

PR423  
TMS320VC550x Design 6

**FEATURES:**

- Provides sequenced core and I/O voltages from 3.3 V input source.
- /RESET delay fixed at 65 ms minimum, 130 ms typical.
- LDO regulator for low noise operation.

**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:
  - o <http://focus.ti.com/lit/ds/symlink/tps77601.pdf>
  - o <http://focus.ti.com/lit/ds/symlink/tps3103k33.pdf>

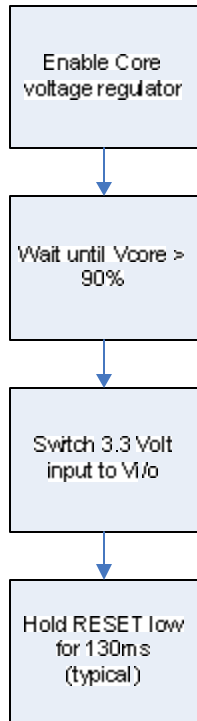
**THEORY OF OPERATION:**

PR423 consists of a series pass transistor for the I/O voltage and a TPS77601 linear regulator for the Core voltage. A TPS77601 is used to convert the 3.3 V to the selected core voltage. A series pass transistor is used to switch a regulated 3.3 V supply to the I/O rail.

**CIRCUIT LIMITATIONS AND CAPABILITIES:**

The TPS77601 is capable of supplying 500 mA of Core current.

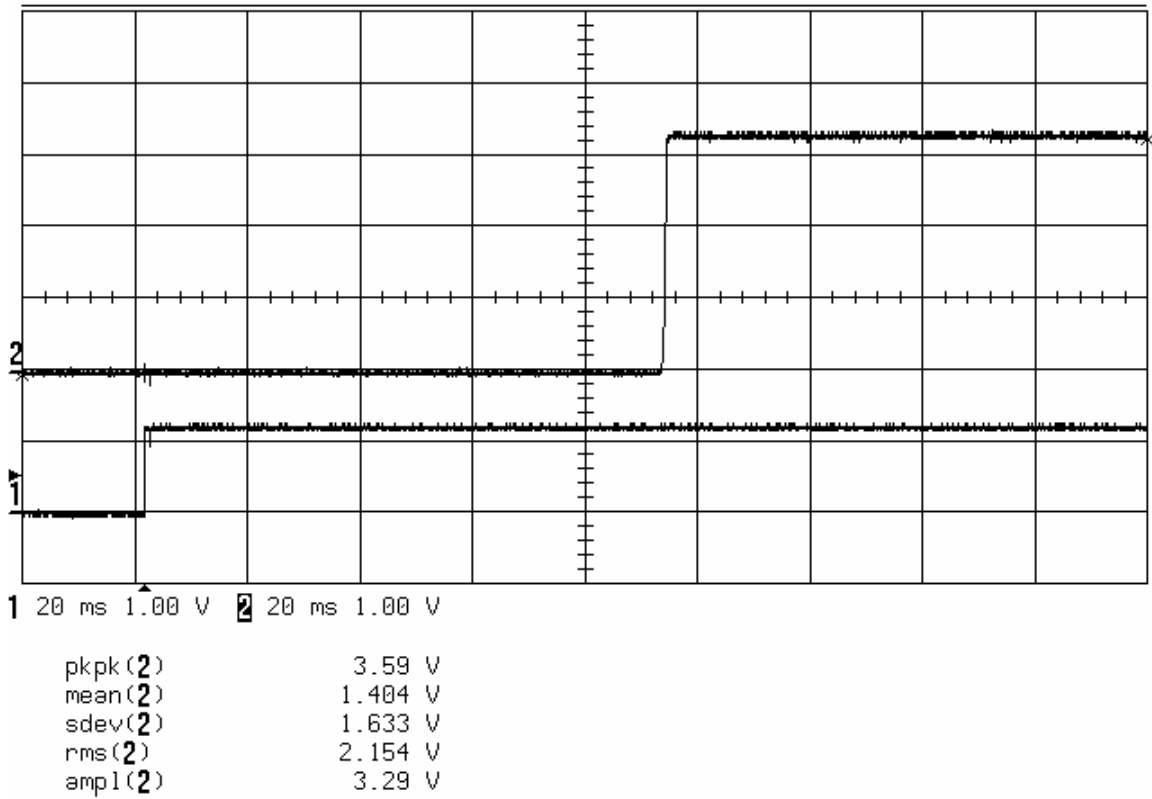
**POWER UP SEQUENCING:**



The circuit will switch the I/O voltage on about 90 ms after the Core voltage is above 90% of its nominal value. Some systems may require a longer time delay between the core and I/O voltage applications. The capacitor, C4, can be adjusted to speed-up or slow down the turn on of the I/O voltage. The turn on time would be delayed by the RC time constant created by R3 and C4.

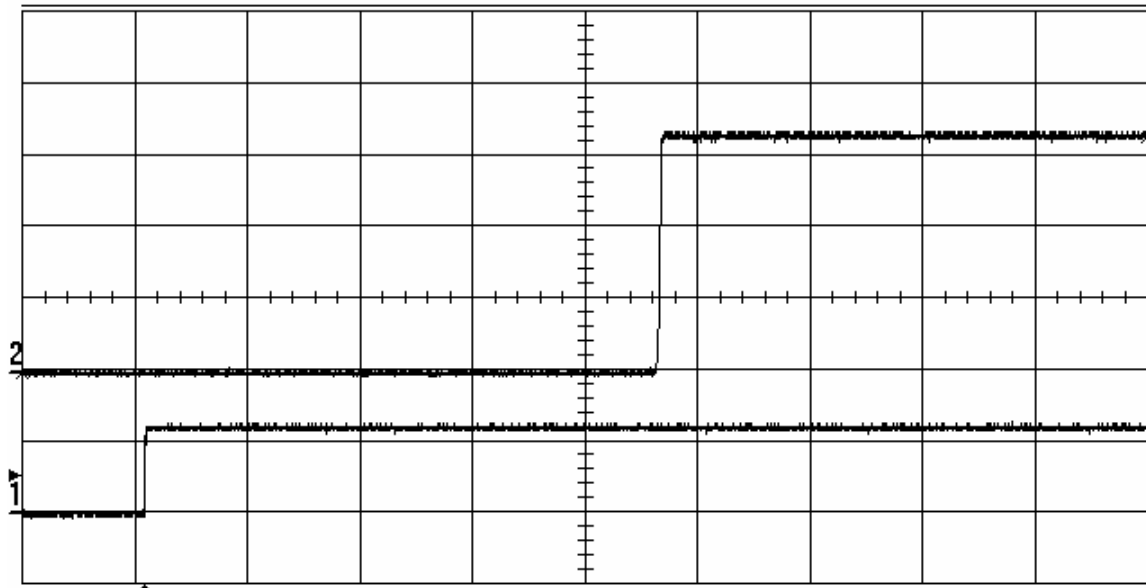
The sequencing circuits can be removed if sequencing is not required. Components R3, R4, C4, Q1 and Q2 can be removed and the 3.3 V input tied directly to the I/O rail. This will not effect the minimum duration of the RESET signal.

#### **WAVEFORMS:**



□ NORMAL

Figure 1 - Power up with  $V_{IN} = 3.3$  V,  $V_{core} = 1.2$  V @ 110 mA,  $V_{i/o} = 3.3$  V @ 50 mA

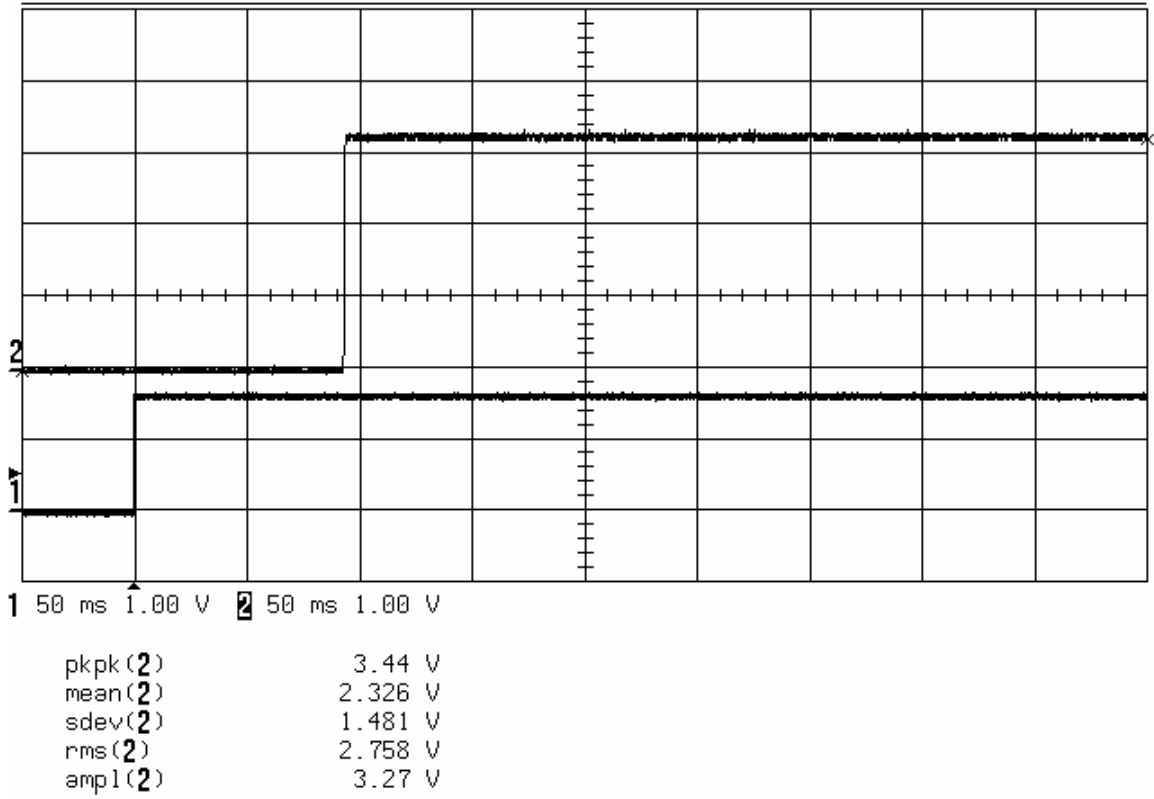


1 20 ms 1.00 V 2 20 ms 1.00 V

pkpk(2)	3.44 V
mean(2)	1.420 V
sdev(2)	1.636 V
rms(2)	2.166 V
ampl(2)	3.29 V

□ NORMAL

Figure 2 - Power up from Enable when  $V_{IN} = 3.3\text{ V}$ ,  $V_{core} = 1.2\text{ V}$  @ 110 mA,  $V_{i/o} = 3.3\text{ V}$  @ 50 mA



□ NORMAL

Figure 3 - Power up with  $V_{IN} = 3.3$  V,  $V_{core} = 1.6$  V @ 250 mA,  $V_{i/o} = 3.3$  V @ 70 mA

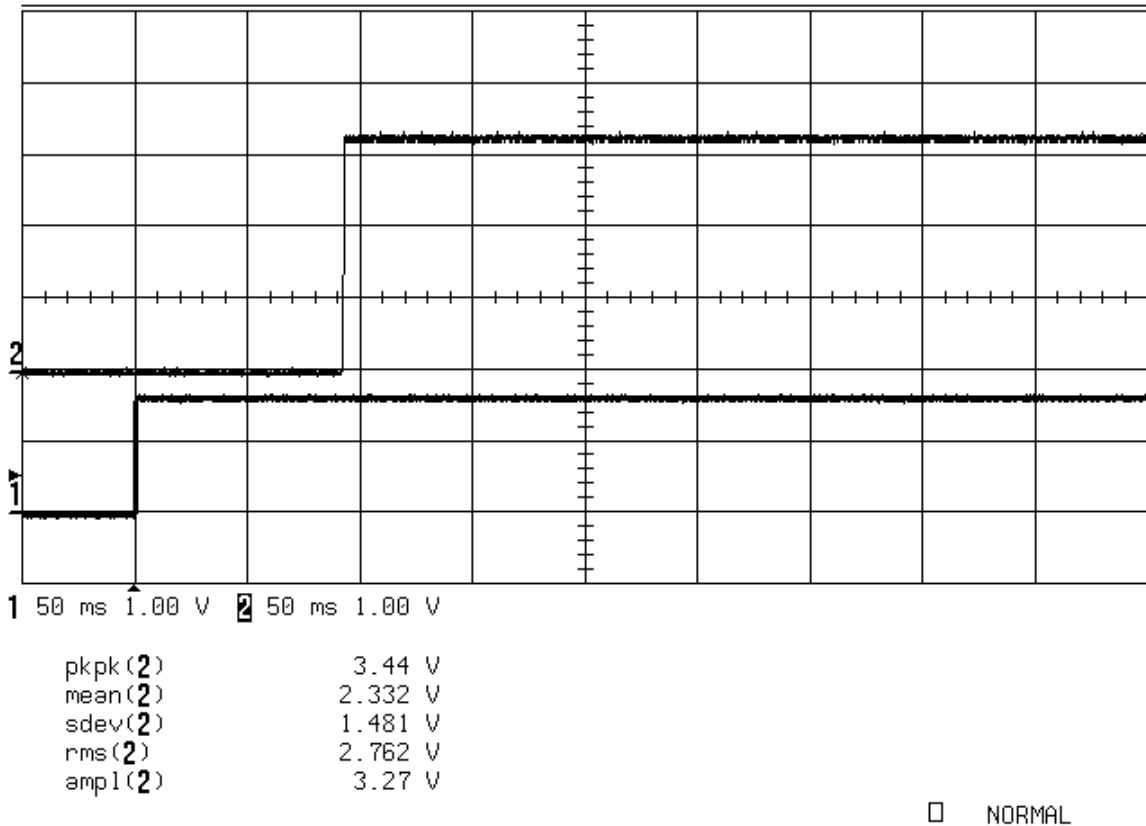


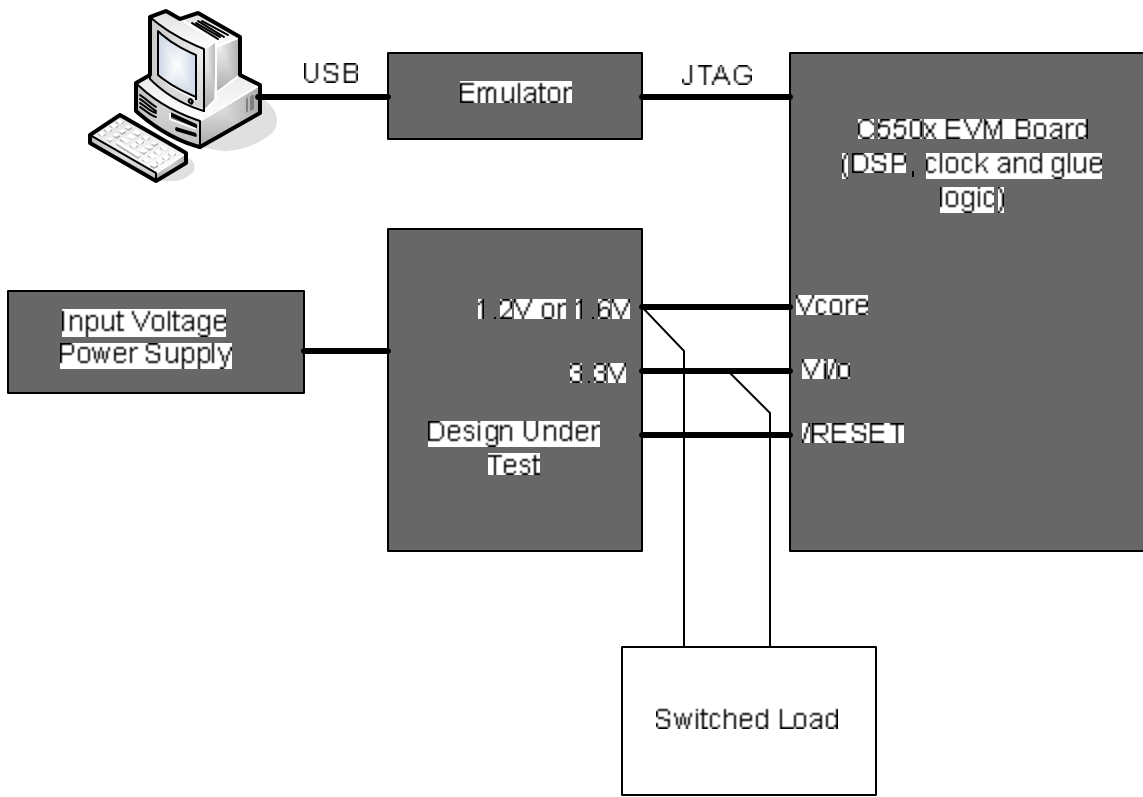
Figure 4 - Power up from Enable when  $V_{IN} = 3.30\text{ V}$ ,  $V_{core} = 1.6\text{ V}$  @  $250\text{ mA}$ ,  $V_{i/o} = 3.3\text{ V}$  @  $70\text{ mA}$

**TESTING METHOD:**

The solution was tested on the bench and in an actual DSP circuit. Bench testing included start up into full DSP load, switched load from no load to full DSP load, and power up sequencing. The full DSP load is defined as the current draw a C550x DSP would present to the power supply under worst operating conditions. This full DSP load current is heavily dependent on board layout, firmware configurations, DSP clock speed, and core voltage. For testing purposes, the following values were assumed to be the full DSP load current.

Voltage (V)	Function	Full load current (mA)
1.2	Core	110
1.6	Core	256
3.3	I/O	70

The solution was also tested in an active DSP board. The following test setup was used for this testing:



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





Filename: PR423_bom.xls						
Date: 02/14/2005						
<b>PR423 BOM</b>						
<b>COUNT</b>						
<b>-001</b>	<b>-002</b>	<b>RefDes</b>	<b>Description</b>	<b>Size</b>	<b>Part Number</b>	<b>MFR</b>
1	1	C1	Capacitor, Ceramic, 10-uF, 6.3-V, X5R, 10%	0805	GRM21BR60J106KE01	muRata
1	1	C2	Capacitor, POSCAP, 33-uF, 8-V, 70-milliohm, 20%	6032 (C)	8TPC33M	Sanyo
1	1	C3	Capacitor, Ceramic, 0.1-uF, 25-V, X7R, 10%	0603	GRM188R71E104KA01	muRata
1	1	C4	Capacitor, Ceramic, 1.0-uF, 10-V, X5R, 10%	0603	GRM188R61A105KA61	muRata
1	1	Q1	Transistor, NPN General Purpose, VCE 50V, VCB 60V, VEB 7V, IC 0.15A	SOT-23	2SC2412K	ROHM
1	1	Q2	MOSFET,P-ch, -12 V, 4 A, 51 milliohm	SOT23	Si2333DS	Vishay
1	0	R1	Resistor, Chip, 1.54k-Ohms, 1/16-W, 1%	0603	Std	Std
0	1		Resistor, Chip, 39.2k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	R2	Resistor, Chip, 110k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	R3	Resistor, Chip, 475k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	R4	Resistor, Chip, 47.5k-Ohms, 1/16-W, 1%	0603	Std	Std
1	0	R5	Resistor, Chip, 97.6k-Ohms, 1/16-W, 1%	0603	Std	Std
0	1		Resistor, Chip, 162k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	R6	Resistor, Chip, 100k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	R7	Resistor, Chip, 10k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	U1	IC, Low-Dropout Regulator, Adj-V, 500-mA	PWP20	TPS77601PWP	TI
1	1	U2	IC, Ultra Low Current/Supply, Voltage Supervisor	SOT23-6	TPS3103K33DBV	TI

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