PR410
TMS320x281x Design 1
TPS767D3XX with precise SVS trip points

FEATURES:

- Meets the sequencing requirements (Option 2) of the TMS320F281x processor. Can be simplified to power the TMS320C281x and TMS320R281x.
- Dual-channel TPS767D318 low-dropout (LDO) linear regulator in thermally enhanced PowerPAD^{TM} package saves cost and space.
- TPS3803-01 adjustable supervisory (SVS) IC is used to provide:
  - more precise monitoring of the V_{DD} = 3.3 V I/O rail than the internal SVS's of the TPS767D3XX can provide.
  - sequencing of first the I/O rail then the core rail.
- TPS3808G01 adjustable SVS IC is used to provide:
  - more precise monitoring of the I/O rail than the internal SVS's of the TPS767D3XX can provide
  - open drain /RESET with programmable delay set with a capacitor on the CT pin
- The Q1 versions of the TPS3803-01 and TPS767D3XX operate up to T_A = 125 C and are automotive qualified. The TPS3808G01 operates up to T_A = 125 C. A Q1 version of the TPS3808G01 that is automotive qualified will be available in early 2005.
- Linear regulators start-up fast, allowing large in-rush currents for charging bulk capacitors at start-up. 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/tps767d301-q1.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:**
  - 0.5% tolerance or better resistors are required to provide the precise SVS trip points listed on the schematic
  - 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 per channel of the dual 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 per channel:

    $P_{Dact} = (V_{IN} - V_{DD\text{-}3.3V}) * I_{Vdd\text{-}3.3V} + (V_{IN} - V_{DD\text{-}CORE})*I_{Vdd\text{-}core}$

    For example, the IC can only dissipate 1.25W at $T_A = 85^o$ 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, transistor Q1 and resistors R1 and R2 can be omitted and both /EN1 and /EN2 can be tied together, thereby allowing both regulators to be enabled at the same time and removing power rail sequencing. However, sequencing is still recommended since it helps 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.

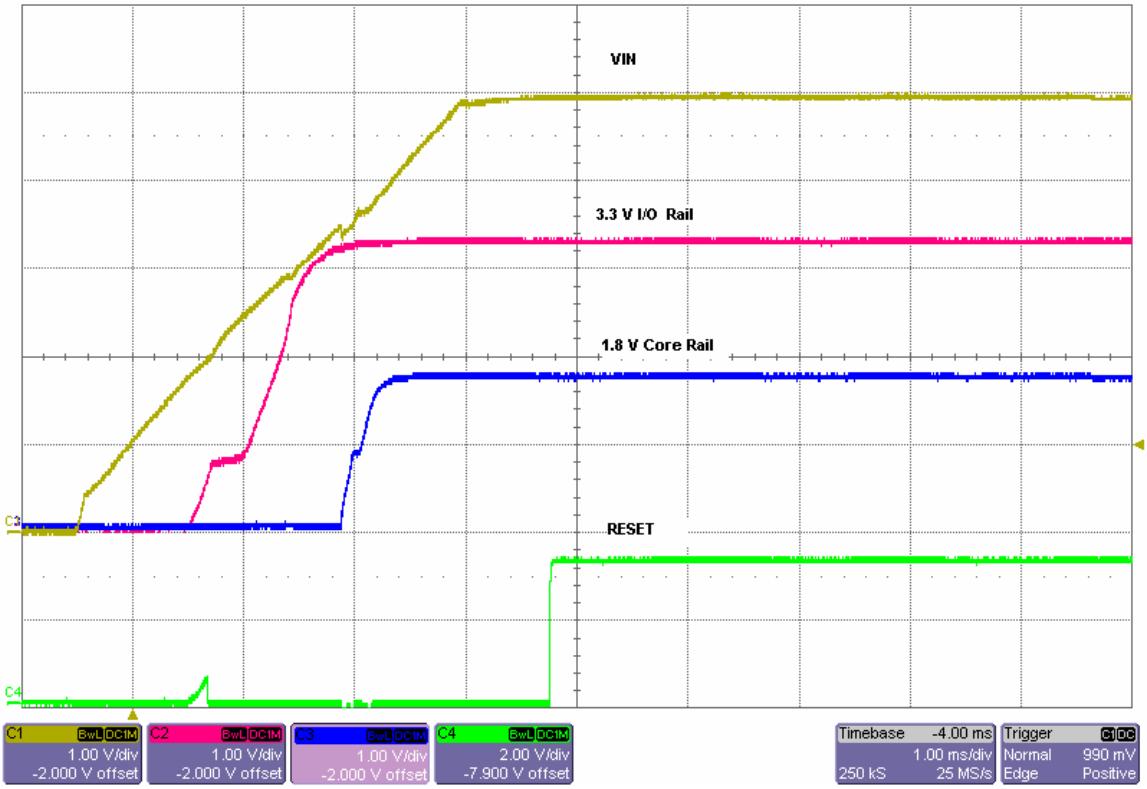


Figure 1 - Power up with V_{IN} = 5.0 V, /EN grounded

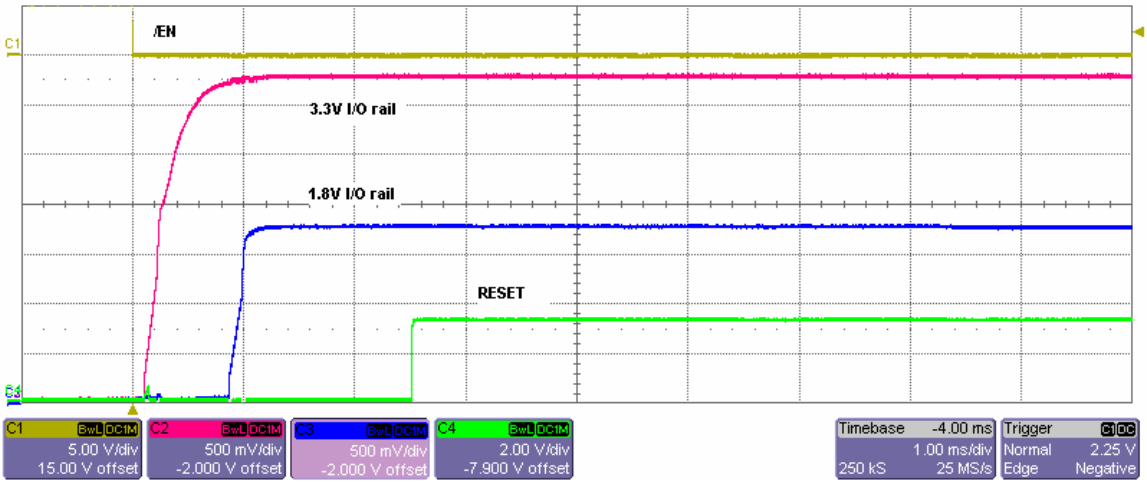


Figure 2 - Power up from enable when V_{IN} = 5.0 V

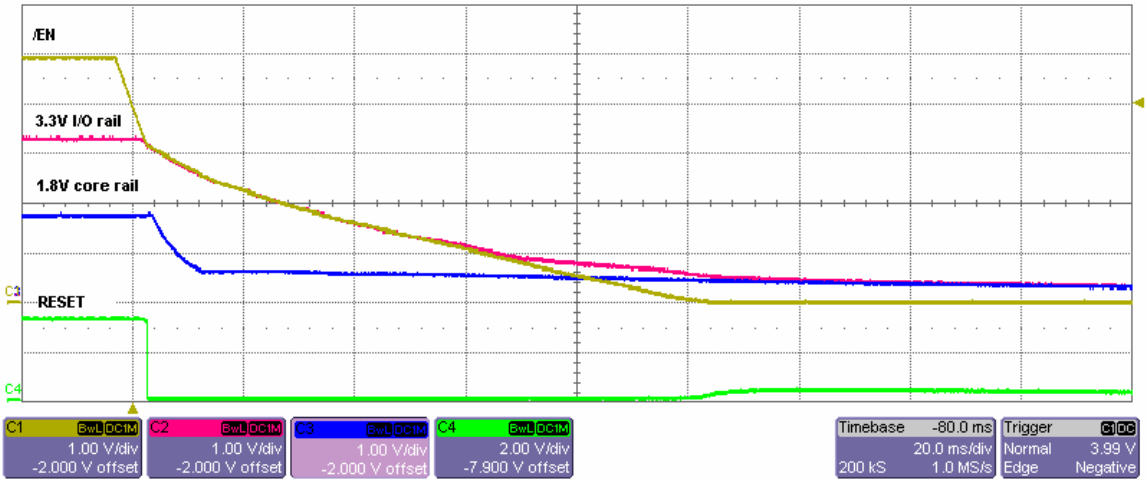


Figure 3 - Power down with V_{IN} = 5.0 V, /EN grounded

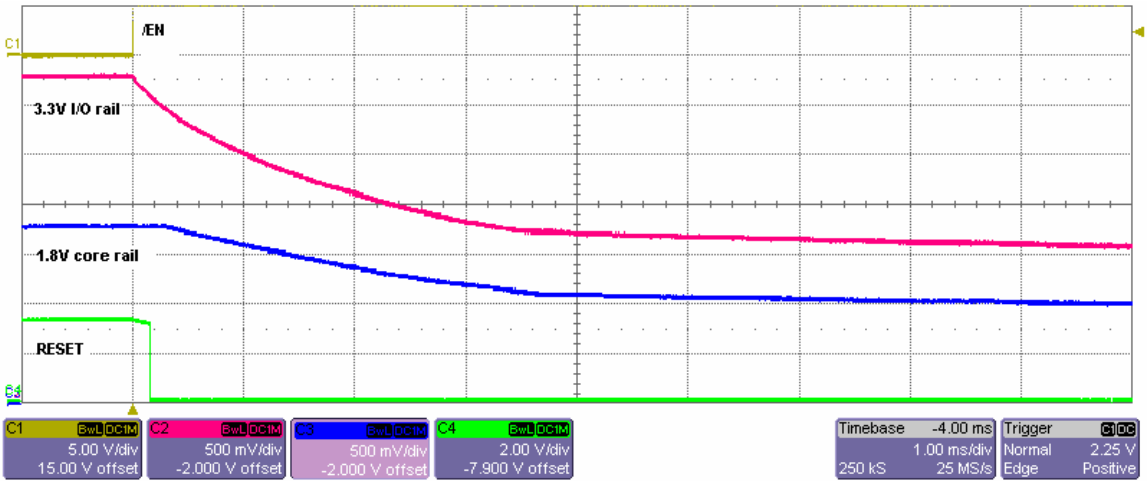


Figure 4 - Power down from enable when V_{IN} = 5.0 V

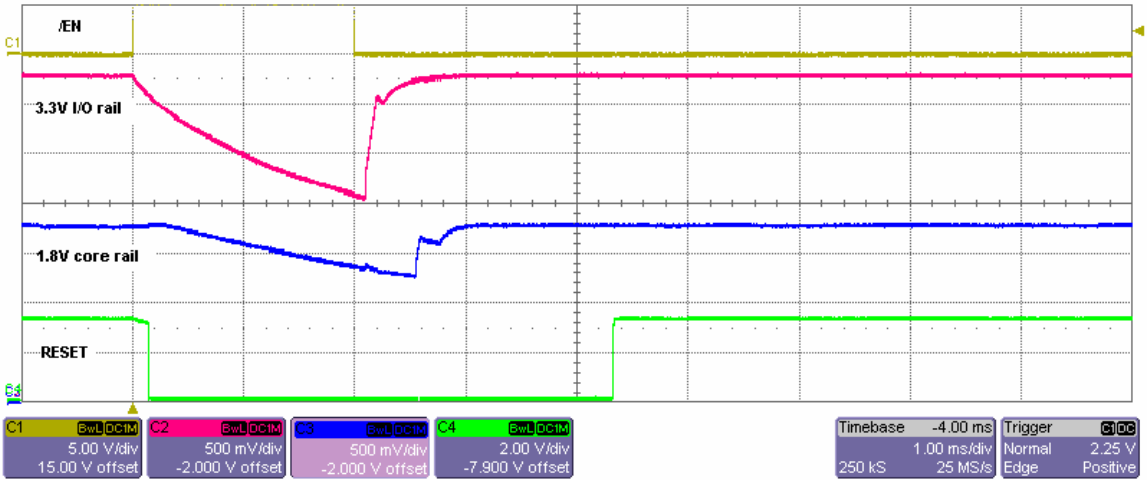


Figure 5 - RESET and recovery after V_{DD} = 3.3V fails

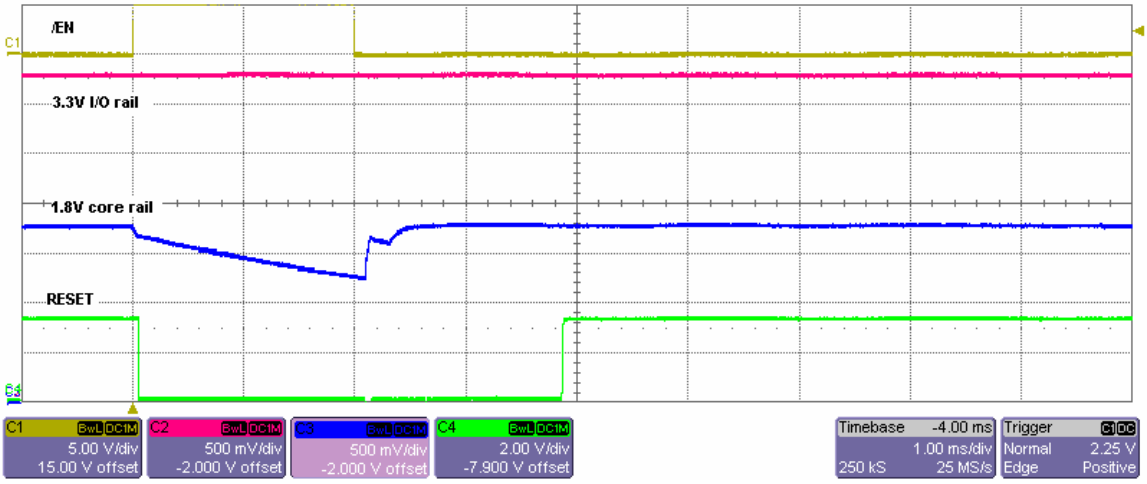
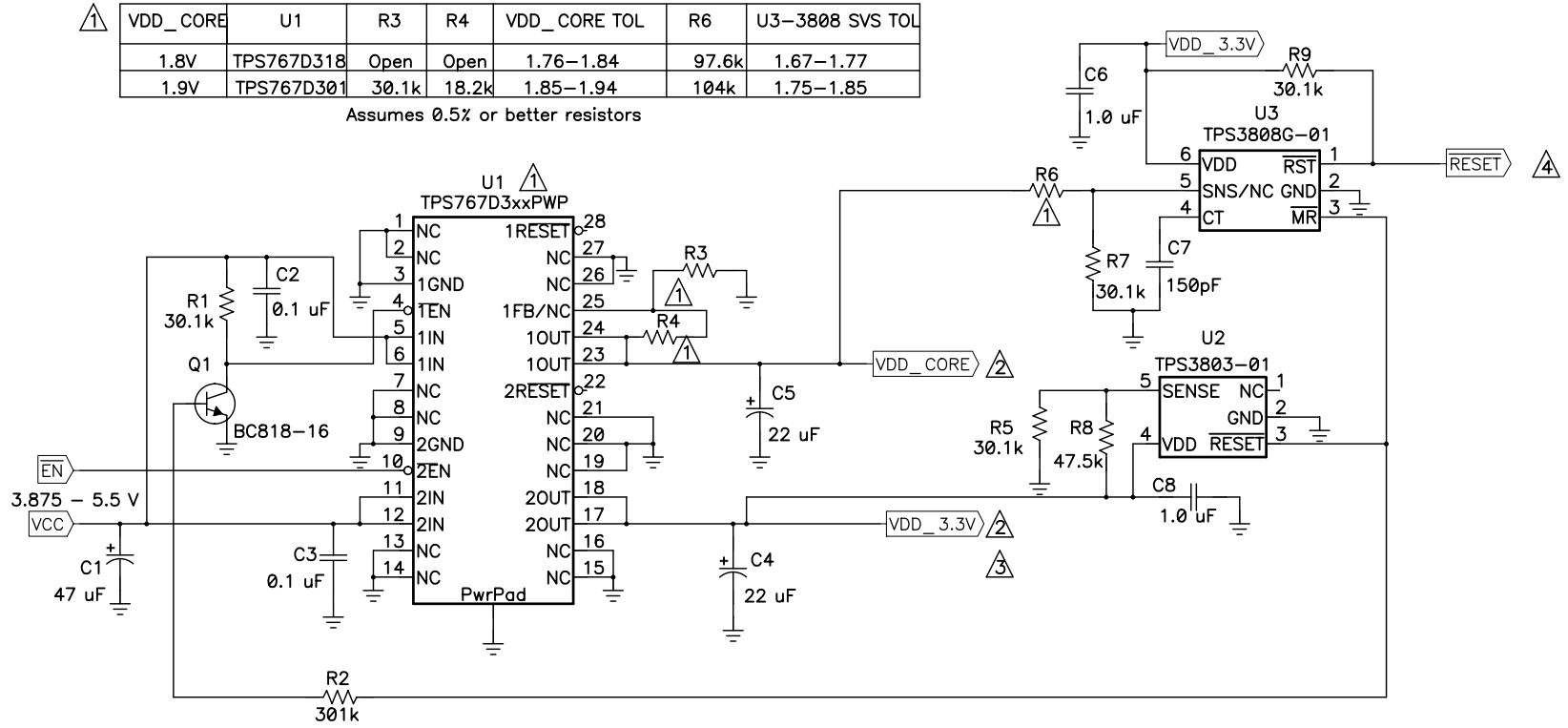


Figure 6 - RESET and recovery after V_{DD} = 1.8V fails

QUESTIONS?

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



VDD_CORE	U1	R3	R4	VDD_CORE TOL	R6	U3–3808 SVS TOL
1.8V	TPS767D318	Open	Open	1.76–1.84	97.6k	1.67–1.77
1.9V	TPS767D301	30.1k	18.2k	1.85–1.94	104k	1.75–1.85

Assumes 0.5% or better resistors

2 Package power dissipation (Pd) determines maximum current.
Pd is a function of Vin and ambient temperature.

VDD_3.3V TOL	R8	U2–3803 SVS
3.234–3.366	47.5k	3.09–3.23

Assumes 0.5% or better resistors

4 /RESET on the TPS3808 has an open drain output and requires an external pullup resistor (R9 on this design).

Title	TPS767D3XX with precise SVS trip points	
Size B	Number PR410	Rev
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Filename: PR410_bom.xls

Date: 1/11/2005

PR410 BOM

COUNT						
001	002	RefDes	Description	Size	Part Number	MFR
1	1	C1	Capacitor, Tantalum, 47-uF, 6.3-V, 1.4-milliohm, 20%	B Case	293D476X6R3B2	Vishay
2	2	C2, C3	Capacitor, Ceramic, 0.1-uF, 25-V, X7R, 10%	0603	C1608X7R1E104KT	TDK
2	2	C4, C5	Capacitor, Tantalum, 22-uF, 6.3-V, 570-milliohm, 20%	B Case	595D226X96R3B2	Vishay
2	2	C6, C8	Capacitor, Ceramic, 1.0-uF, 16-V, X5R, 10%	0603	C1608X5R1C105KT	TDK
1	1	C7	Capacitor, Ceramic, 150-pF, 50-V, X7R, 10%	0603	C1608X7R1H151KT	TDK
1	1	Q1	Bipolar, NPN, 25-V, 500-mA, 0.3-W	SOT23	BC818-16	Vishay
4	4	R1, R5, R7, R9	Resistor, Chip, 30.1k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	R2	Resistor, Chip, 301k-Ohms, 1/16-W, 1%	0603	Std	Std
0			Resistor, Chip, xx-Ohms, 1/16-W, 1%			
	1	R3	Resistor, Chip, 30.1k-Ohms, 1/16-W, 1%	0603	Std	Std
0			Resistor, Chip, xx-Ohms, 1/16-W, 1%			
	1	R4	Resistor, Chip, 18.2k-Ohms, 1/16-W, yy%	0603	Std	Std
1			Resistor, Chip, 97.6k-Ohms, 1/16-W, 1%	0603	Std	Std
	1	R6	Resistor, Chip, 104k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	R8	Resistor, Chip, 47.5k-Ohms, 1/16-W, 1%	0603	Std	Std
1			IC, Dual 1-A Low-Dropout Regulator	PWP28	TPS767D318PWP	TI
	1	U1	IC, Dual 1-A Low-Dropout Regulator	PWP28	TPS767D301PWP	TI
1	1	U2	IC, Voltage Supervisor, 3.3-Volts,	SOP-5 (DCK)	TPS3803H33DCK	TI
1	1	U3	IC, Low Quiescent Current Programmable, Adj-V, Delay Time 1ms to10s	SOT23-6	TPS3808G-01	TI

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Post Office Box 655303 Dallas, Texas 75265