Design Solution # 52

SP7662 Buck Converter Design for 3.3V to 1.45V conversion

Designed by: Tim Sullivan

Part Number: SP7662

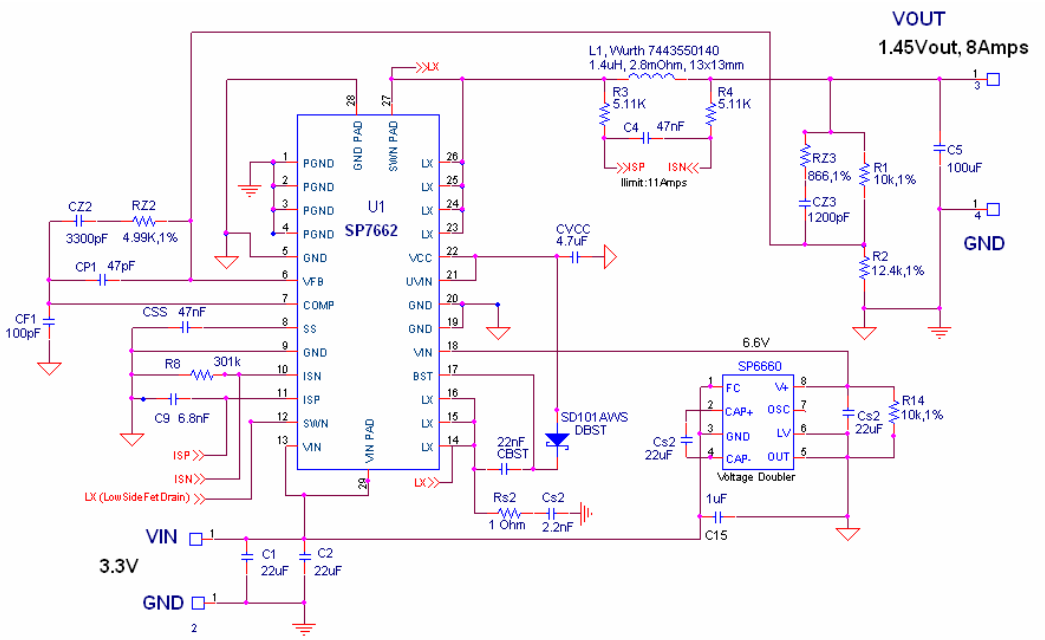
Application Description: An SP7662 PowerBlox™ is used to create a 1.45Volt output from a 3.3Volt source. A voltage doubler is used to create the 5Volts required for the SP7662 Vcc voltage.

Electrical Requirements:

Input Voltage:	3.3V +/-2%
Output Voltage:	1.45 Volts
Output Current:	up to 8A capable

Circuit Description:

This circuit has been designed to provide 1.45Volts from a 3.3Volt nominal supply. It uses the PowerBlox™ solution SP7662 and 32 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 due to the incorporation of the high- and low-side FETs and the PWM controller into one package.



The solution uses a Wurth 13x14x5mm, low resistance inductor which is a good balance of size and performance for this application. An inexpensive Sipex SP6660 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. For further information on implementing Type III loop configuration, see this application note on the Sipex website:

http://www.sipex.com/files/ApplicationNotes/Type%20III%20Loop%20Compensation%20Oct12-06.pdf

The feedback components for a different configuration of output voltage, output inductor, and/or output capacitor can be calculated and simulated using the Sipex PowerBlox™ Power Lab. A link is provided from the main Sipex web page at www.sipex.com . One design note on the SP6660 circuit is the addition of R14. This 10kΩ resistor ensures the SP6660 starts each power up from an output voltage of 0Volts. Without this resistor the SP6660 may not start when the input voltage is cycled quickly.

This report includes an application schematic complete with component values, a full Bill of Materials, and figures illustrating the electrical performance of the design. It ends with a comparison to a similar part from Texas Instruments.

Performance Measurements

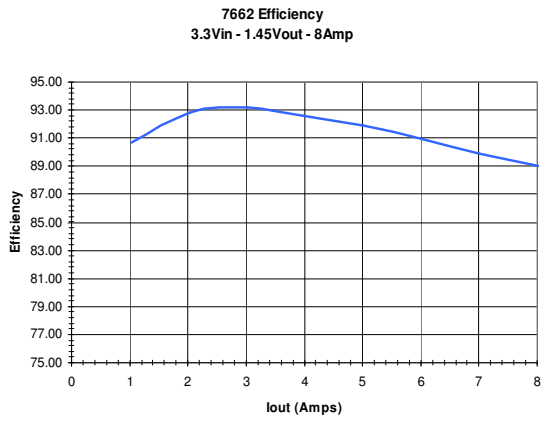


Figure 1 – Efficiency vs Load

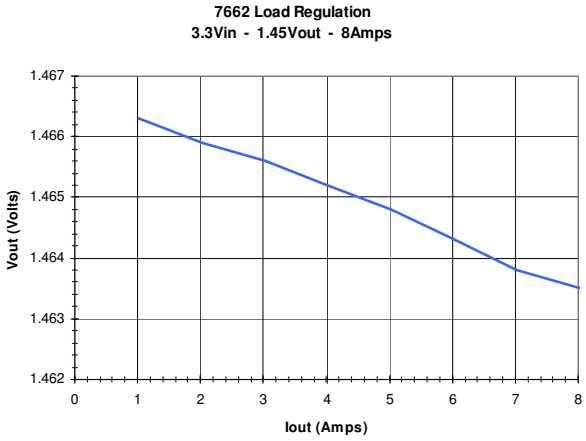


Figure 2 – Load Regulation

Performance Measurements

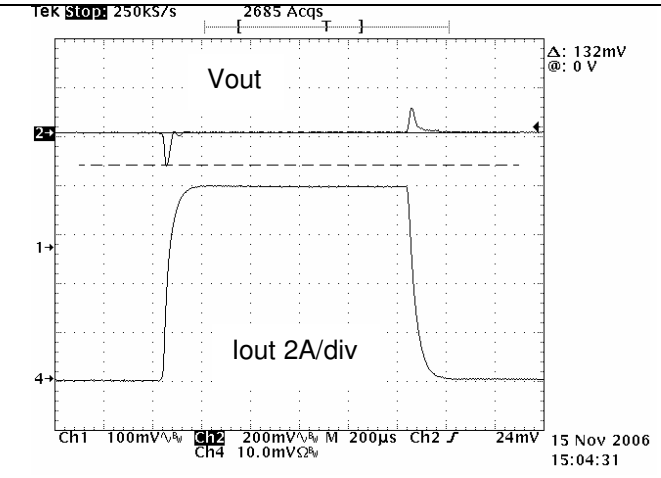


Figure 2 – Load Step Response 0->8 Amps

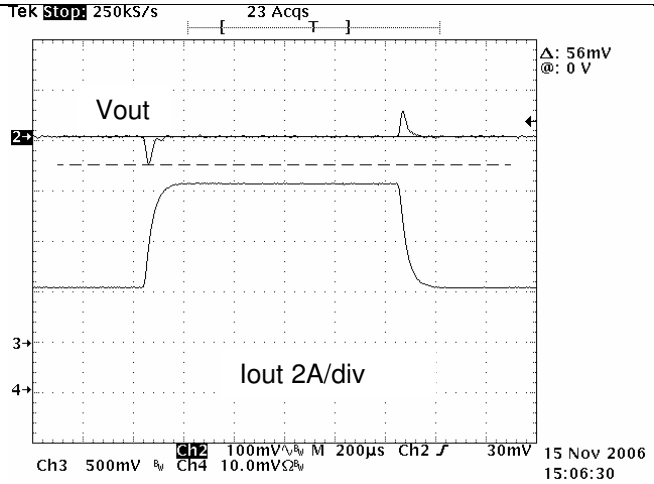


Figure 3 – Load Step Response 4->8 Amps

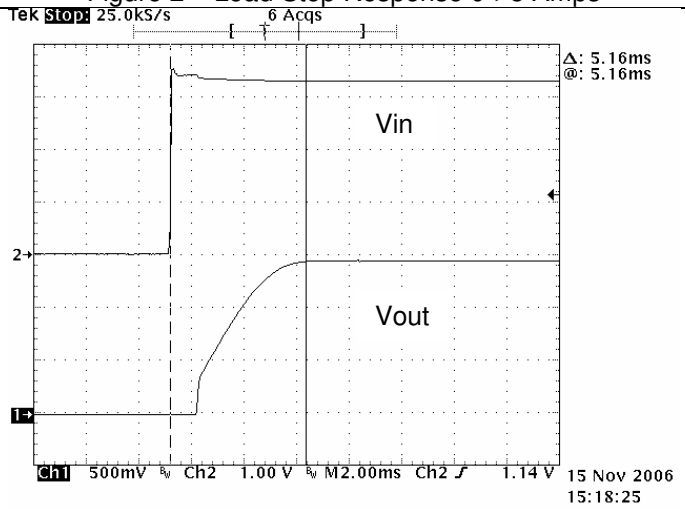


Figure 4 – Start-Up Response: in to 8 Amps

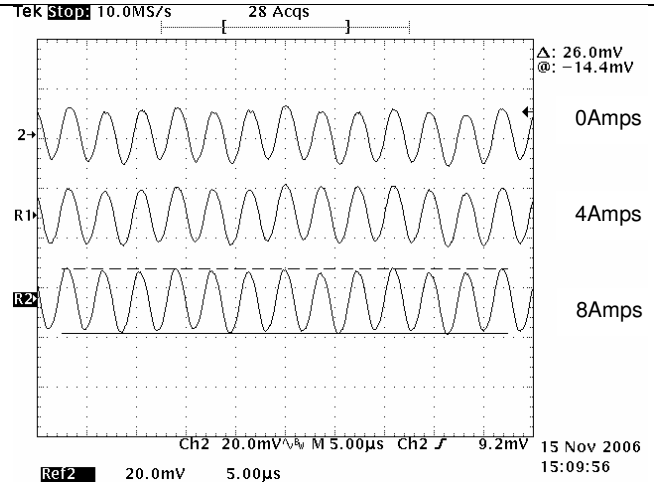
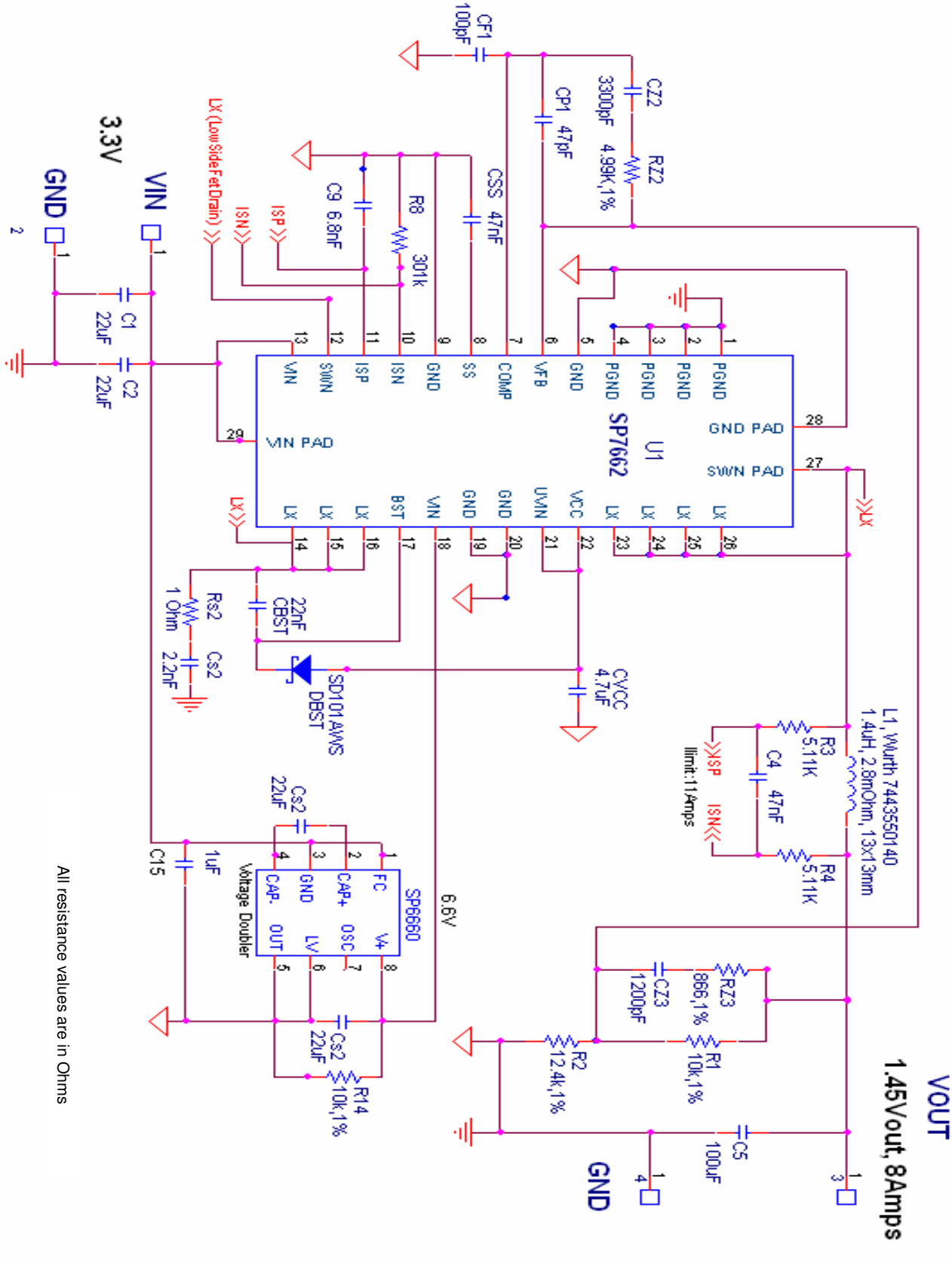


Figure 5 – Output Ripple, Various Output Current



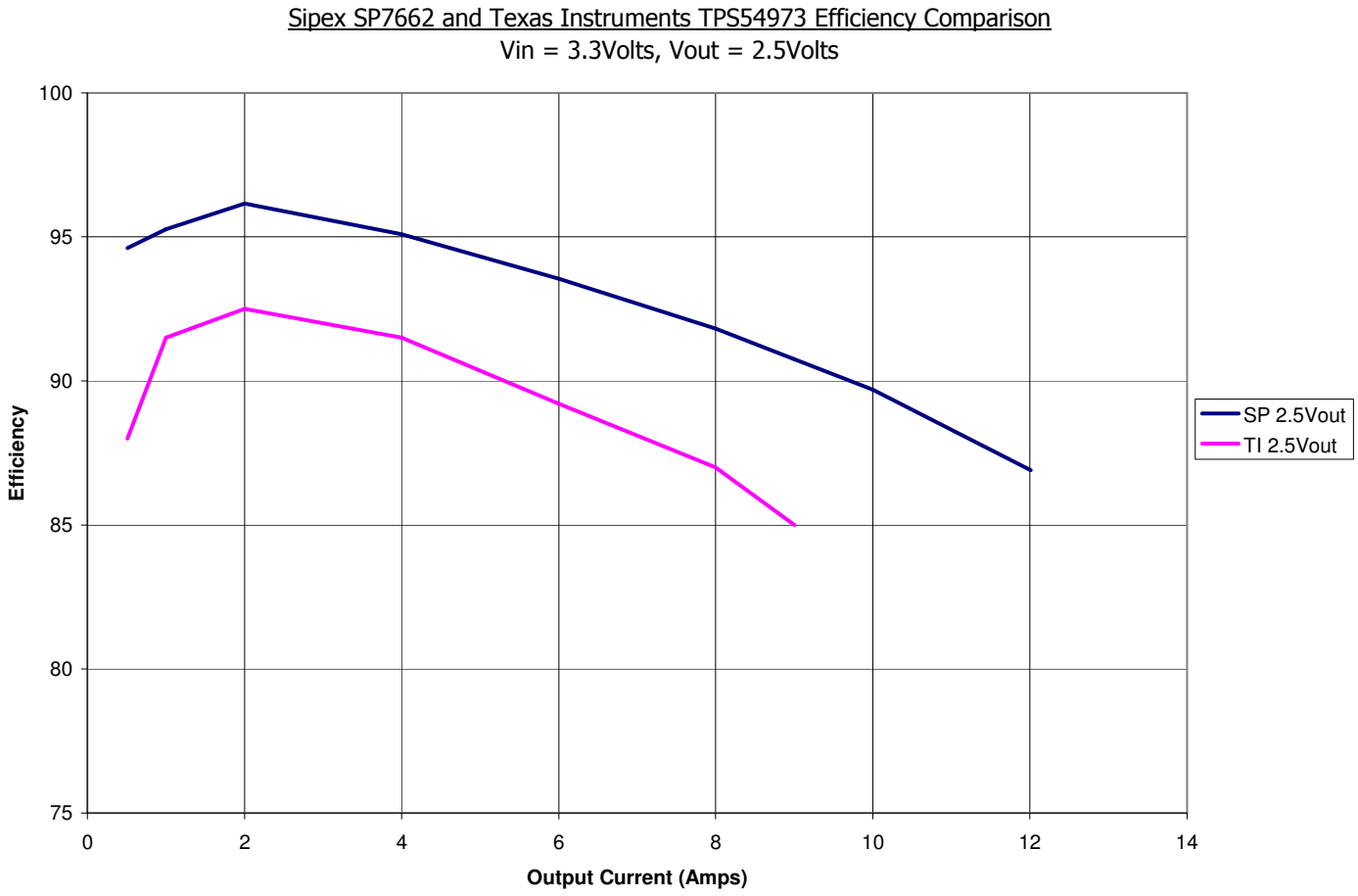
Converter Bill of Materials:

	7662		3.3Vin 1.45Vout 8Amps			
Line No.	Ref. Des.	Qty.	Manufacturer	Layout Size	Component	Vendor Phone #
1	PCB	1	Sipex		SP7662EB-07	978-667-7800
2	U1	1	Sipex	DFN-26	7662 Buck Regulator	978-667-7800
3	DBST	1	Vishay Semi	SOD-323	SD101AWS 15mA-30V Schottky	800-344-4539
4	L1	1	Wurth	5050	1.4uH, 2.8mΩ, 22A, 7443550140	201-785-8800
5	C1, C2	2	Murata	1210	22uF Ceramic X5R 6.3V	978-779-3111
6	C5	1	Murata	1210	100uF Ceramic X5R 6.3V	978-779-3111
7	C4,	1	Murata	0603	47nF Ceramic X7R 50V	978-779-3111
8	CBST	1	Murata	0603	0.1uF Ceramic X7R 50V	978-779-3111
9	C9	1	Murata	0603	6.8nF Ceramic X7R 50V	978-779-3111
10	CVCC	1	Taiyo Yuden	0603	4.7uF Ceramic X5R 10V	800-388-2496
11	CF1	1	Murata	0603	100pF Ceramic C0G 50V	978-779-3111
12	Cs2	1	Murata	0603	2.2nF Ceramic C0G 50V	978-779-3111
13	CSS1	1	Murata	0603	47nF Ceramic X7R 50V	978-779-3111
14	CP1	1	Murata	0603	47pF Ceramic C0G 50V	978-779-3111
15	CZ2	1	Murata	0603	3300pF Ceramic C0G 50V	978-779-3111
16	CZ3	1	Murata	0603	1200pF Ceramic C0G 50V	978-779-3111
17	R1	1	Panasonic	0603	10k Ohm Thick Film Res 1%	800-344-4539
18	R2	1	Panasonic	0603	12.4k Ohm Thick Film Res 1%	800-344-4539
19	R3, R4	2	Panasonic	0603	4.99k Ohm Thick Film Res 1%	800-344-4539
20	R12	*1	Panasonic	0603	0 Ohm Thick Film Res 1%	800-344-4539
21	R8	1	Panasonic	0603	301k Ohm Thick Film Res 1%	800-344-4539
22	R11	*1	Panasonic	0603	0 Ohm Thick Film Res 1%	800-344-4539
23	RBST	*1	Panasonic	0603	0 Ohm Thick Film Res 1%	800-344-4539
24	Rs2	1	Panasonic	0603	1 Ohm Thick Film Res 1%	800-344-4539
25	RZ2	1	Panasonic	0603	4.99k Ohm Thick Film Res 1%	800-344-4539
26	RZ3	1	Panasonic	0603	866 Ohm Thick Film Res 1%	800-344-4539
27	VIN, VOUT, GND x 2	4	Vector Electronic	.042 Dia	Test Point Post	800-344-4539

*=required for demo board operation, not required for end application

	6660 Voltage Doubler					
	Voltage Doubler	1	Sipex	uSOIC	SP6660 Charge Pump or Inverter	978-667-7800
	CD1, CD2	2	Murata	1210	22uF Ceramic X5R 10V	978-779-3111
	RD1	1	Panasonic	0603	10k Ohm Thick Film Res 1%	800-344-4539
	CD3	1	Murata	0603	1uF Ceramic X5R 50V	978-779-3111

Efficiency Comparison:



For further assistance:

Email: Sipexsupport@sipex.com
W W W Support page: http://www.sipex.com/content.aspx?p=support
Sipex Application Notes: http://www.sipex.com/applicationNotes.aspx
Type III loop Compensation Application Note:
http://www.sipex.com/files/ApplicationNotes/Type%20III%20Loop%20Compensation%20Oct12-06.pdf
Type III loop Compensation Calculator:
http://www.sipex.com/files/ApplicationNotes/TypeIIICalculator.xls

Sipex Corporation
Headquarters and
Sales Office
233 South Hillview Drive
Milpitas, CA95035
tel: (408) 934-7500
faX: (408) 935-7600