Technical Article

How to Select the Right Power Solution for Your FPGA or PMIC

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Given their high performance and integration capabilities, several data center and industrial applications use Xilinx® Ultrascale™ and Ultrascale+ field-programmable gate arrays (FPGAs), including enterprise switches, server FPGA accelerator cards, test and measurement, and space and defense.

Knowing the Xilinx FPGA power specifications for a particular Ultrascale+ FPGA family – Zynq multiprocessor system-on-chip (MPSoC), Virtex, Kintex – requires downloading and using the Xilinx Power Estimator (XPE), as shown in Figure 1.

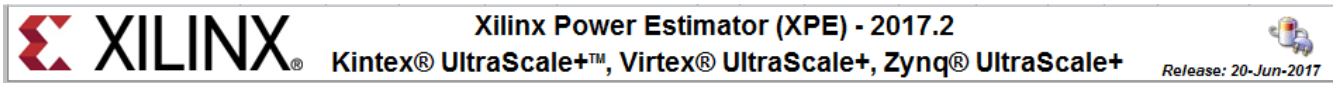

Figure 1. XPE Tool Header

Once on the XPE site, you'll select the settings that correspond to your device family (Zynq Ultrascale+, for example), device part number (such as the XCZU9EG), speed grade, temperature grade and environment (including board size and layers). You'll then complete the power profile by selecting the clock, logic, input/output (I/O), RAM, digital signal processor (DSP) and transceiver options.

TI has done the pre-work and created a spreadsheet with all Xilinx Ultrascale+ Family variants, their corresponding part numbers, rail names, loading options (choices of clock/logic/I/O, RAM, DSP and transceiver) and voltage and current specifications, as shown in Figure 2.

XCVU9P		XCVU11P		XCVU13P	
V_{CCINT}	low (14.779A)	V_{CCINT}	low (16.447A)	V_{CCINT}	low (22.728A)
Output Voltage: 0.720	med (28.801A	Output Voltage: 0.720	med (32.320A	Output Voltage: 0.720	med (46.871A
Max Load: 49.389A	high (49.389A	Max Load: 56.643A	high (56.643A	Max Load: 91.441A	high (91.441A
V_{CCINT_IO}	low (0.419A)	V_{CCINT_IO}	low (0.245A)	V_{CCINT_IO}	low (0.296A)
Output Voltage: 0.850	med (0.460A)	Output Voltage: 0.850	med (0.266A)	Output Voltage: 0.850	med (0.358A)
Max Load: 0.569A	high (0.569A)	Max Load: 0.328A	high (0.328A)	Max Load: 0.562A	high (0.562A)
V_{CCBRAM}	low (0.082A)	V_{CCBRAM}	low (0.079A)	V_{CCBRAM}	low (0.118A)
Output Voltage: 0.850	med (0.155A)	Output Voltage: 0.850	med (0.153A)	Output Voltage: 0.850	med (0.248A)
Max Load: 0.281A	high (0.281A)	Max Load: 0.289A	high (0.289A)	Max Load: 0.544A	high (0.544A)
V_{CCAUX}	low (0.714A)	V_{CCAUX}	low (0.725A)	V_{CCAUX}	low (0.932A)
Output Voltage: 1.800	med (0.727A)	Output Voltage: 1.800	med (0.754A)	Output Voltage: 1.800	med (1.187A)
Max Load: 0.924A	high (0.924A)	Max Load: 1.099A	high (1.099A)	Max Load: 2.557A	high (2.557A)
V_{CCAUX_IO}	low (0.279A)	V_{CCAUX_IO}	low (0.172A)	V_{CCAUX_IO}	low (0.198A)
Output Voltage: 1.800	med (0.279A)	Output Voltage: 1.800	med (0.172A)	Output Voltage: 1.800	med (0.199A)
Max Load: 0.280A	high (0.280A)	Max Load: 0.173A	high (0.173A)	Max Load: 0.200A	high (0.200A)
$V_{CCO\ 1.5V}$	low (0.335A)	$V_{CCO\ 1.5V}$	low (0.335A)	$V_{CCO\ 1.5V}$	low (0.335A)
Output Voltage: 1.500	med (0.335A)	Output Voltage: 1.500	med (0.335A)	Output Voltage: 1.500	med (0.335A)
Max Load:0.335A	high (0.335A)	Max Load:0.335A	high (0.335A)	Max Load:0.335A	high (0.335A)
V_{CCADC}	low (0.024A)	V_{CCADC}	low (0.024A)	V_{CCADC}	low (0.032A)
Output Voltage: 1.800	med (0.024A)	Output Voltage: 1.800	med (0.024A)	Output Voltage: 1.800	med (0.032A)
Max Load: 0.024A	high (0.024A)	Max Load: 0.024A	high (0.024A)	Max Load: 0.032A	high (0.032A)

Figure 2. Xilinx Ultrascale+ Device Number Power Specs

These detailed power specifications for every Xilinx Ultrascale+ FPGA family, device number and loading type (low/medium/high) will soon be represented in TI's Xilinx FPGA power selection portal , as shown in Figure 3. Xilinx Ultrascale FPGAs and TI's power solutions are already represented in this portal.

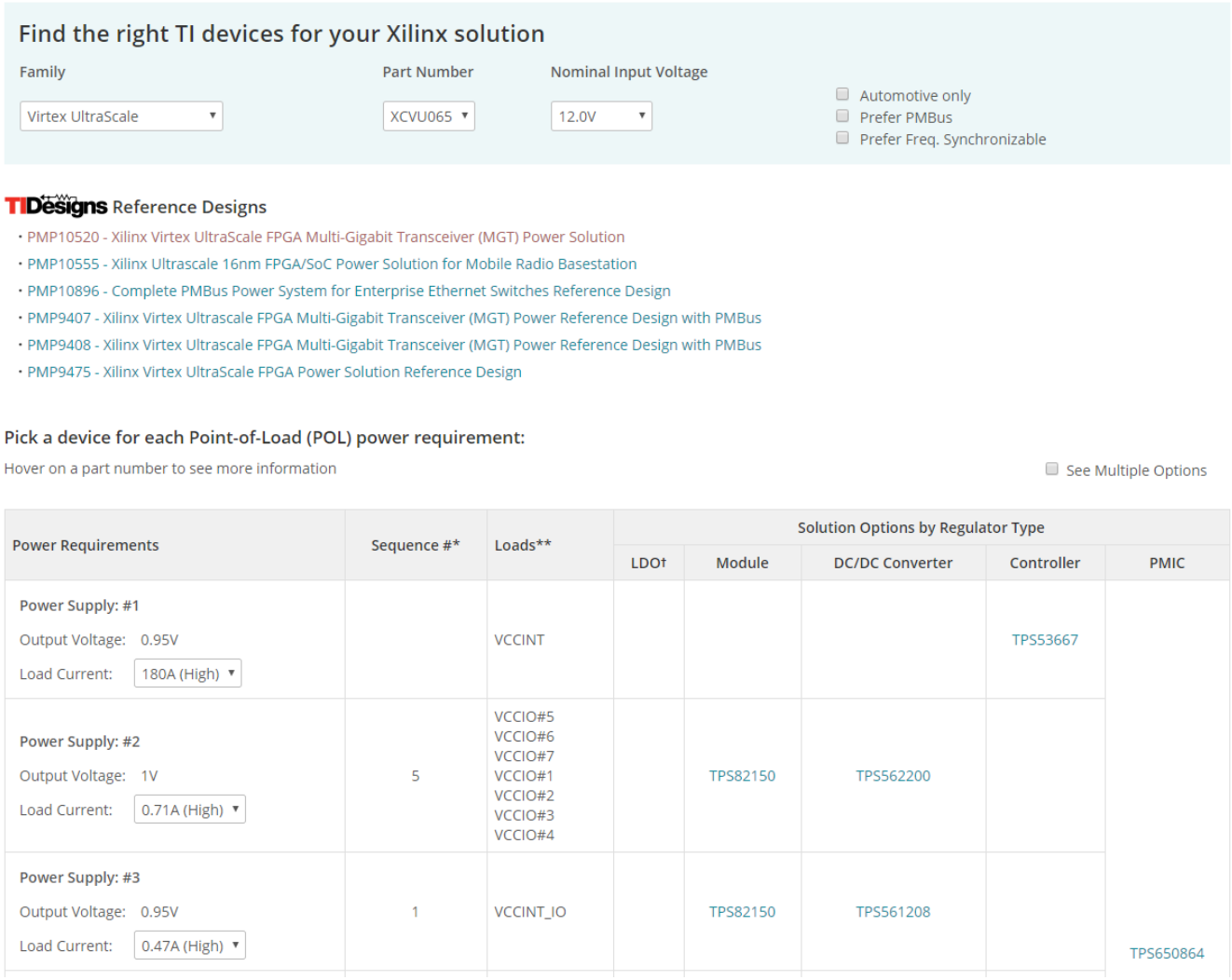

Figure 3. TI's Xilinx FPGA Power Solution Selection Portal

As you can see in Figure 3, depending on the loading (low, medium, high), the power solution may vary to optimize the performance/efficiency/density/cost of the specific design.Based on TI's summary of the XPE power requirements of Ultrascale+ FPGA families and the solution recommendation on TI's Xilinx power solution selection portal, you may be able to get a head start on your board design with a corresponding reference design in the TI Designs reference designs library. For example, for the Virtex Ultrascale XCVU065 medium-loading VCCINT rail 120A requirement, TI's FPGA power solution selection portal recommends the TPS53647 DCAP+™ control mode buck controller with PMBus.Figure 4 shows a 1V/120A four-phase buck from the High Efficiency, Power Density 1V/120A/30A/30A (4+1+1) with PMBus Reference Design that you can use for this requirement.

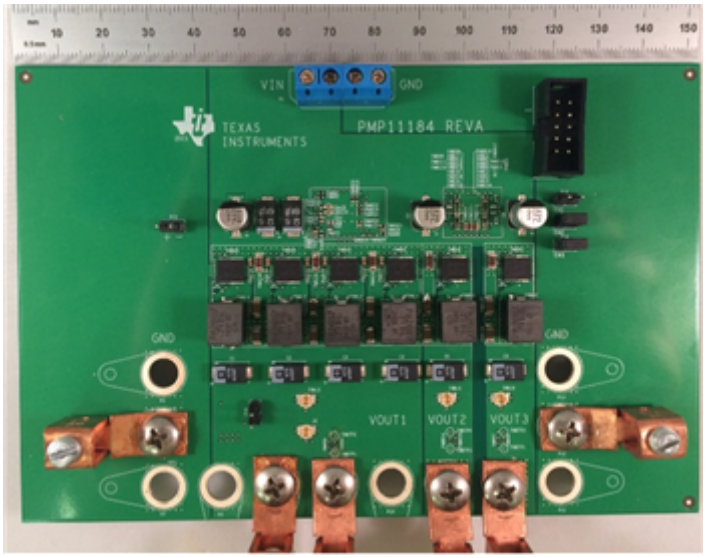

Figure 4. High Efficiency, Power Density 1V/120A/30A/30A (4+1+1) with PMBus Reference Design **A noteworthy feature of TI's FPGA power solution selection portal is that hovering over the TI device number also gives you a quick overview of the specific WEBENCH® Designer results for that Xilinx FPGA (as shown in Figure 5), making it easy for you to make a first-level decision.**

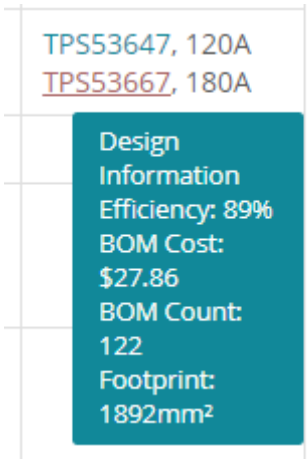

Figure 5. Quick Look at the Xilinx Virtex Ultrascale XCVU065 12V Input, VCCINT Rail, High-loading (200A) WEBENCH Designer Results

You can find and download the various Xilinx FPGA designs on the TI reference designs selection page . Type Ultrascale or Ultrascale+ in the Keyword box, get the results, and then filter for your particular FPGA or type of solution (power-management integrated circuit [PMIC], discrete buck converter/controller, multiphase buck or module), as shown in Figure 6.

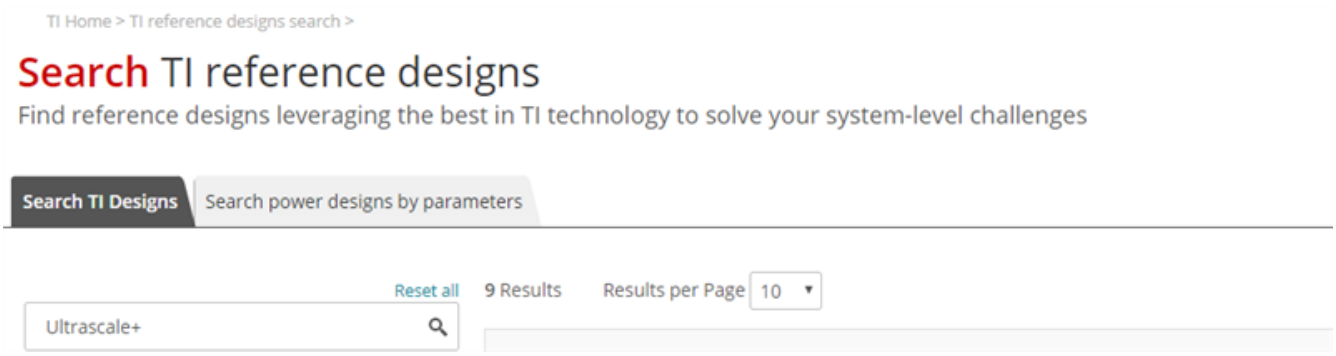

Figure 6. Finding Xilinx Ultrascale/Ultrascale+ FPGA Reference Designs on the TI Reference Designs Selection Page

You can also click the Search power designs by parameters tab and check the FPGA box. This will give you all of the available FPGA reference designs in tabular form, as shown in Figure 7, which you can filter for the Xilinx Ultrascale/Ultrascale+ reference design that you need.

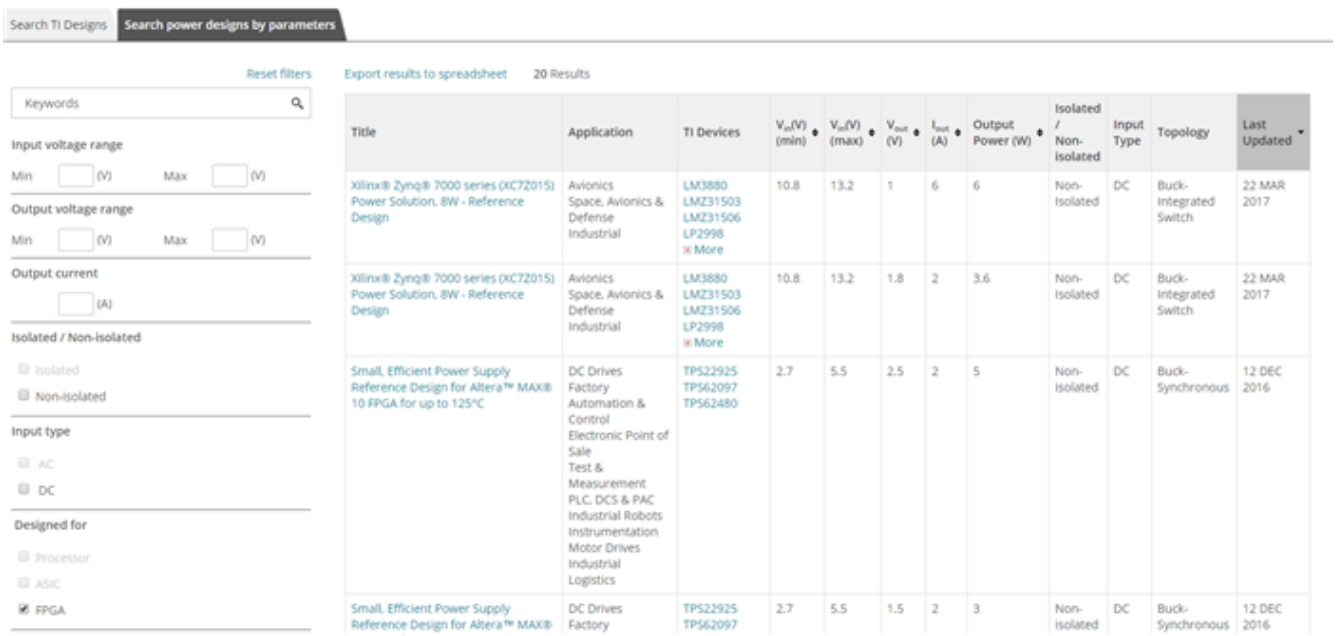

Figure 7. Finding Xilinx Ultrascale/Ultrascale+ FPGA Reference Designs on the TI Reference Designs Selection Page by Using the FPGA Filter

If you are designing with Xilinx Ultrascale/Ultrascale+ FPGAs and don't know where to start, TI has made it easy to select the power solution, find the optimal reference design from the TI Designs reference design library , and get ahead of the competition with our easy-to-use power selection and design tools.

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