

SP7652 Buck Converter for 12V to 8V conversion

Part Number: SP7652

Designed by: Tim Sullivan

Application Description: An SP7652 PowerBlox™ is used to create an 8volt output from a 12volt source.

Electrical Requirements:

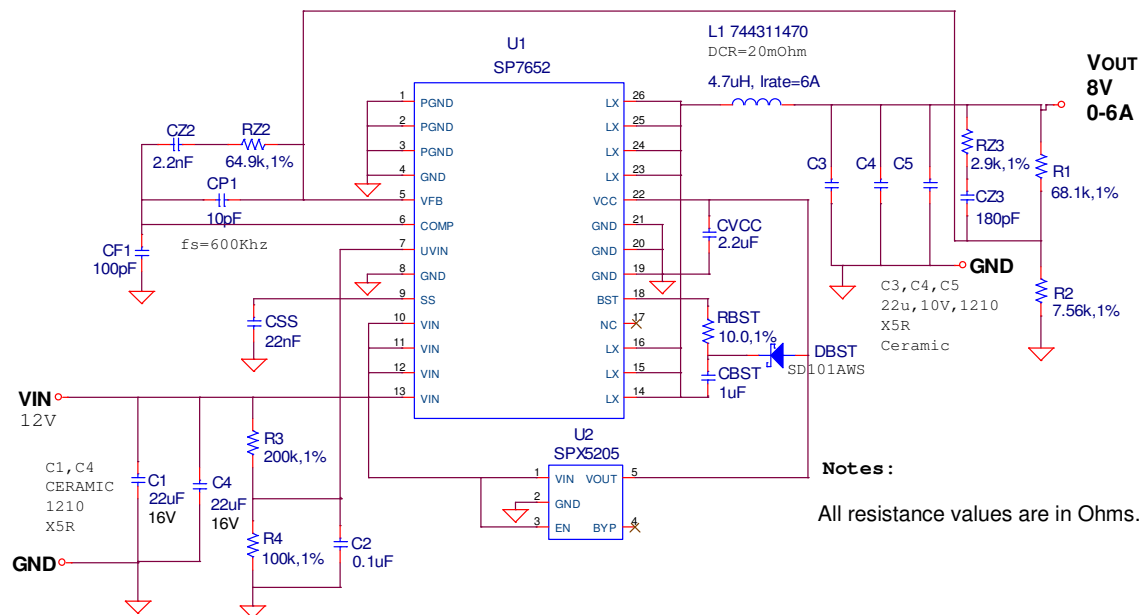
Input Voltage: 12V +/-2volts
 Output Voltage: 8Volts
 Output Current: up to 6A capable

Circuit Description:

This circuit has been designed to provide up to 8volts from a 12volt nominal supply. It uses the PowerBlox™ solution SP7652 and 24 other discrete parts (not including pcb and I/O pins) and uses approximately 2 square inches of board space. It is possible to maintain this small area usage by the incorporation of the high and low side FETs and the PWM controller into one package.

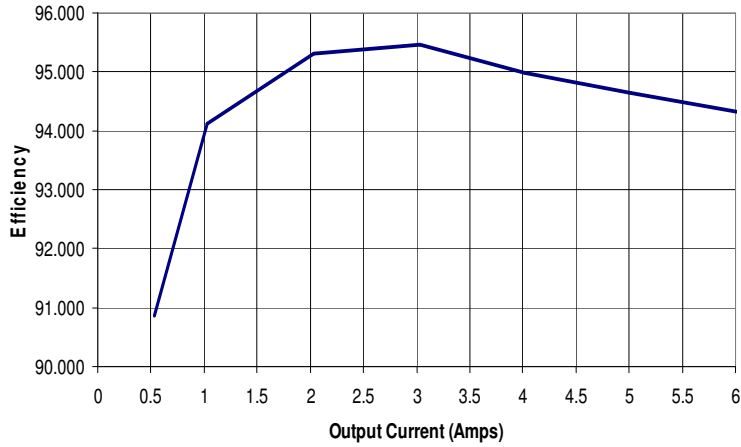
The solution uses a Wurth 7mm X 7mm, low resistance inductor which is a good balance of size and performance for this solution. An inexpensive Sipex SPX5205 LDO was used to provide the 5V Vcc for the part. Ceramic capacitors were used on the converter input and output and a Type III feedback configuration was implemented to provide excellent transient response.

This report includes an application schematic complete with component values, a complete Bill of Materials, and figures illustrating the electrical performance of the design.



Performance Measurements

7652 Efficiency
12Vin, 8Vout



7652 Load Regulation
12Vin, 0-6Amps Out

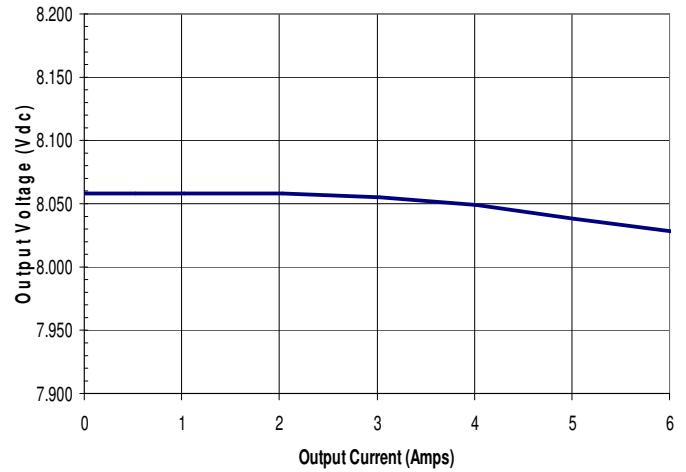


Figure 1 – Efficiency vs Load

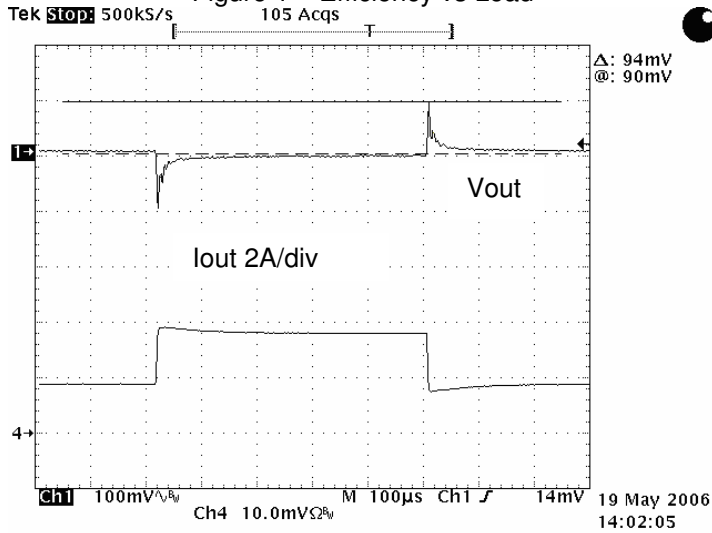


Figure 2 – Load Regulation

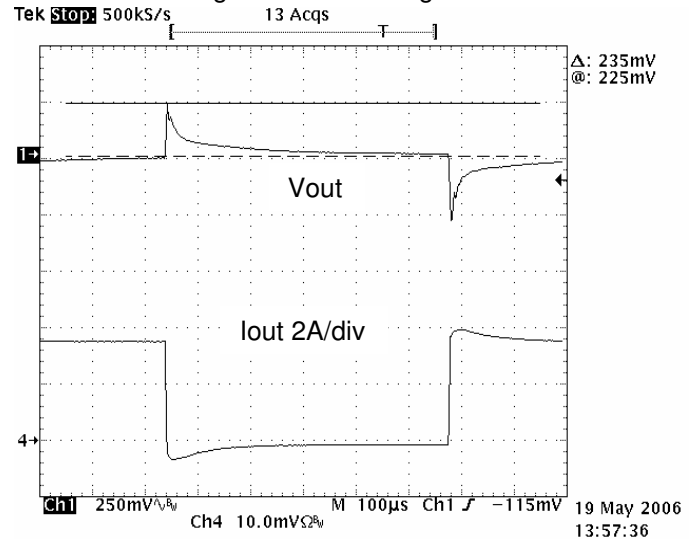


Figure 2 – Load Step Response 2->4 Amps

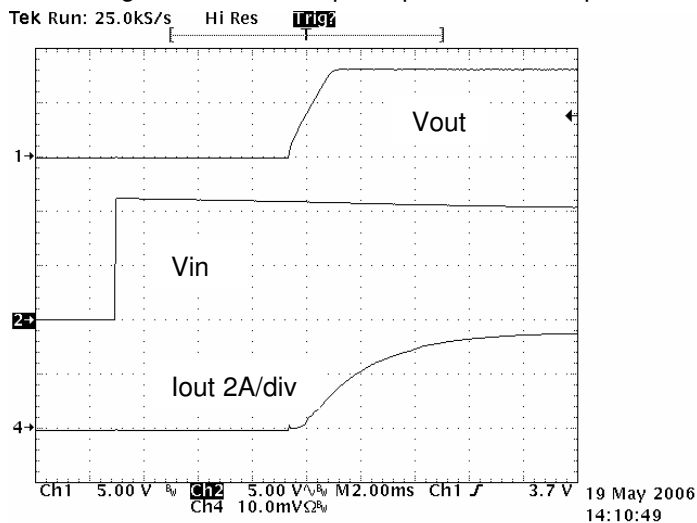


Figure 4 – Start-Up Response: VIN to 4 Amps

Figure 3 – Load Step Response 0->4 Amps

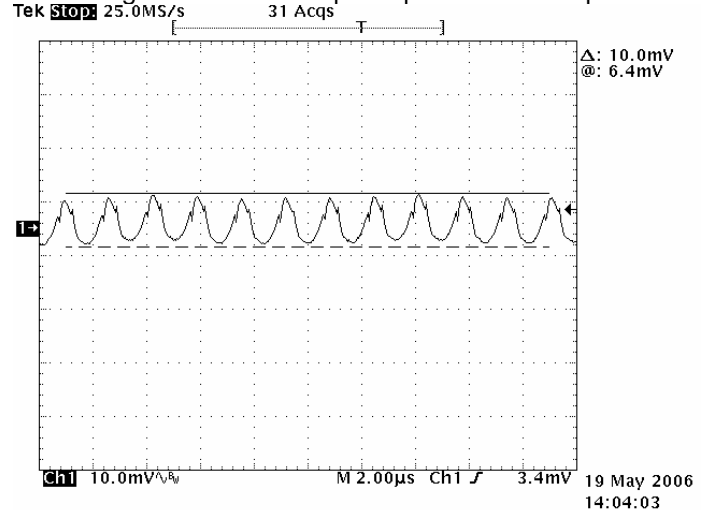
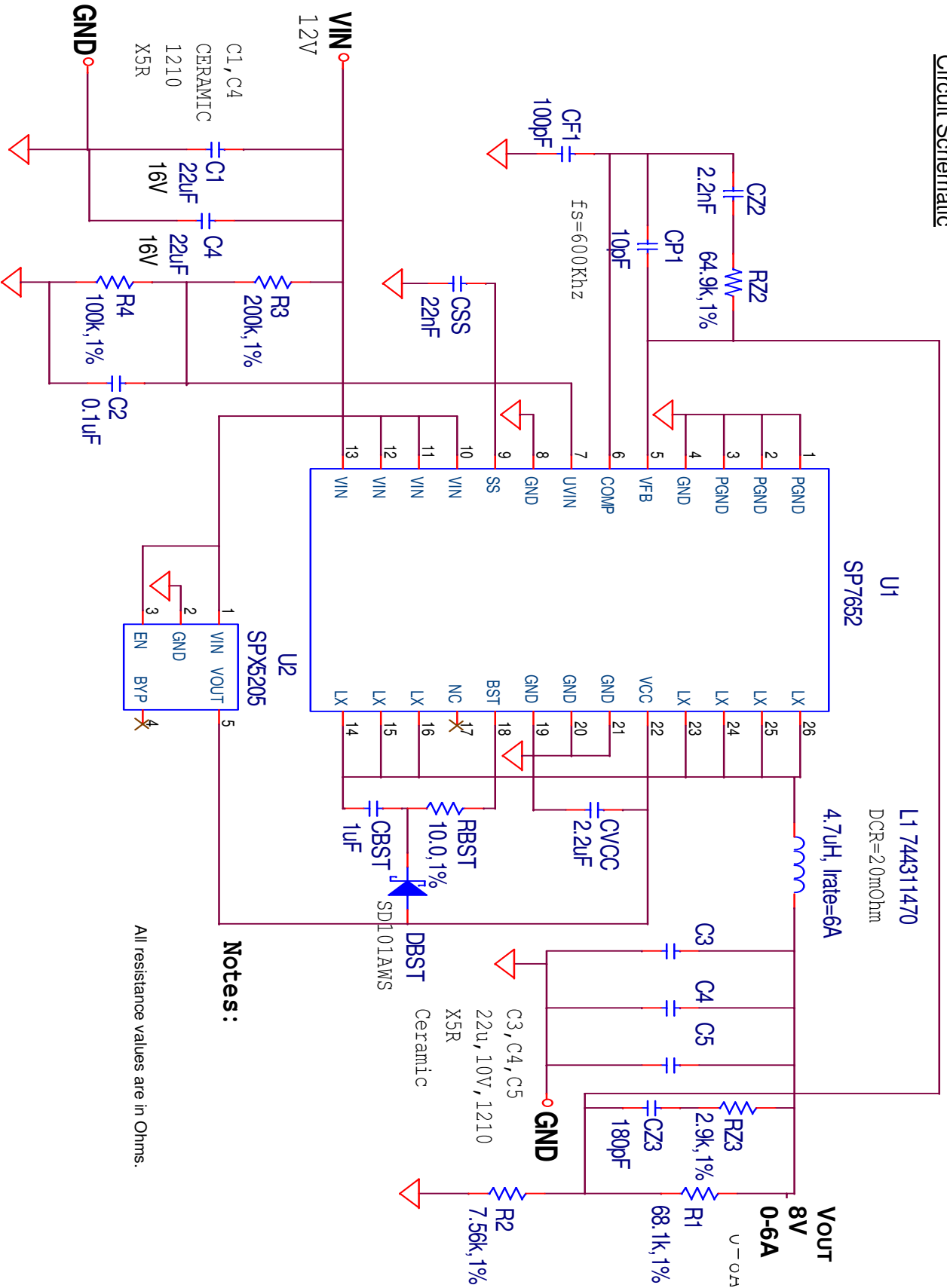


Figure 5 – Output Ripple, Output Current = 6Amps

Circuit Schematic



Notes:

All resistance values are in Ohms.

Converter Bill of Materials:

SP7652 Evaluation Board							12Vin / 8Vout	
Line No.	Ref. Des.	Qty.	Manuf.	Manuf. Part Number	Layout Size	Component		
1	PCB	1	Sipex	146-6549-02	1.75"X2.75"	SP7652EB		
2	U1	1	Sipex	SP7652EU	DFN-26	2-FETs Buck Ctrl		
3	U2	1	Sipex	SPX5205M5-5.0	SOT-23-5	150mA LDO Voltage Reg		
4	DBST	1	Vishay Semi	SD101AWS	SOD-323	15mA Schottky Diode		
5	L1	1	Würth	Würth 744311470	6.86X6.47mm	4.7uH Coil 6A 20mohm		
6	C3,C4,C5	3	TDK	C3225X5R0J226M	1210	22uF Ceramic X5R 10V		
7	C1,C4	2	TDK	C3225X5R1C226M	1210	22uF Ceramic X5R 16V		
8	CVCC	1	TDK	C1608X5R1A225K	0603	2.2uF Ceramic X5R 10V		
9	CBST	1	TDK	C1608X5R1A105K	0603	1.0uF Ceramic X5R 10V		
10	C2	1	TDK	C1608X7R1H104K	0603	0.1uF Ceramic X7R 50V		
11	CSS	1	TDK	C1608X7R1H223K	0603	22,000pF Ceramic X7R 50V		
12	CP1	1	TDK	C1608COG1H100J	0603	10pF Ceramic COG 50V		
13	CZ2	1	TDK	C1608COG1H222J	0603	2,200pF Ceramic COG 50V		
14	CF1	1	TDK	C1608COG1H101J	0603	100pF Ceramic COG 50V		
15	CZ3	1	TDK	C1608COG1H181J	0603	180pF Ceramic COG 50V		
16	RZ2	1	Panasonic	ERJ-3EKF6492V	0603	64.9K Ohm Thick Film Res 1%		
17	R2	1	Panasonic	ERJ-3EKF7561V	0603	7.56K Ohm Thick Film Res 1%		
18	RZ3	1	Panasonic	ERJ-3EKF2901V	0603	2.9K Ohm Thick Film Res 1%		
19	R1	1	Panasonic	ERJ-3EKF6812V	0603	68.1K Ohm Thick Film Res 1%		
20	R3	1	Panasonic	ERJ-3EKF2003V	0603	200K Ohm Thick Film Res 1%		
21	RBST	1	Panasonic	ERJ-3EKF10R0V	0603	10.0 Ohm Thick Film Res 1%		
22	R4	1	Panasonic	ERJ-3EKF1003V	0603	100K Ohm Thick Film Res 1%		
23	VIN, VOUT, GND, GND2	4	Vector Electronic	K24C/M	.042 Dia	Input/Output Terminal Posts		