

Low Voltage, High Power Electronic Load Design for FPGA Current Draw Reproducing

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SUMMARY

FPGA devices can draw exceptionally high currents from low-voltage rails, imposing stringent constraints on the associated power-supply architecture. The present paper introduces an electronic load that faithfully reproduces such current profiles, thereby streamlining the development of low-voltage, high-power supplies and facilitating rigorous validation of the target rails (Figure 1). The conception of an electronic load is intrinsically demanding: the schematic must be meticulously devised, the PCB layout must respect an aggressive resistance budget, and the attendant thermal issues require explicit mitigation. The study demonstrates that loads analogous to those drawn by FPGAs can be generated using more economical solutions than commercial offerings. Accordingly, the prototype operates across 0.8–2.5 V rails and sinks up to 100 A with sub-microsecond edges whilst maintaining an aggregate path resistance below 8 m Ω . A bipartite topology comprising a low-loss MOSFET power

stage and a microcontroller-supervised analogue feedback loop—provides constant-current operation with over-voltage, over-current and thermal protection. Bench-top characterisation confirmed rise times of approximately 1 μ s and precise replication of the dynamic waveform captured with a Rogowski coil at DesignCon 2020, substantiating the load's suitability for exercising contemporary FPGA regulators. Although a residual temperature-dependent phase lag persists, the data indicate that an appropriately sized heat sink and judicious capacitor selection would yield a compact, robust solution at a fraction of the cost of commercial dynamic loads.

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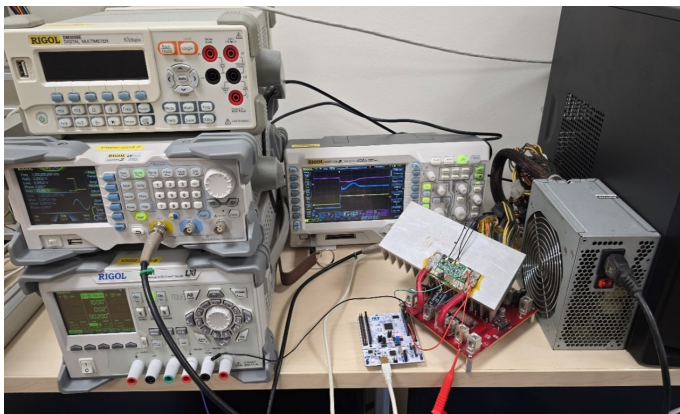


Figure 1. Test setup

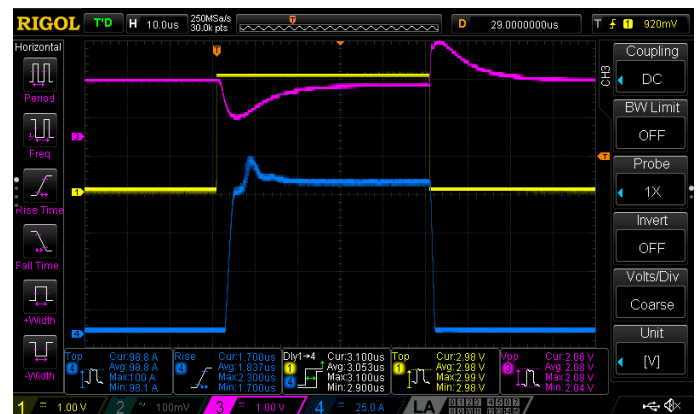


Figure 2. Transient response of the electronic load