

Xilinx Virtex UltraScale FPGA Power Solution (PMP9475)



System Description

The PMP9475 reference design provides all the power supply rails necessary to power Xilinx's Virtex UltraScale family of FPGAs. It features a UCD90120A for flexible power up and power down sequencing as well as voltage monitoring, current monitoring, and voltage margining through the PMBus interface. This design uses a 12V input.

Featured Applications

- FPGA

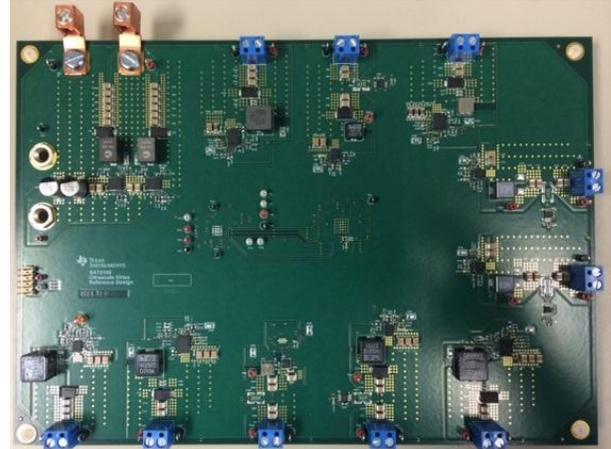
Design Resources

- Block Diagram and Schematic
- Test Data
- Gerber Files
- Design Files
- Bill of Materials

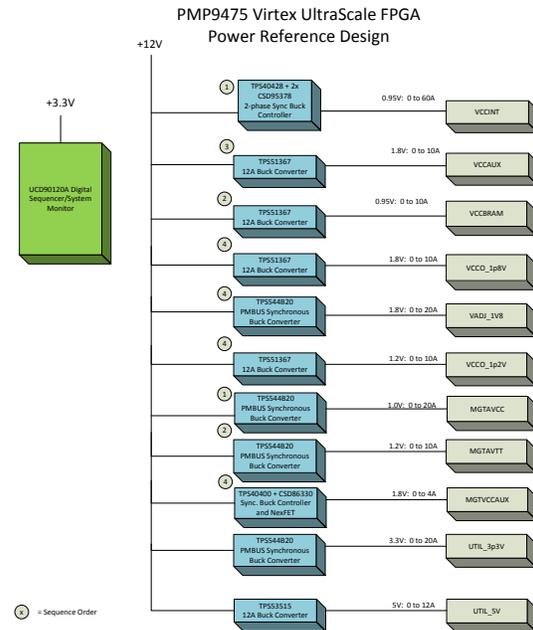
Design Features

- 12V Input Voltage
- Provides all the power supply rails needed to power a Xilinx Virtex UltraScale FPGA
- Power-up and power-down sequencing
- PMBUS compatible interface
- Low cost discrete IC design

Design Photo



Block Diagram



Jump start system design and speed time to market

Comprehensive designs include schematics or block diagrams, BOMs, design files and test reports by experts with deep system and product knowledge. Designs span TI's portfolio of analog, embedded processor and connectivity products and supports a board range of applications including industrial, automotive, medical, consumer, and more. To explore the designs, go to <http://www.ti.com/tidesigns>

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Associated Part Numbers

<u>Part Number</u>	<u>Part Description</u>
TPS40428	Stackable PMBus synchronous buck converter with a driverless controller. It can be configured for dual output or 2-phase operation. Input voltage ranges from 5 to 12V and can support load current up to 120A.
CSD95378BQ5M	Synchronous buck NexFET smart power stage with TAO offset. Has a continuous operating current capability of 60A.
TPS51367	Synchronous buck converter based on DCAP-2 control topology. Input voltage ranges from 3 to 22V and has an output current of 12A.
TPS544B20	Non-isolated DC-DC SWIFT converter that is PMBus compatible and capable of high-frequency operation. Input voltage ranges from 4.5 to 18V and has an output current of 20A.
TPS40400	Synchronous buck controller that operates from a nominal 3 to 20V supply. It is an analog PWM controller that allows programming and monitoring via the PMBus interface.
CSD86330Q3D	Synchronous buck NexFET power block MOSFET pair designed for applications offering high current, efficiency, and frequency capability with a 5V gate drive.
TPS53515	Synchronous buck SWIFT converter. Input voltage ranges from 1.5 to 18V and has a continuous output current of 12A.
UCD90120A	12-rail PMBus/I2C addressable power-supply sequencer and monitor with ACPI support.
INA333	Low power, precision instrumentation amplifier with excellent accuracy.

Design Considerations:

The design goal is to provide a full solution to power a Xilinx Virtex UltraScale FPGA; including core, transceiver, auxiliary, and I/O power. The design must also provide power up and power down sequencing, voltage and current monitoring, and voltage margining through a PMBus interface.

Core Supply –

The core supply required 0.95V at 60A. The TPS40428 two phase driverless controller was used with 2xCSD95378 NexFET smart power stages. A 2 phase design was used to reduce the output voltage ripple and keep the power dissipation manageable without an external heat sink. A PMBus interface allowed telemetry functions such as voltage and current reporting as well as flexibility with voltage margining.



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Transceiver Power Supplies –

The transceiver supplies were designed with low output noise in mind, limiting the voltage ripple to <10mV. MGTAVCC required 1.0V at 20A, MGTAVTT required 1.2V at 10A, and MGTVCCAUX required 1.8V at 4A. TPS544B20 was chosen for MGTAVCC and MGTAVTT since it's a 20A integrated MOSFET step down converter with internal current sense. This eliminated the need to use an external sense resistor to monitor current which in turn reduces loss since the resistor is not there to dissipate extra power. TPS40400 controller along with a CSD86330 MOSFET was chosen for MGTVCCAUX since it provides all the necessary PMBUS telemetry and can meet all the necessary specifications along with providing a lower cost. An external sense resistor is still needed with this option but since it's only running 4A, the losses are much smaller than the other two rails.

I/O Power Supplies –

A combination of TPS544B20, TPS51367, and TPS53315 were used to provide the remaining power supply rails for this system. These ICs feature integrated MOSFETs and require minimal external components. These power supply rails were designed to keep output ripple at a minimum and DC & AC errors <3%.

Telemetry, Sequencing, and Margining –

A UCD90120A system health monitor is used to provide flexible power up and down sequencing, voltage monitoring, current reporting, and voltage margining for the entire set of power supply rails. This device is interfaced through PMBus to TI's Digital Fusion GUI to allow for easy configuration.



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