PR426
TMS320VC550x Design 9

FEATURES:

- Provides sequenced core and I/O voltages from an input source between 3.6 and 5.0 V.
- /RESET delay fixed at 65 ms minimum, 130 ms typical.
- All switching regulators for high efficiency operation.
- Small solution size.

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/tps62300.pdf
  - http://focus.ti.com/lit/ds/symlink/tps3103k33.pdf
  - http://focus.ti.com/lit/ds/symlink/tps76933.pdf

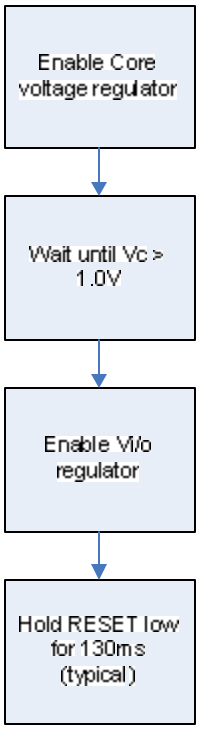
THEORY OF OPERATION:

PR426 consists of a TPS62300 buck regulator to regulate the core voltage and a TPS76933 linear regulator for the I/O voltage.

CIRCUIT LIMITATIONS AND CAPABILITIES:

The TPS62300 is capable of supplying 500 mA of core current. The TPS76933 is capable of 100 mA of I/O current.

POWER UP SEQUENCING:



The circuit will start to ramp up the I/O voltage immediately after the core voltage is above about 1.0V. The 1.0V threshold value will vary with the characteristics of the transistor being used in the sequencing circuit. Some systems may require a longer time delay between the core and I/O voltage applications. A capacitor can be added between the base of Q1 and ground to slow the turn on of the I/O voltage. The turn on time is delayed by the RC time constant created by R4 and the added capacitor.

Since the enables of the two IC's are opposite logic polarities, the sequencing circuit (R3, R4 and Q1) of this design forms an inverter. If sequencing is not required, components R3, R4, and Q1 can be removed. However, each IC's enable will need to be tied to its respective logic 'on' state.

WAVEFORMS:

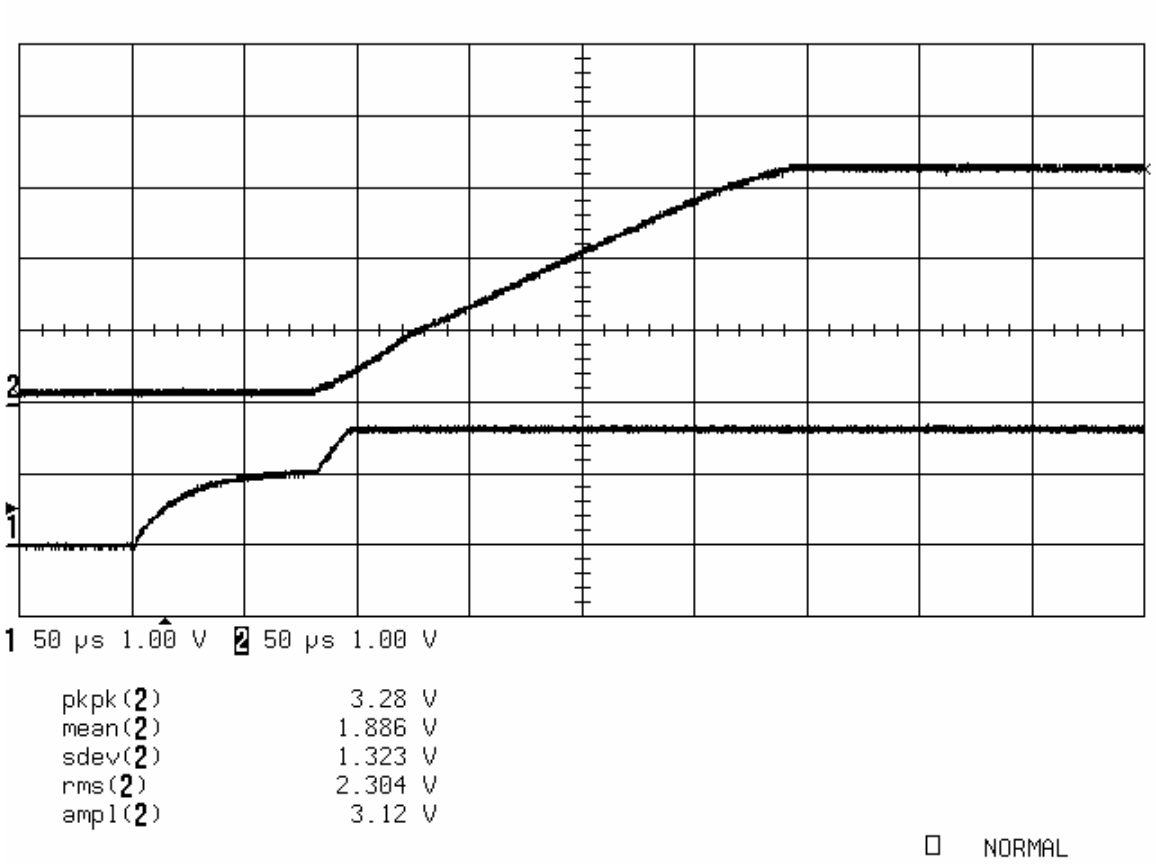


Figure 1 - Power up with V_{IN} = 3.6 V, Vcore=1.6 V @ 267 mA, Vi/o = 3.3 V @ 70 mA

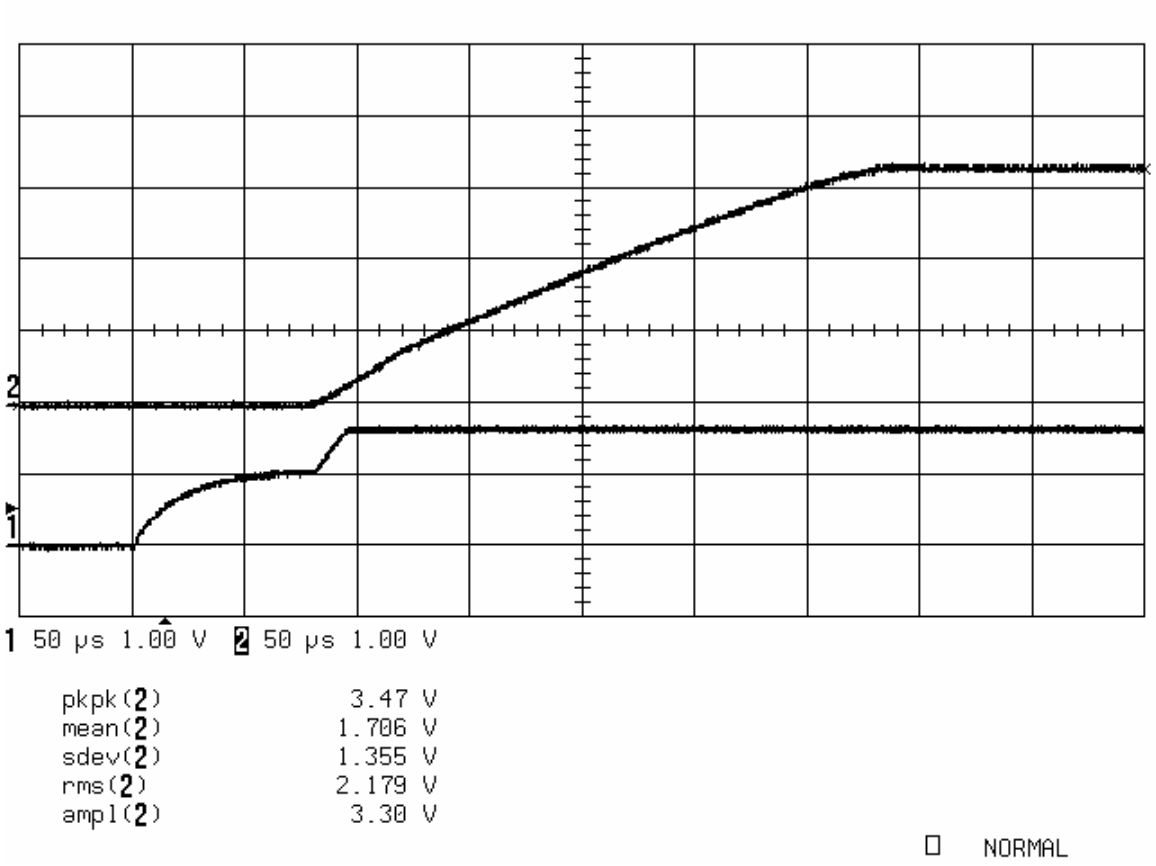


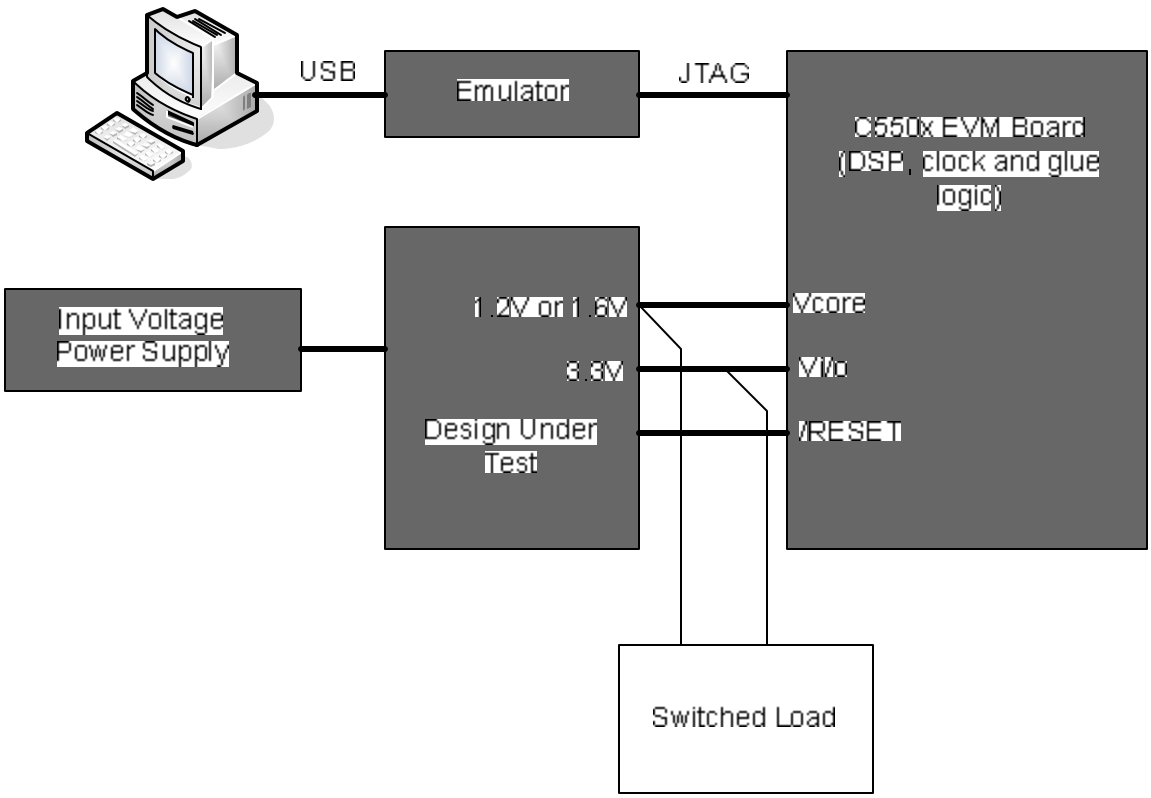
Figure 2 - Power up from Enable when V_{IN} = 3.6 V, Vcore=1.6 V @ 267 mA, Vi/o = 3.3 V @ 70 mA

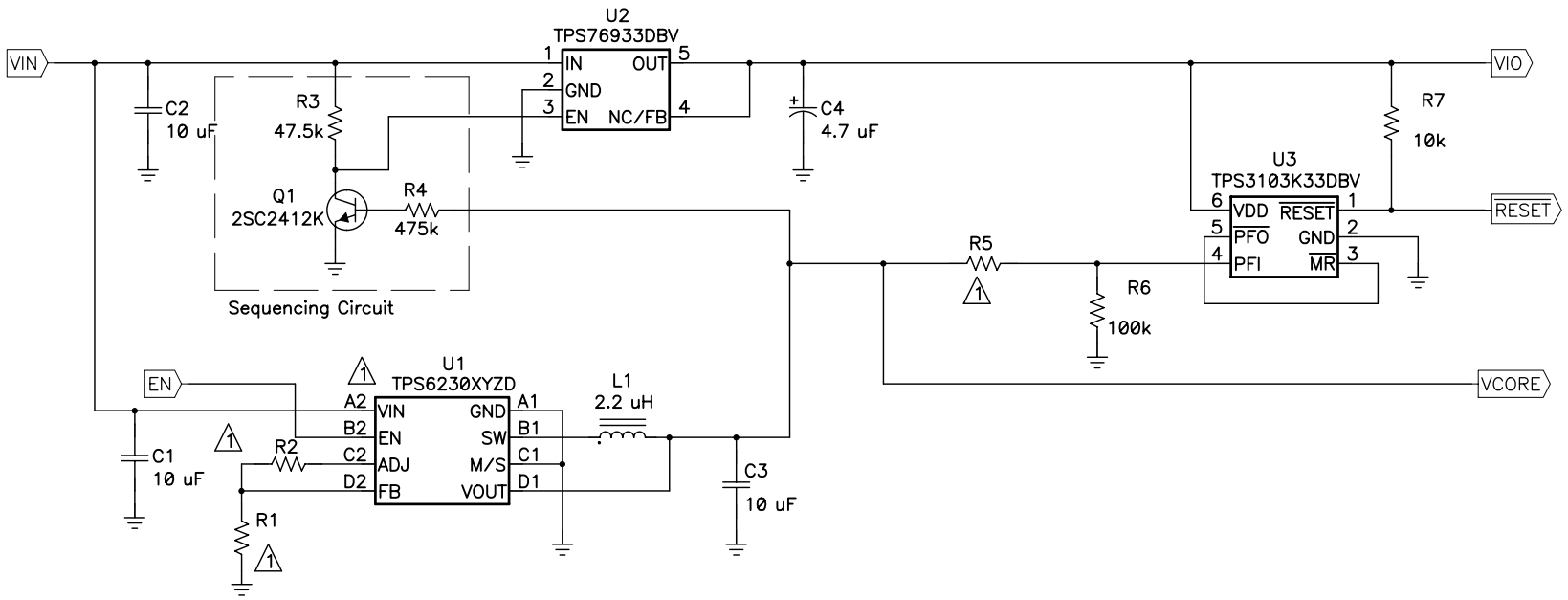
TESTING METHOD:

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:


USB
Emulator
JTAG
C6550x EVM Board
(DSP, clock and glue
logic)
Input Voltage
Power Supply
1.2V or 1.6V
3.3V
Design Under
Test
Vcore
Vio
/RESET
Switched Load



Voltage	U1	R1	R2	R5
1.2V	TPS62300	332k	332k	97.6k
1.6V	TPS62302	Open	Open	162k

Title	C5000 DSP Attach Design 9 for 3.6 < Vin < 5.0V	
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Date: 02/14/2005

PR426 BOM

COUNT						
-001	-002	RefDes	Description	Size	Part Number	MFR
2	2	C1, C2	Capacitor, Ceramic, 10-uF, 6.3-V, X5R, 10%	0805	GRM21BR60J106KE01	muRata
1	1	C3	Capacitor, Ceramic, 10-uF, 4-V, X5R, 10%	0603	C1608X5R0G106KT	TDK
1	1	C4	Capacitor, Tantalum, 4.7-uF, 20-V, 0.95-Ohm, 20%	3528(B)	595D475X020B2T	Vishay
1	1	L1	Inductor, SMT, 2.2-uH, 770-mA, 230-milliohms	0805	CB2016T2R2M	Taiyo Yuden
1	1	Q1	Transistor, NPN General Purpose, VCE 50V, VCB 60V, VEB 7V, IC 0.15A	SOT-23	2SC2412K	ROHM
1	0	R1	Resistor, Chip, 332k-Ohms, 1/16-W, 1%	0603	Std	Std
0	0		Resistor, Chip, xx-Ohms, 1/16-W, 1%	0603		
1	0	R2	Resistor, Chip, 332k-Ohms, 1/16-W, 1%	0603	Std	Std
0	0		Resistor, Chip, xx-Ohms, 1/16-W, 1%	0603		
1	1	R3	Resistor, Chip, 47.5k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	R4	Resistor, Chip, 475k-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	0	U1	IC, 3MHz Synchronous Step-Down Converter, 400mA	CSP-8	TPS62300YDZ	TI
0	1		IC, 3MHz Synchronous Step-Down Converter, 400mA	CSP-8	TPS62302YDZ	TI
1	1	U2	IC, Micro-Power 150 mA LDO Regulator	SOT23-5	TPS76933DBV	TI
1	1	U3	IC, Ultra Low Current/Supply, Voltage Supervisor	SOT23-6	TPS3103K33DBV	TI

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