

PR211
Spartan™-II Design 3
TPS64203 Switching DC/DC Controller-Based Power Management Solution Providing
up to 3 A from $V_{IN} = 5.0\text{ V}$ or 3.3 V

FEATURES:

- Tiny SOT-23 switching DC/DC controller, U2, delivers up to 3 A at low cost.
- Easily customizable design allows for maximum cost control by:
 - o Sizing Q1 for the amount of current up to 3 A to meet the application's I_{CCINT} requirement,
 - o Omitting current sense resistor R1 and connecting ISNS to the drain of Q1,
 - o Selecting the linear regulator from the TPS79xxx family to meet the application's I_{CCO} requirement.
- In-rush current (for charging decoupling capacitors and FPGA start-up) that places a demand on the input power supply is minimized by the use of the:
 - o External supervisory (SVS) IC, U1, which monitors the input rail and prevents the regulator from enabling until the input bulk capacitors (not shown in the schematic) are fully charged.
 - o Integrated soft-start of U2.
 - o Sequential sequencing of V_{CCINT} then V_{CCO} using V_{CCINT} to enable the V_{CCO} regulator, U3.
- The design meets Xilinx's V_{CCINT} and V_{CCO} start-up profile requirements, where applicable, including monotonic voltage ramp, in-rush current and power voltage ramp time requirements.

IMPORTANT WEB LINKS:

- Link to the TI home page for Xilinx FPGA power management solutions at <http://www.ti.com/xilinuxfpga> for more information and other reference designs.
- Link to datasheets at <http://focus.ti.com/lit/ds/symlink/tps64203.pdf>, <http://focus.ti.com/lit/ds/symlink/tps78601.pdf>, and <http://focus.ti.com/lit/ds/symlink/tlc7705.pdf>.
- Link to application note SLVA118 <http://focus.ti.com/lit/an/slva118/slva118.pdf> to explore the thermal considerations in using linear regulators.
- Link to application note SLVA160 <http://focus.ti.com/lit/an/slva160/slva160.pdf> for guidance on selecting a different option from the TPS642xx family.

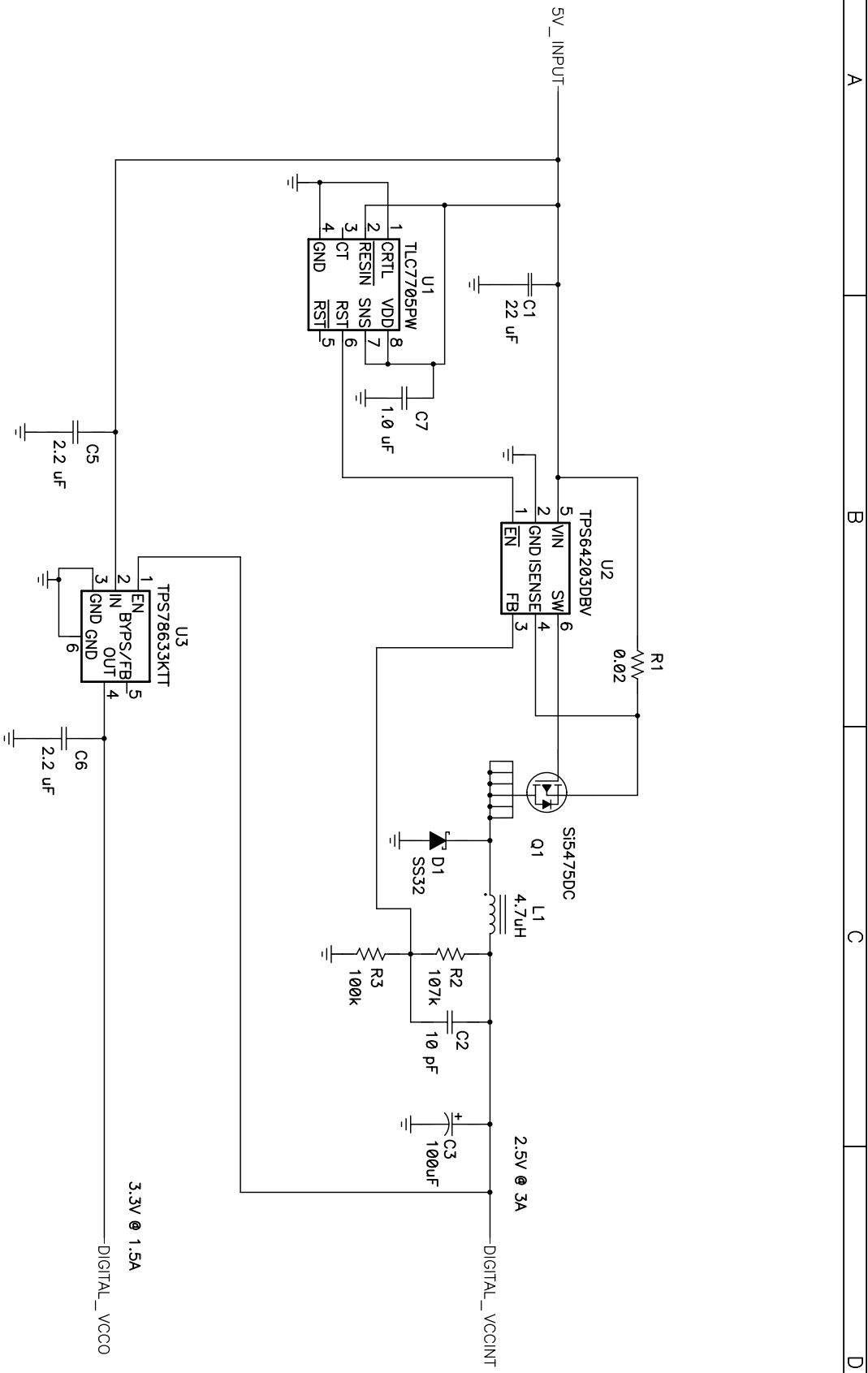
IMPLEMENTATION NOTES:

- **Sequencing:** Although Xilinx FPGAs **do NOT require it**, this reference design employs sequencing. This practice is consistent with good power supply design and prevents the input power supply from being pulled down due to supporting in-rush currents for charging large capacitive loads.

- **I_{CCINT} inrush current:** Mitigated by softstart.
- **Power Dissipation/Thermal Issues:** Refer to the application section of the linear regulator datasheet for maximum power dissipation at different ambient conditions as well as guidance on sizing the ground plane area underneath the package for heatsinking.
- **Designing with the TPS64203:**
 - o The TPS64203 controller has limited current to drive the gate of the PMOS transistor, Q1. To ensure proper operation of the controller, a PMOS transistor with a maximum total gate charge, Q_g, of less than 50 nC is required.
 - o Omitting current sense resistor R1 and connecting ISNS to the drain of Q1, thereby using the R_{DSon} of Q1 as the current sense, results in an effective, but slightly less accurate, current limit function.
- **Layout:** The 1.0 uF capacitor, C7, should be placed as close as possible between VDD and GND of the TLC77xx SVS IC.
- **Modifications:**
 - o CT of TLC7705 is not connected, but can be used with a capacitor to add a delay between the 5 V rail coming up and RST = /EN of TPS64203.
 - o Adapt for 3.3V supply by:
 - Omitting U3 circuit,
 - Replacing TLC7705 with TLC7733.
 - o For a low-cost, discrete Supply Voltage Supervisory Circuit alternative to U1, please see reference design PR286 (Active-High Reset Output) or PR281 (Active-Low Reset Output).

QUESTIONS?

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



Title			
Spartan-II Controller			
Size	Number	Rev	
B	PR211		
Date	8/19/04	Drawn by	
Filename	pr211.sch	Sheet	of

Filename: PR211_bom.xls					
Date: 08/19/2004					
		PR211 BOM			
COUNT	RefDes	DESCRIPTION	SIZE	MFR	PART NUMBER
1	C1	Capacitor, Ceramic, 22-uF, 10-V, X5R, 10%	1210	muRata	GRM32ER61A226KA65
1	C2	Capacitor, Ceramic, 10-pF, 50-V, C0G, +/- 5pF	603	TDK	C1608C0G1H100D
1	C3	Capacitor, Tantalum, 100-uF, 10-V, 80-milliohm, 20%	7343 (D)	Vishay	593D107X0010D2T35
2	C5, C6	Capacitor, Ceramic, 2.2-uF, 6.3-V, X5R, 10%	805	muRata	GRM21BR60J225KC01
1	C7	Capacitor, Ceramic, 1.0-uF, 6.3-V, X5R, 10%	603	muRata	GRM188R60J105KA01
1	D1	Diode, Schottky Barrier Rectifier, 3-A, 20-V	SMC	Vishay	SS32
1	L1	Inductor, High Current, SMT, 4.7-uH, 5.4-A, 18-milliohm	0.510 x 0.370	Vishay	IDC-5020NB4R7M
1	Q1	MOSFET, P-ch, 20V,4.8-A, 76-milliohm	1206-8	Siliconix	Si5475DC
1	R1	Resistor, Chip, 0.02-Ohms, 1/4-W, 1%	1210	Std	Std
1	R2	Resistor, Chip, 107k-Ohms, 1/16-W, 1%	603	Std	Std
1	R3	Resistor, Chip, 100k-Ohms, 1/16-W, 1%	603	Std	Std
1	U1	IC, Voltage Supervisor, Micropower	35630	TI	TLC7705PW
1	U2	IC, Step-Down Controller	SOT23-6	TI	TPS64203DBV
1	U3	IC, Ultra Low-Noise, High PSRR, Fast RF 1.5A LDO Linear Regulator	DDPAK-5	TI	TPS78633KTT

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