PR425
TMS320VC550x Design 8

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

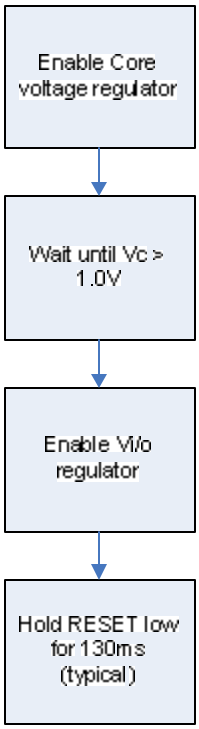
THEORY OF OPERATION:

PR425 consists of two TPS62300 buck regulators to regulate the core and I/O voltages.

CIRCUIT LIMITATIONS AND CAPABILITIES:

Each TPS62300 is capable of supplying 500 mA of 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. This 1.0V threshold will vary with the characteristics of the transistors 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 Q2 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 R5 and the added capacitor.

The sequencing circuits can be removed if sequencing is not required. Components R3, R4, R5, Q1 and Q2 can all be removed and the two enables tied together. This will not effect the minimum duration of the RESET signal.

The minimum logic high voltage for U2, the I/O converter, is 1.2 V. For 1.2 V core systems, the nominal output voltage of the core converter is 1.2V. Components R3, R4, R5, Q1 and Q2 provide voltage level translation from 1.2 V to the input voltage level so that U2 is reliably turned on in 1.2 V systems. This circuit is not required for 1.6 V systems so R3, R4, R5, Q1 and Q2 can be removed and the core voltage tied directly to the enable of U2. This will slightly alter the voltage ramp up of the core and I/O rails.

WAVEFORMS:

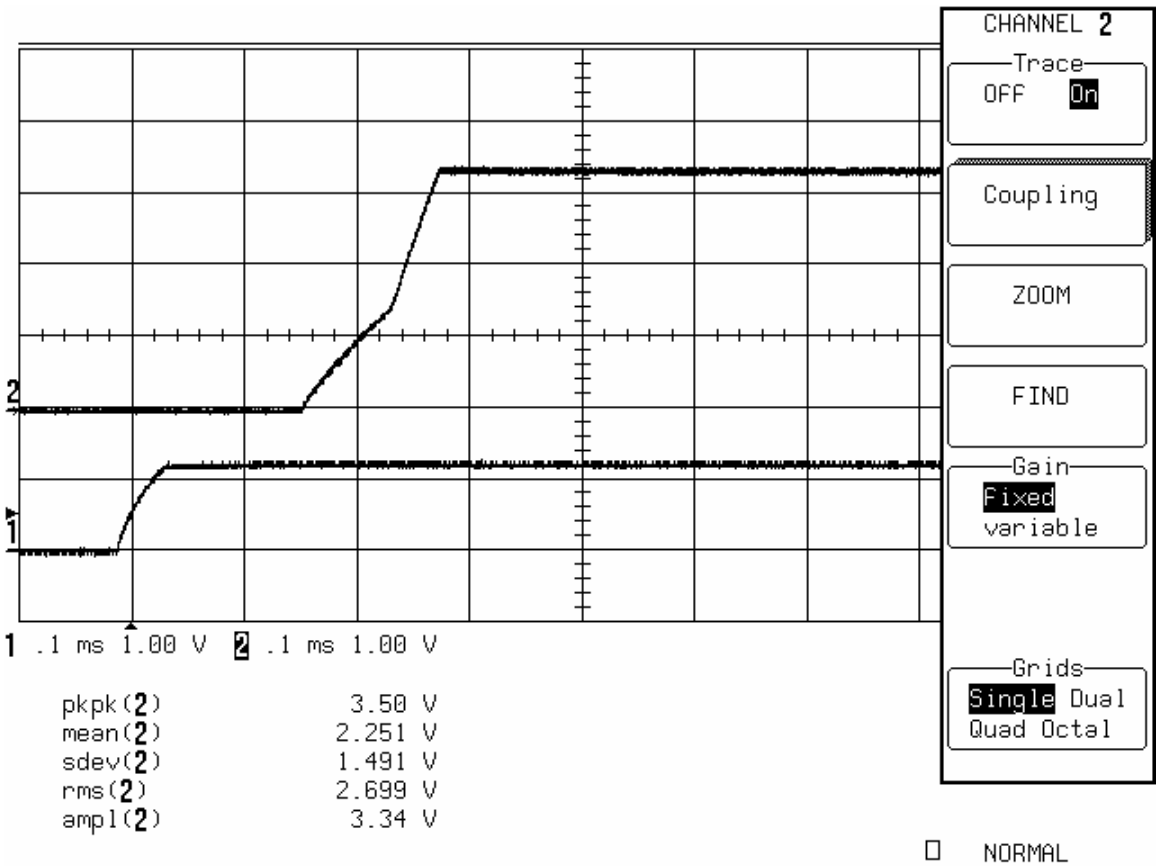


Figure 1 - Power up with V_{IN} = 3.6 V, Vcore=1.6 V @ 250 mA, Vi/o = 3.3 V @ 70 mA

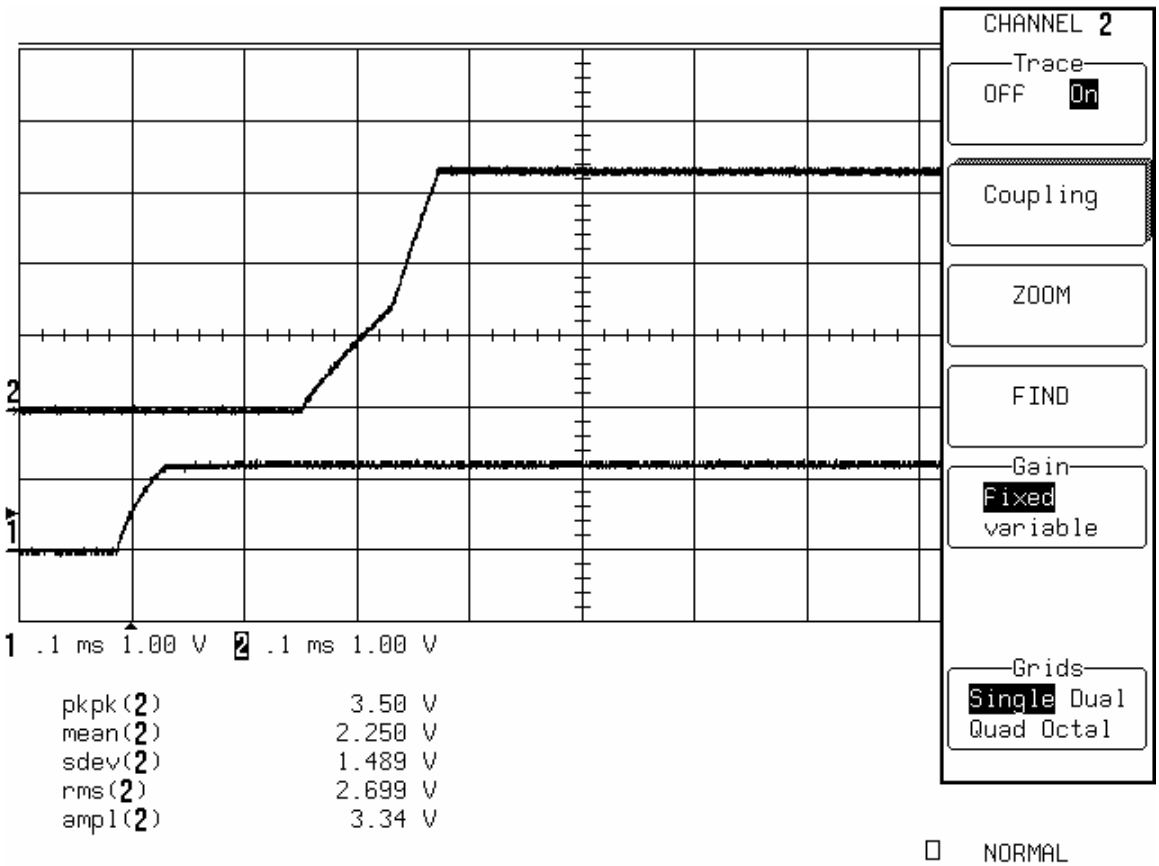


Figure 2 - Power up from Enable when V_{IN} = 3.6 V, Vcore=1.6 V @ 250 mA, Vi/o = 3.3 V @ 70 mA

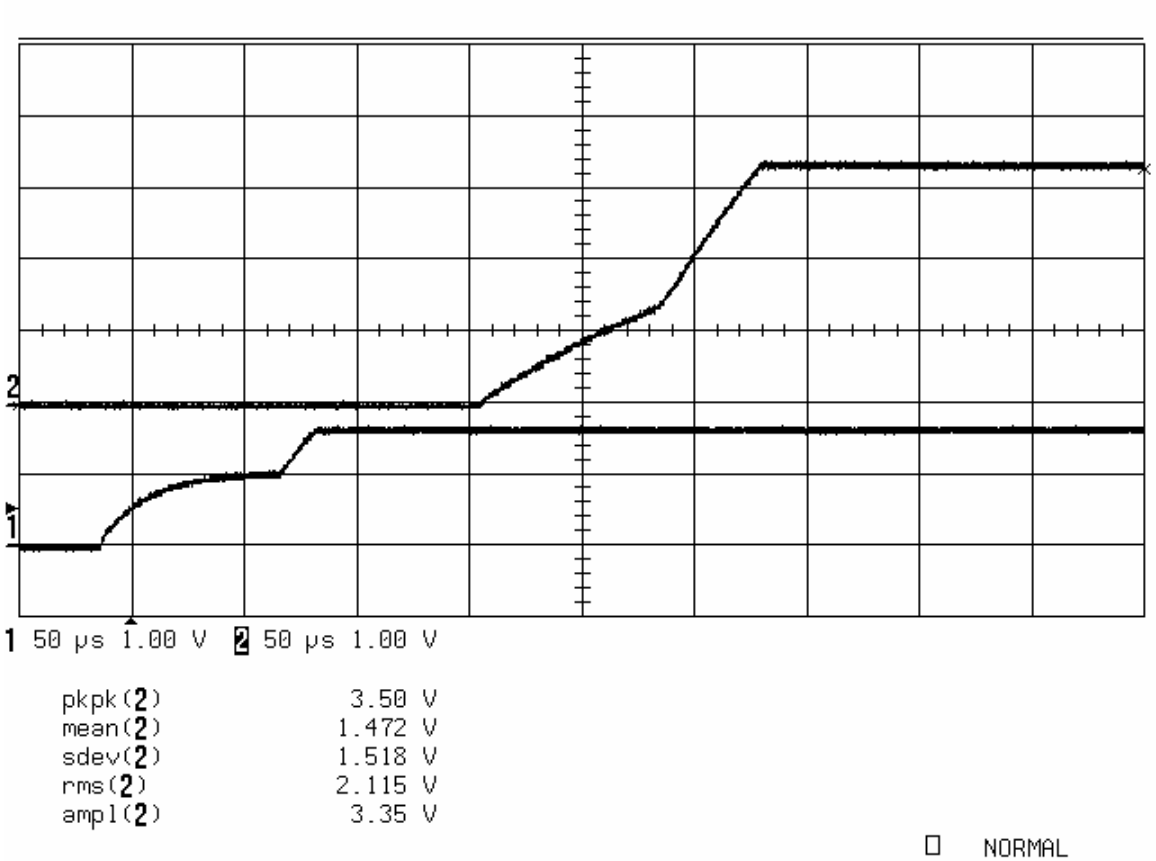


Figure 3 - Power up with V_{IN} = 3.6 V, Vcore=1.6 V @ 250 mA, Vi/o = 3.3 V @ 70 mA, no sequencing circuit, Vcore tied to enable of U2

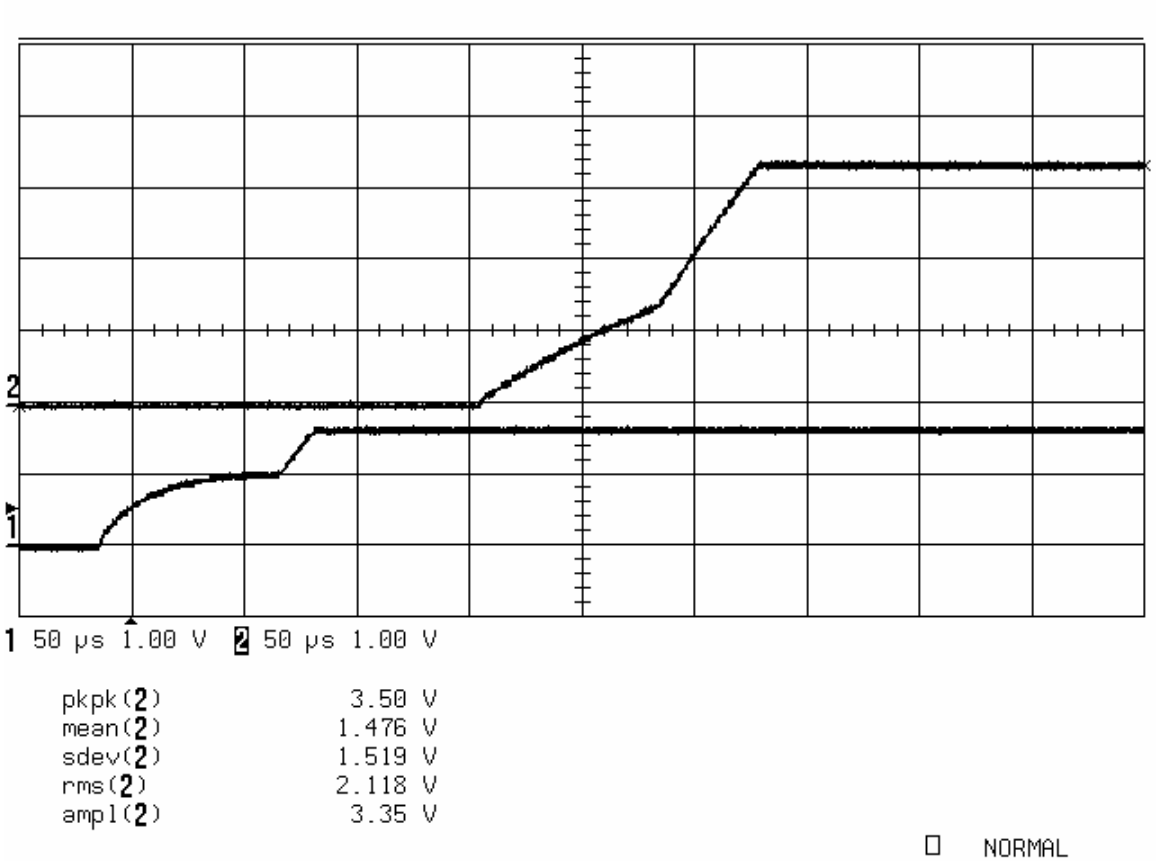


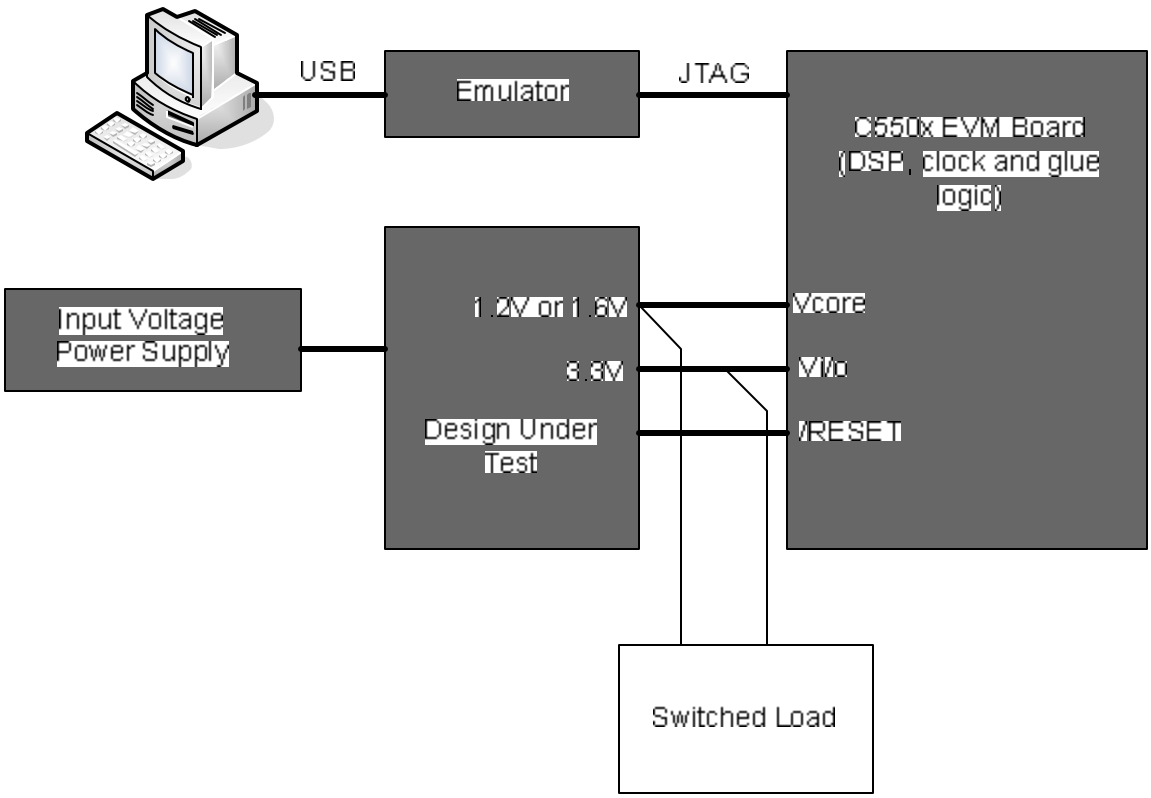
Figure 4 - Power up from Enable when V_{IN} = 3.6 V, Vcore=1.6 V @ 250 mA, Vi/o = 3.3 V @ 70 mA, no sequencing circuit, Vcore tied to enable of U2

TESTING METHOD:

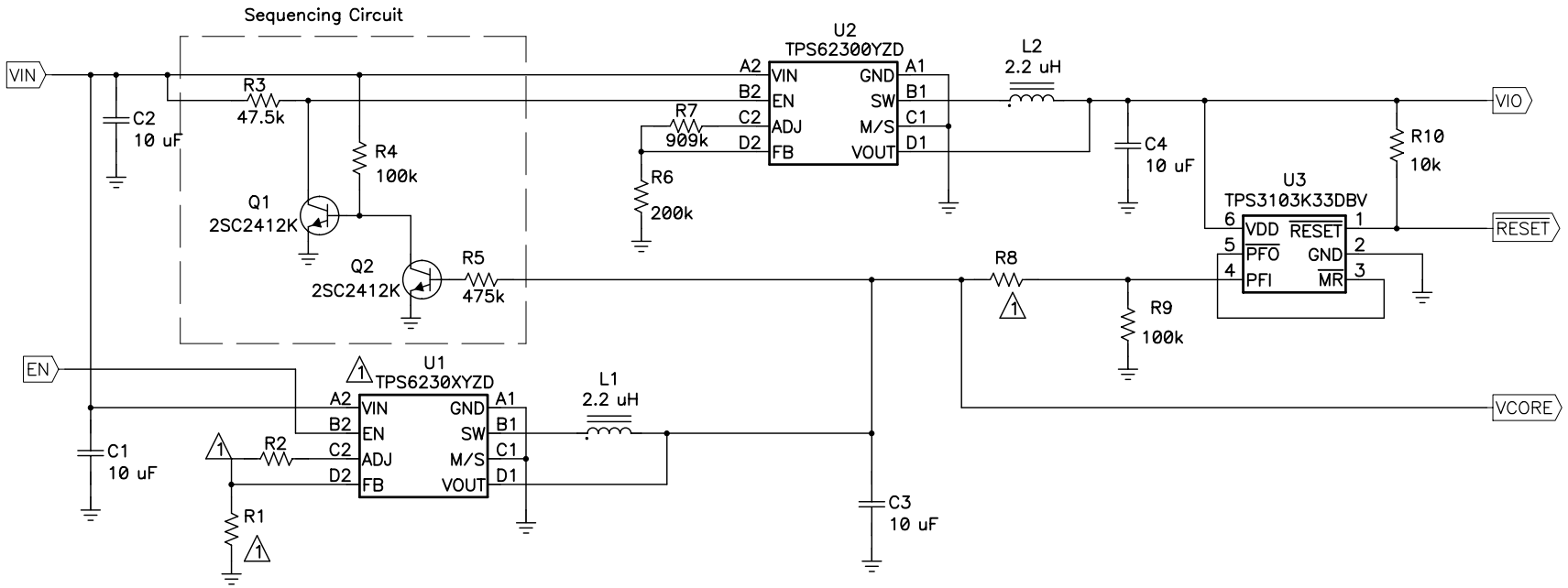
The solution was tested on the bench and in an actual DSP circuit. Bench testing included start up into full DSP load, switched load from no load to full DSP load, and power up sequencing. The full DSP load is defined as the current draw a C550x DSP would present to the power supply under worst operating 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 1.5V
3.3V
Design Under
Test
Vcore
Vio
/RESET
Switched Load

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



Voltage	U1	R1	R2	R8
1.2V	TPS62300	332k	332k	97.6k
1.6V	TPS62302	Open	Open	162k

Title	C5000 DSP Attach Design 8 for 3.6 < Vin < 5.0V	
Size B	Number PR425	Rev
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Filename pr425.sch		Sheet of

Filename: PR425_bom.xls

Date: 02/14/2005

PR425 BOM

COUNT						
-001	-002	RefDes	Description	Size	Part Number	MFR
4	4	C1, C2, C3, C4	Capacitor, Ceramic, 10-uF, 6.3-V, X5R, 10%	0805	GRM21BR60J106KE01	muRata
2	2	L1, L2	Inductor, SMT, 2.2-uH, 770-mA, 230-milliohms	0805	CB2016T2R2M	Taiyo Yuden
2	2	Q1, Q2	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
2	2	R4	Resistor, Chip, 100k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	R5	Resistor, Chip, 475k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	R6	Resistor, Chip, 200k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	R7	Resistor, Chip, 909k-Ohms, 1/16-W, 1%	0603	Std	Std
1	0	R8	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	R9	Resistor, Chip, 100k-Ohms, 1/16-W, 1%	0603	Std	Std
1	1	R10	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, 3MHz Synchronous Step-Down Converter, 400mA	CSP-8	TPS62300YDZ	TI
1	1	U3	IC, Ultra Low Current/Supply, Voltage Supervisor	SOT23-6	TPS3103K33DBV	TI

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