PR412
TMS320x281x Design 1
TPS736XX with optional TPS2051B switch from V_{IN} = 3.3V

FEATURES:

- Meets the sequencing requirements (Option 2) of the TMS320F281x processor. Can be simplified to power the TMS320C281x and TMS320R281x.
- Optional TPS2051B switch provides control of the timing between I/O rail up and core rail up
- Single-channel TPS736xx low-dropout (LDO) linear regulator, with inherent soft start, provides the core rail with high accuracy
- TPS3803-01 adjustable supervisory (SVS) IC is used to:
  - monitor the V_{DD} = 3.3 V I/O rail
  - sequence first the I/O rail then the core rail.
- TPS3808G01 adjustable SVS IC is used to:
  - monitor of the I/O rail
  - provide open drain /RESET with programmable delay set with a capacitor on the CT pin.
- The Q1 versions of the TPS3803-01 operates up to T_A = 125 C and is automotive qualified. The TPS3808G01 operates up to T_A = 125 C. Q1 versions of the TPS3808G01 and TPS736xxDCQ that are automotive qualified will be available in early 2005.
- The current draw on the input power supply is minimized by sequencing first the I/O rail then the core rail.

IMPORTANT WEB LINKS:

- Link to the TI power management home page at http://power.ti.com then select the TI DSP Solutions link for more information and other reference designs.
- Link to datasheets at http://focus.ti.com/lit/ds/symlink/tps73601.pdf, http://focus.ti.com/lit/ds/symlink/tps3803-01-q1.pdf and http://focus.ti.com/lit/ds/symlink/tps3808g01.pdf .
- Link to application note SLVA118 http://focus.ti.com/lit/an/slva118/slva118.pdf to explore the thermal considerations in using linear regulators.

IMPLEMENTATION NOTES:

- **Component selection:**
  - If different capacitors are used for C4 and C5 than recommended per the BOM, they must meet the ESR requirements per the datasheet.
- **Power Dissipation/Thermal Issues:**

- The maximum output current of the regulator is dependent on the device's power dissipation. The following equation can be used to compute actual power dissipation and/or maximum output current for the linear regulator:

  $P_{Dact} = (V_{IN} - V_{DD\text{-}CORE})*I_{Vdd\text{-}core}$

  For example, the IC can only dissipate 1.25Wat $T_A = 85^o$ C and no airflow.
- The maximum power dissipation of which the package is capable is

  $$P_{Dmax} = (T_{Jmax} - T_A)/R_{\Theta JA}$$

  where T_{Jmax} is the maximum junction temperature of the device and $R_{\Theta JA}$ is the thermal resistance for a given board type and set of ambient conditions.
- Refer to the application section of the datasheet for thermal resistances at different ambient temperatures, airflows and ground plane heatsink area.

- **Modifications**
  - **/RESET delay:** Adjustable with capacitor C8.
  - **For C281x and R281x DSPs:** Since sequencing is not required for the TMS320C281x or the TMS320R281x, power switch U1 can be omitted. However, the controlled sequencing and soft-start that the power switch provides is still recommended since both help to prevent the input power supply from being pulled down at start-up due to in-rush currents for charging each rail's bulk capacitors.
- **Waveforms:**

  Waveforms were generated while powering an ezDSP TMS320F2812 evaluation board and with the 1.8-V rail pulling 200 mA and the 3.3-V rail pulling 175 mA steady state.

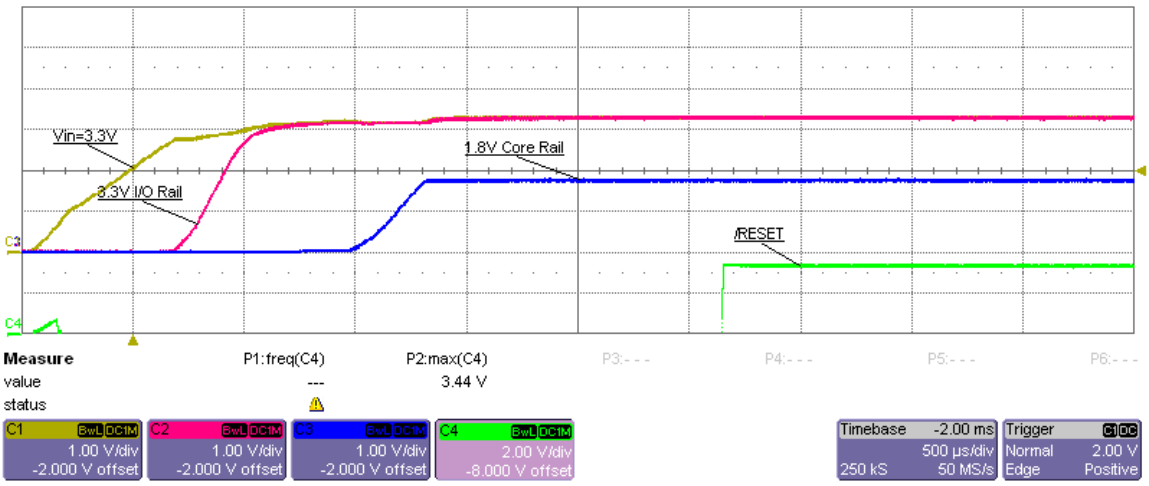


Figure 1 - Power up with V_{IN} = 5.0 V, /EN grounded

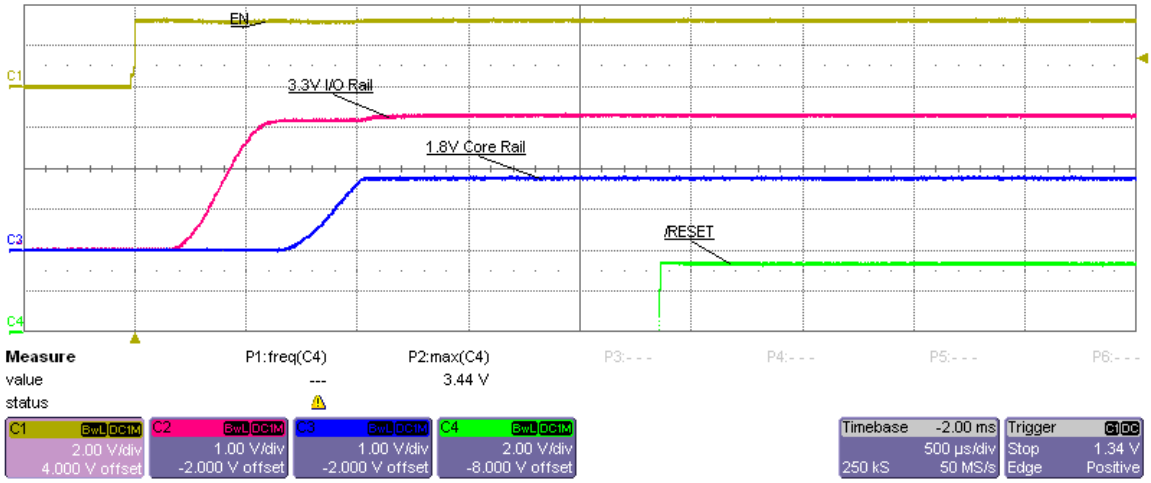


Figure 2 - Power up from enable when V_{IN} = 5.0 V

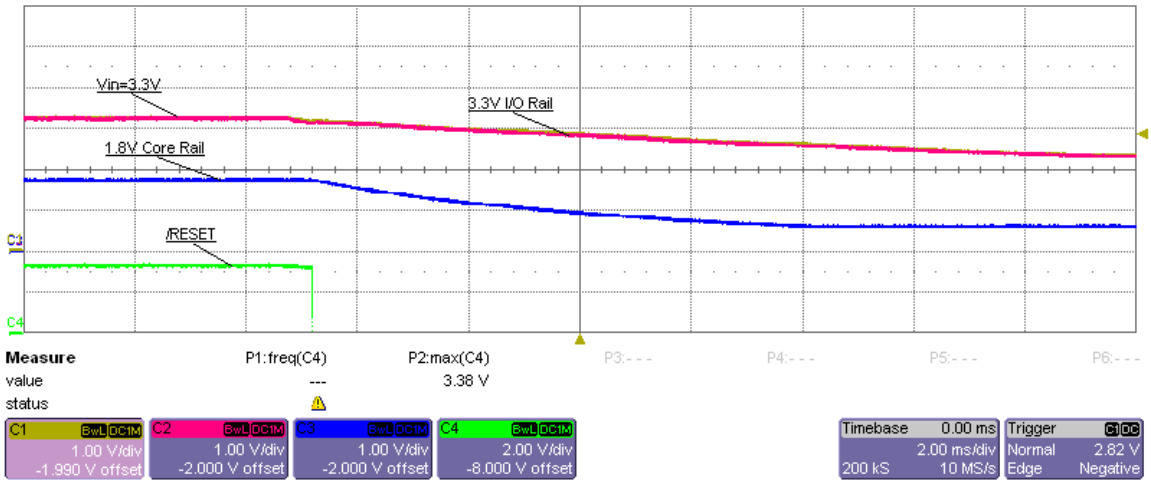


Figure 3 - Power down with V_{IN} = 5.0 V, /EN grounded

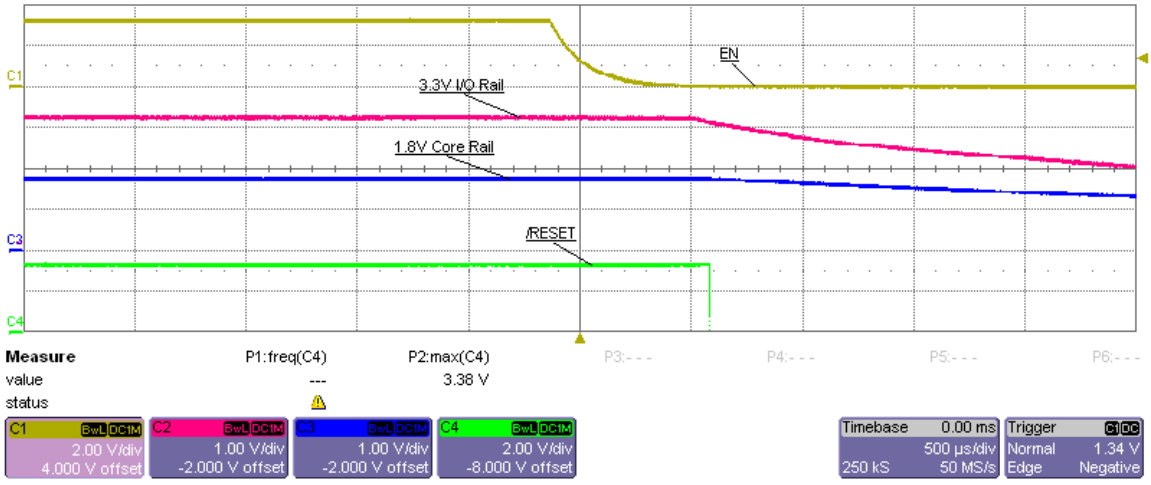


Figure 4 - Power down from enable when V_{IN} = 5.0 V

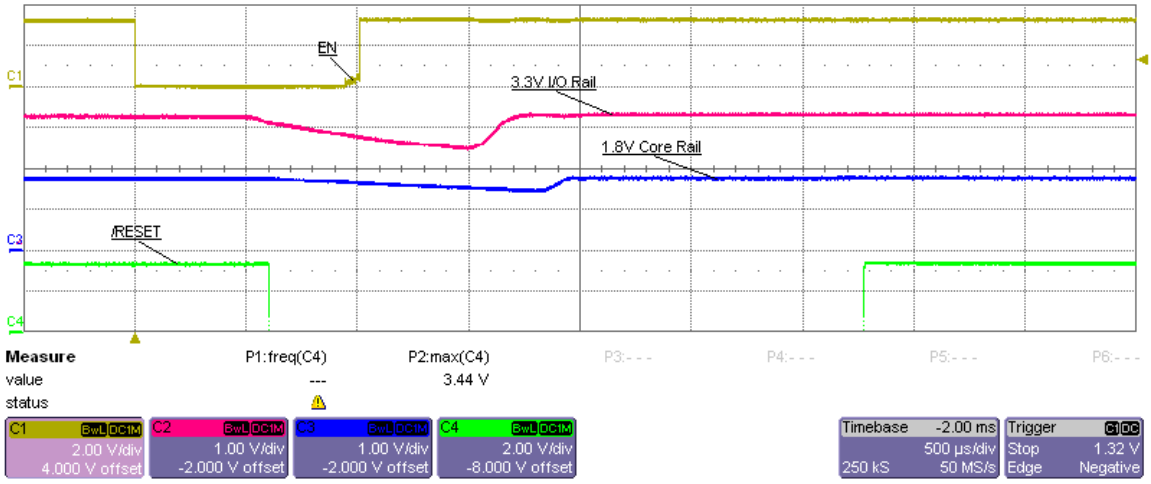


Figure 5 - RESET and recovery after V_{DD} = 3.3V fails

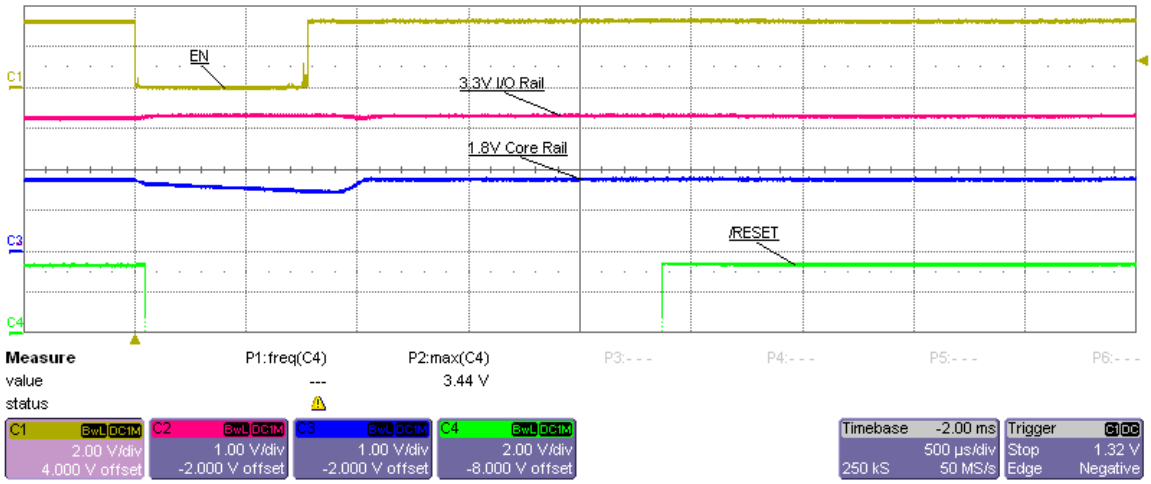
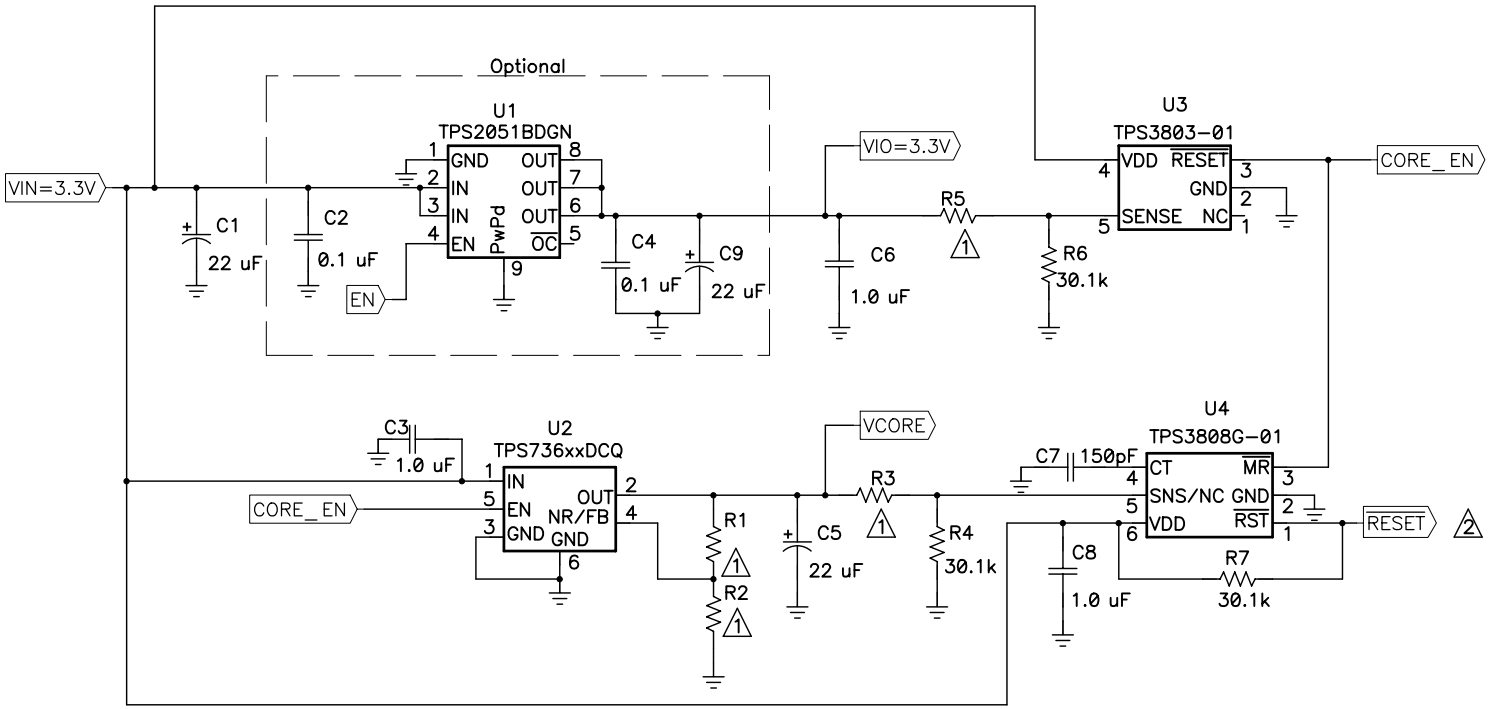


Figure 6 - RESET and recovery after V_{DD} = 1.8V fails

QUESTIONS?

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



1	VDD_CORE	U2	R1	R2	VDD_CORE TOL	R3	U4–3808 SVS TOL	R5	U3–3803 SVS TOL
	1.8V	TPS73618	Open	Open	1.78–1.82	97.6k	1.67–1.77	47.5k	3.09–3.23
	1.9V	TPS73601	31.6k	54.9k	1.86–1.93	104k	1.75–1.85		

2 /RESET on the TPS3808 has an open drain output and requires an external pullup resistor (R7 on this design).

Title	TMS320x281x DSP Attach Design 3 – for Vin=3.3V	
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Filename: PR412_bom.xls

Date: 1/11/2005

PR412 BOM

COUNT						
-001	-002	RefDes	DESCRIPTION	SIZE	Part Number	MFR
3	3	C1, C5, C9	Capacitor, Tantalum, 22-uF, 6.3-V, 570-milliohm, 20%	B Case	595D226X96R3B2	Vishay
2	2	C2, C4	Capacitor, Ceramic, 0.1-uF, 50-V, X7R, 10%	0603	C1608X7R1H104K	TDK
3	3	C3, C6, C8	Capacitor, Ceramic, 1.0-uF, 16-V, X7R, 10%	0603	C1608X7R1C105K	TDK
1	1	C7	Capacitor, Ceramic, 150-pF, 50-V, C0G, 5%	0603	C1608C0G1H151J	TDK
0	0	R1	Resistor, Chip, xx-Ohms, 1/16-W, 1%	0603		
0	1		Resistor, Chip, 31.6k-Ohms, 1/16-W, 1%	0603	Std	Std
0	0	R2	Resistor, Chip, xx-Ohms, 1/16-W, 1%	0603		
0	1		Resistor, Chip, 54.9k-Ohms, 1/16-W, 1%	0603	Std	Std
1	0	R3	Resistor, Chip, 97.6k-Ohms, 1/16-W, 1%	0603	Std	Std
0	1		Resistor, Chip, 104k-Ohms, 1/16-W, 1%	0603	Std	Std
3	3	R4, R6, R7	Resistor, Chip, 30.1k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	R5	Resistor, Chip, 47.5k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	U1	IC,Current-Limited Power -Distribution Switches, 2.7-5.5V, 500mA	DGN-8	TPS2051BDGN	TI
1	0	U2	IC, Cap-Free NMOS, 400mA LDO Regulator With Reverse Current Protection	SOT223-6	TPS73618DCQ	TI
0	1		IC, Cap-Free NMOS, 400mA LDO Regulator With Reverse Current Protection	SOT223-6	TPS73601DCQ	TI
1	1	U3	IC, Voltage Supervisor, 3.3-Volts,	SOP-5 (DCK)	TPS3803-01DCK	TI
1	1	U4	IC, Low Quiescent Current Programmable, Adj-V, Delay Time 1ms to10s	SOT23-6	TPS3808G-01	TI

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Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265