PR450

Virtex™-4 Design 6

TPS75003 Power Management Solution Providing Up to 3A from V_{IN} = 5 V

FEATURES:

- Recommended only for all SX, FX100 and smaller, and LX80 and smaller Virtex-4 FPGAs with no more than 300 mA of $I_{CCAUXMIN}$ power on currents
- Flexible dual buck controller design allows for optimization of the solution for output power, size, power dissipation and/or cost

IMPORTANT WEB LINKS:

- Link to the TI home page for Xilinx FPGA power management solutions at http://www.ti.com/xilinxfpga for more information and other reference designs.
- Link to the datasheets at http://focus.ti.com/lit/ds/symlink/TPS75003.pdf
- Link to the TPS75003 design spreadsheet at http://www-s.ti.com/sc/psheets/sbvc002a/sbvc002a.zip to assist further optimization/customization of design.

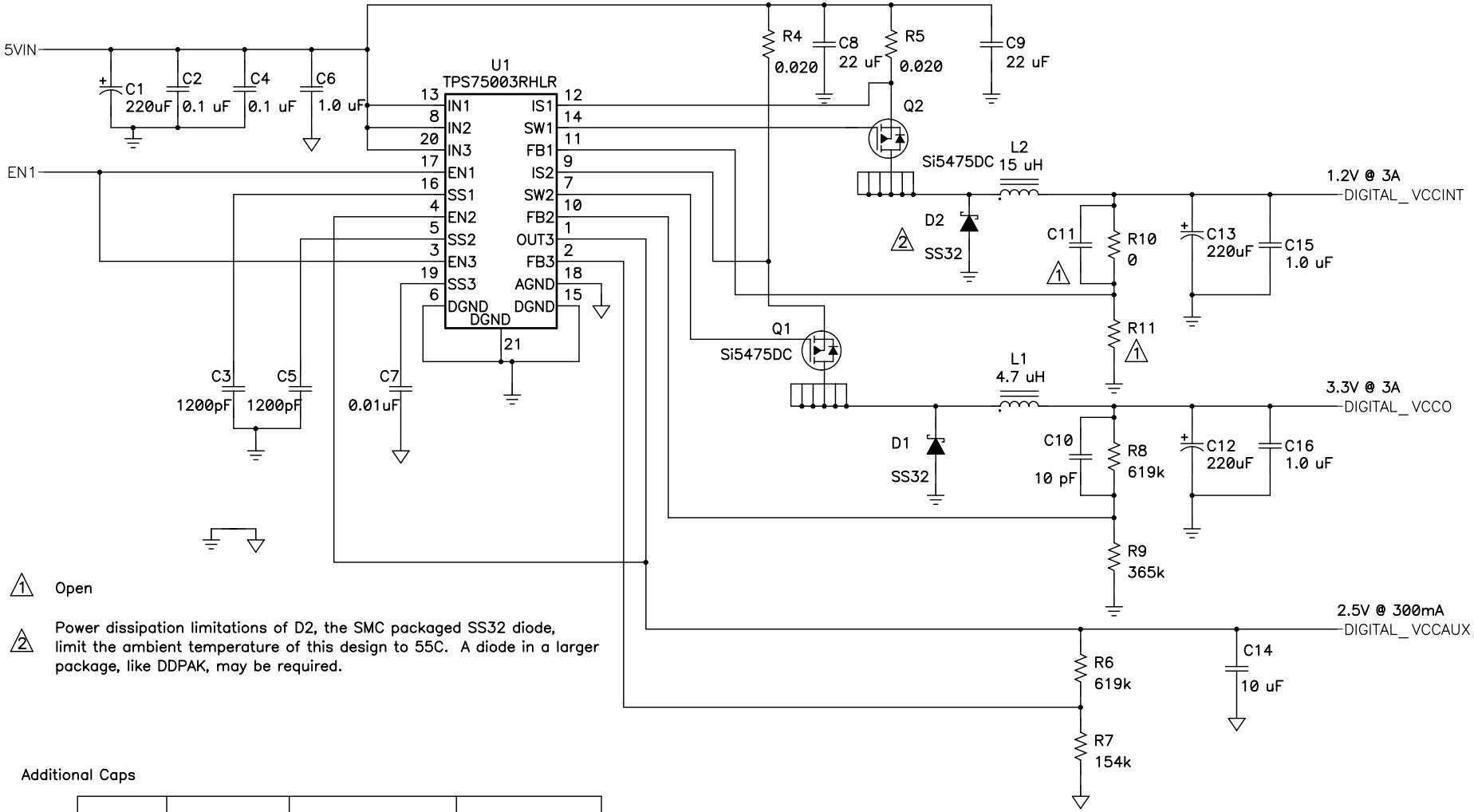
IMPLEMENTATION NOTES:

- **Thermal Considerations:** Diode D2 in the SMC package has limited power dissipation capabilities. So, this design is not recommended for ambient temperatures above 55 C without additional airflow.
- **Sequencing:** Per Xilinx DS302 v1.3, Virtex-4 power rails can be turned on in any sequence, though V_{CCAUX} must power on before or with V_{CCO} for the minimum power-on current specifications shown in the Xilinx datasheet to apply. For this reason and to reduce the risk that large currents for charging bulk capacitance forces the point of load converter into current limit and/or pulls down the input supply at power up, the following recommended design techniques were used:
  - Integrated soft-start configured with a capacitor to provide a current controlled, monotonic rise time for V_{CCINT}, V_{CCAUX} and V_{CCO}
  - Starting V_{CCINT} and V_{CCAUX} simultaneously then starting V_{CCO} using the ENABLE pins of the TPS75003
- **Additional Capacitance:** The TPS75003 buck controller outputs use a current controlled soft start, thus the soft start timing is dependent on the startup load current. If the amount of bulk capacitance changes from the values in the table below, the startup load current may increase and so the soft-start timing may need to change to ensure monotonic startup of the voltage rails.

Capacitor (uF)	V_{CCO} QTY	V_{CCAUX} QTY	V_{CCINT} QTY
0.047	51	14	38
0.22	39	7	19
0.68	15	4	10
2.2	15	3	7
330 (0.15 Ω ESR)	15	1	3

QUESTIONS?

- Send an email to mailto:**fpgasupport@list.ti.com**



1 Open

2 Power dissipation limitations of D2, the SMC packaged SS32 diode, limit the ambient temperature of this design to 55C. A diode in a larger package, like DDPAK, may be required.

Additional Caps

VALUE	DIGITAL_VCCO QTY	DIGITAL_VCCAUX QTY	DIGITAL_VCCINT QTY
0.047 uF	51	14	38
0.22 uF	39	7	19
0.68 uF	15	4	10
2.2 uF	15	3	7
330 uF	15	1	3

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PR450 BOM

COUNT	RefDes	Description	Size	Part Number	MFR
1	C1	Capacitor, POSCAP, 220-uF, 6.3-V, 40-milliohm, 20%	7343(D)	6TPB220ML	Sanyo
1	C10	Capacitor, Ceramic, 10-pF, 50-V, C0G, 5%	0603	C1608C0G1H100D	TDK
0	C11	Capacitor, Ceramic, xx-uF, xx-V	0603		
2	C12, C13	Capacitor, POSCAP, 220-uF, 4-V, 55-milliohm, 20%	7343(D)	4TPB220ML	Sanyo
1	C14	Capacitor, Ceramic, 10-uF, 10-V, X5R, 20%	0805	C2012X5R1A106MT	TDK
2	C2, C4	Capacitor, Ceramic, 0.1-uF, 16-V, X7R, 10%	0603	C1608X7R1C104K	TDK
2	C3, C5	Capacitor, Ceramic, 1200-pF, 50-V, X7R, 10%	0603	C1608X7R1H122K	TDK
3	C6, C15, C16	Capacitor, Ceramic, 1.0-uF, 6.3-V, X5R, 10%	0603	C1608X5R0J105K	TDK
1	C7	Capacitor, Ceramic, 0.01-uF, 50-V, X7R, 10%	0603	C1608X7R1H103K	TDK
2	C8, C9	Capacitor, Ceramic, 22-uF, 6.3-V, X5R, 20%	0805	C2012X5R0J226MT	TDK
2	D1, D2	Diode, Schottky, 3.0-A, 20-V	SMC	SS32	Vishay
1	L1	Inductor, SMT, 4.7-uH, 4.6-A, 2.9-milliohm	0.327 X 0.327	CDRH8D38-4R7	Sumida
1	L2	Inductor, SMT, 15-uH, 4.5-A, 27-milliohm	0.472 sq	CDRH127-150	Sumida
2	Q1, Q2	MOSFET, P-ch, -12V,-7.6-A, 31-milliohm	1206-8	Si5475DC	Vishay
1	R10	Resistor, Chip, 0-Ohms, 1/16W, 5%	0603	Std	Std
0	R11	Resistor, Chip, xx-Ohms, 1/16-W, 1%	0603		
2	R4, R5	Resistor, Chip, 0.020-Ohms, ¼ W, 1%	1210	Std	Std
2	R6, R8	Resistor, Chip, 619k-Ohms, 1/16-W, 1%	0603	Std	Std
1	R7	Resistor, Chip, 154k-Ohms, 1/16-W, 1%	0603	Std	Std
1	R9	Resistor, Chip, 365k-Ohms, 1/16-W, 1%	0603	Std	Std
1	U1	IC, Triple Channel DC/DC Converter	QFN-20	TPS75003RHLR	TI

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