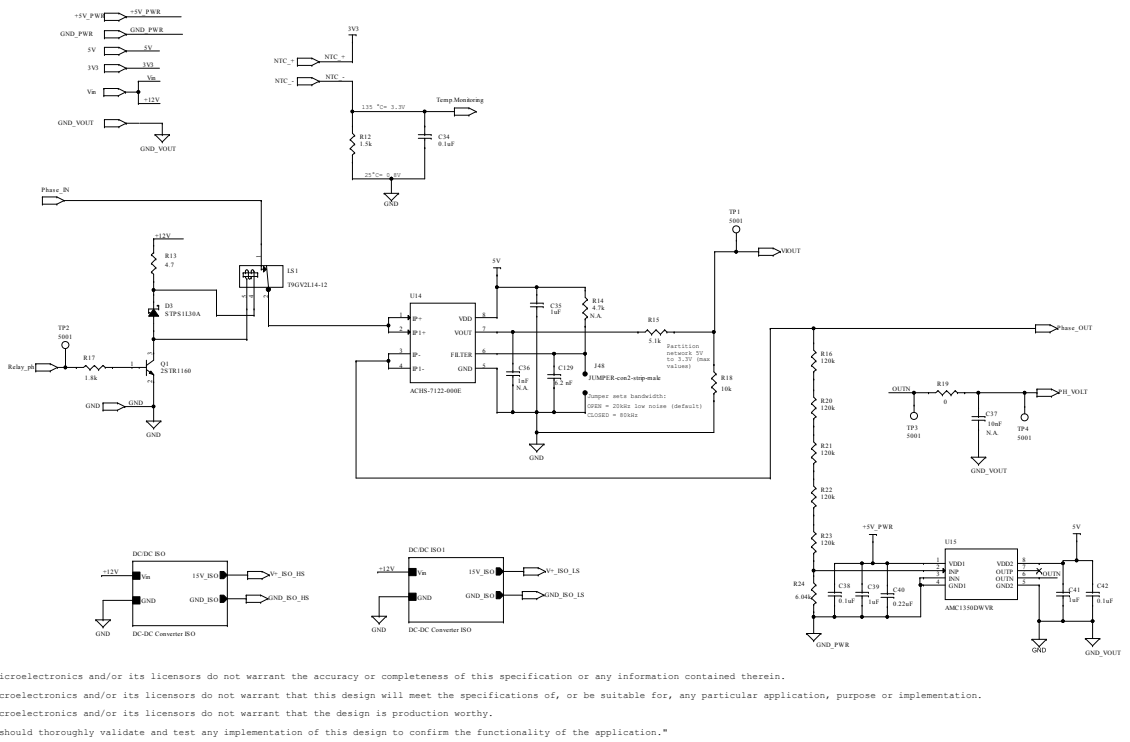


Figure 45. STEVAL-FTD01BCB circuit schematic (17 of 23)

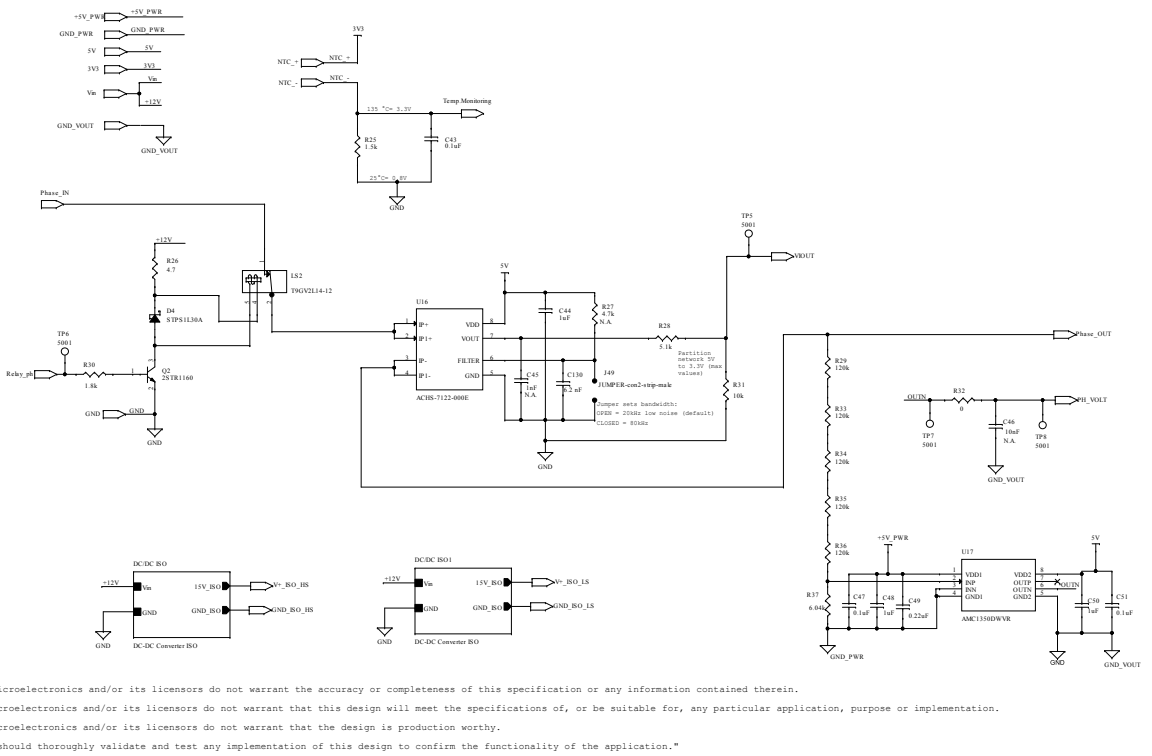
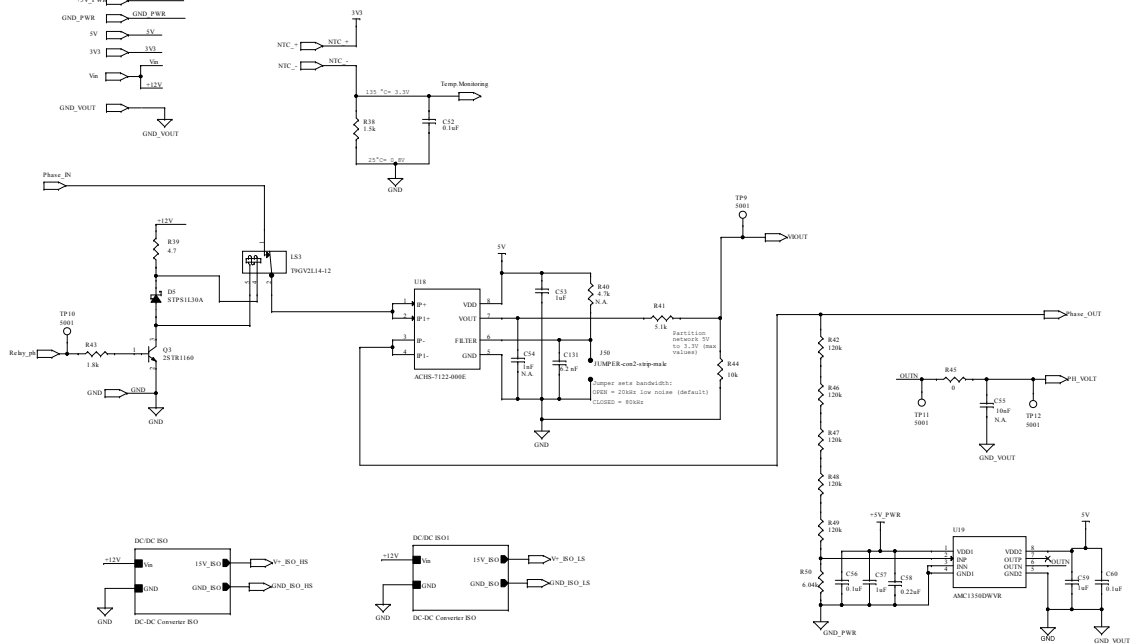
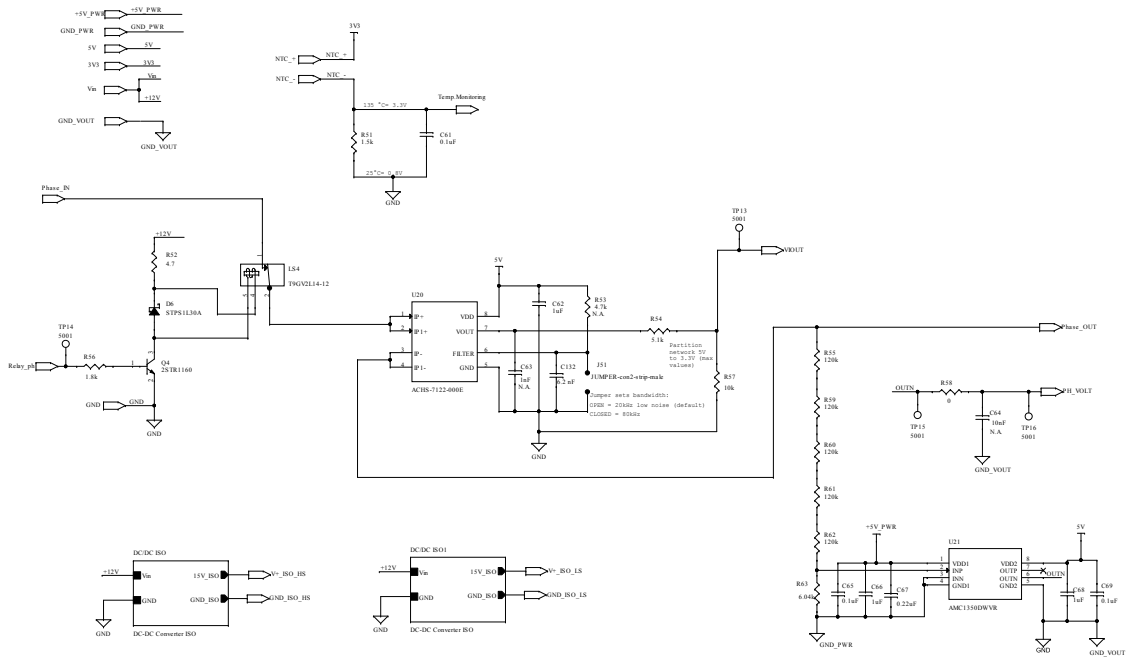


Figure 46. STEVAL-FTD01BCB circuit schematic (18 of 23)



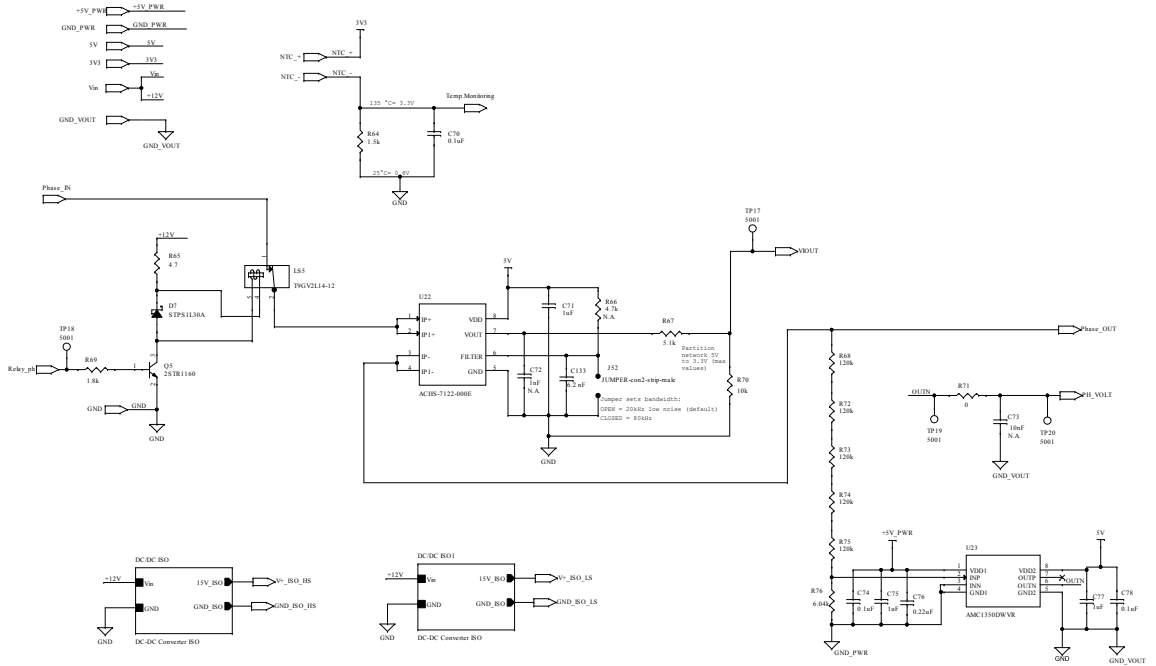
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Figure 47. STEVAL-FTD01BCB circuit schematic (19 of 23)



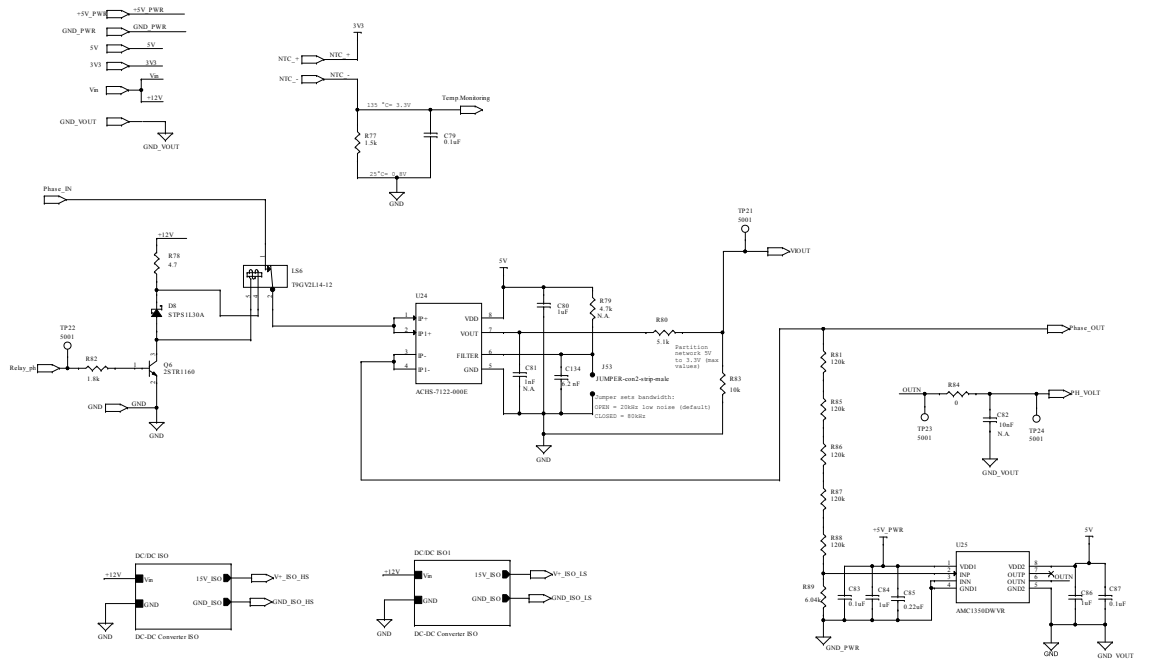
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Figure 48. STEVAL-FTD01BCB circuit schematic (20 of 23)



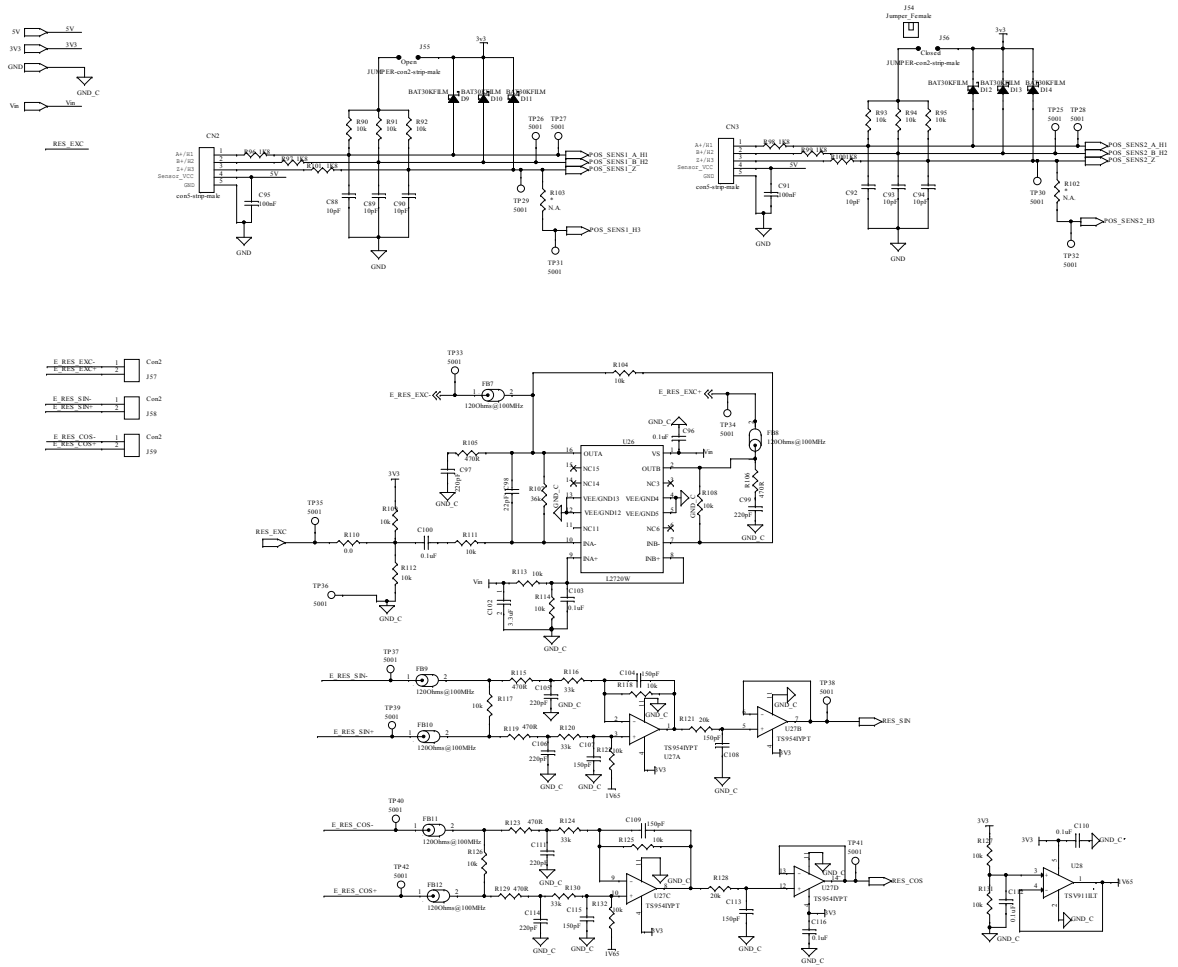
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Figure 49. STEVAL-FTD01BCB circuit schematic (21 of 23)



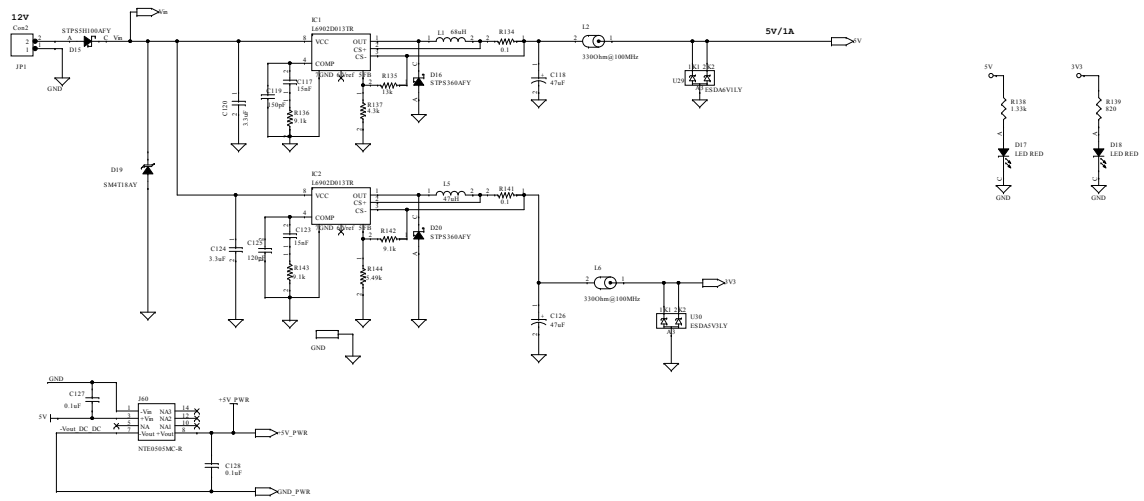
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Figure 50. STEVAL-FTD01KCB circuit schematic (22 of 23)



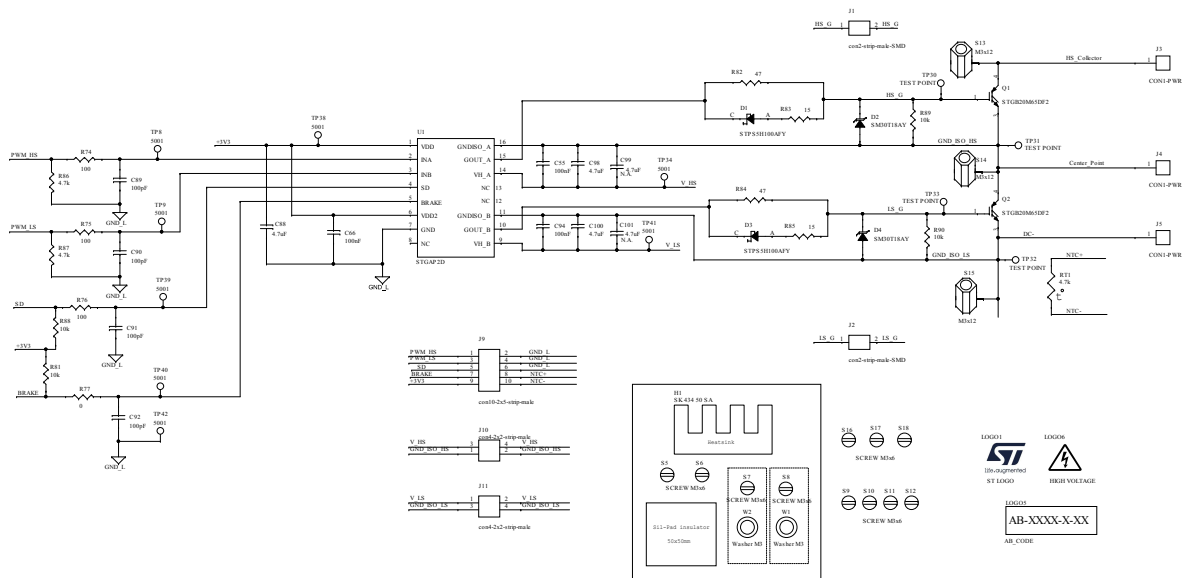
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Figure 51. STEVAL-FTD01BCB circuit schematic (23 of 23)



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Figure 52. STEVAL-FTD01CCB circuit schematic (1 of 1)



2 Custom evaluation boards information

Important: 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
19-Sep-2023	1	Initial release.

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