ANALOG DEVICES

SEPIC Converter; Input +30-60V; Output 3.3V 150mA

Reference Design **PRD1193**

FEATURES

- 30V to 60V Input Voltage Range
- Novel low cost "bootstrap" IC bias method for improved efficiency

DESCRIPTION

This is an ADP1613-based 30 - 60V input Cascode SEPIC converter which produces 3.3V output at 0 - 150 mA.

U1 (ADP1613 boost regulator) serves as the controller IC and Q1 is a Cascode (source-driven) power switch MOSFET.

At initial power-up, Q2 (MMBTA06) provides bias power to run the ADP1613. Once the output voltage reaches ~1.5V or so, Q3 attempts to turn off Q2 to save input power. However, while the output voltage is rising, C8 overrides the effect of Q3 by coupling current into the base of Q2 to keep it turned on. This assures that Q2 does not turn off (possibly shutting down the ADP1613) before the output voltage has risen adequately to power the IC. Once the output voltage settles at 3.3V, D2 provides ~3.0V power to the ADP1613, the C8-coupled override decays, and Q3 turns off Q2 for a significant gain in efficiency.

Note that the ADP1613 is set for ~650 KHz operation but the 60V to 3.3V conversion requires a duty cycle ~ 6%, which is less than the minimum which the ADP1613 is generally capable. The result is that the converter will tend to "pulse skip" at all values of load current when powered by 60V input. Output ripple should stay within specified limits however. Bench adjustment of compensation values R1-C1 may help improve ripple or dynamic load response, but the values shown are believed to be good.

Table 1. Target Specifications (0 to 55 degrees C)

Rail	Volts Min	Volts Nom	Volts Max	Current	Output Ripple
+5V	4.9	5	5.1	0 - 150 mA DC	50 mV p-p
Vinput	30	45	60	----	

Rev. A

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REVISION HISTORY

12/18/2009—Revision 0: Paper Design

Figure 1. Schematic Diagram

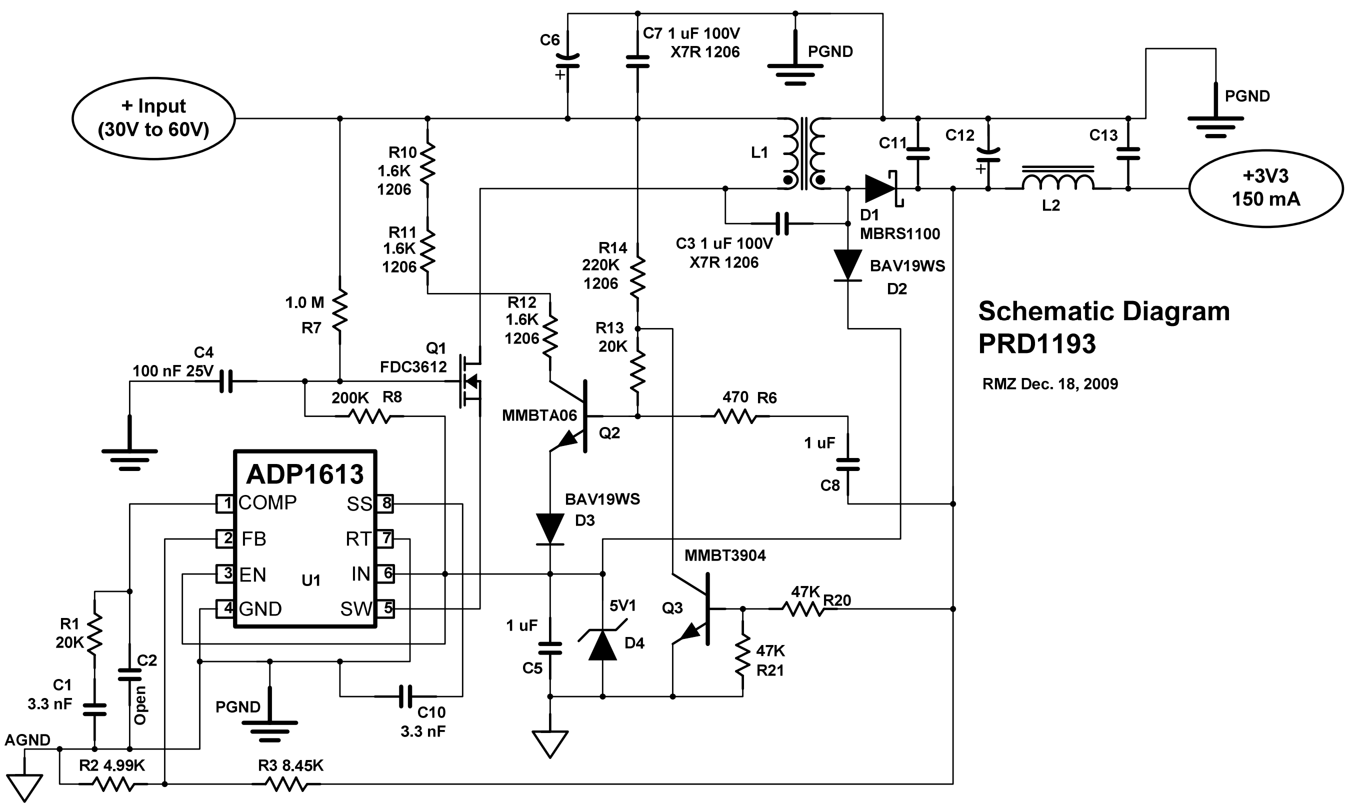

Table 2. Bill Of Materials

Seq.	*Ref Des.*	*Description*	*Manufacturer*	*Cost*	*Comment*
1	C1	3.3 nF 10% X7R 0603		$0.010	
2	C2	Not used			
3	C3	C3216JB2A105M	TDK	$0.120	Ceramic 1 uF 100V 1206 X7R
4	C4	100 nF 20% 25V X7R		$0.005	
5	C5	1 uF 16V X5R 0603		$0.010	
6	C6	EEUFC2A220	Panasonic	$0.090	Low ESR 22 uF 100V (Series FC)
7	C7	C3216JB2A105M	TDK	$0.120	Ceramic 1 uF 100V 1206 X7R
8	C8	1 uF 16V X5R 0603		$0.010	
9	C10	3.3 nF 10% X7R 0603		$0.010	
10	C11	22 uF 20% 6V3 X5R 0805		$0.060	
11	C12	EEU-FM0J561	Panasonic	$0.072	Low ESR 560 uF 6V3 (Series FM)
12	C13	22 uF 20% 6V3 X5R 0805		$0.060	
13	D1	MBRS1100	On Semi	$0.110	
14	D2	BAV19WS	Micro Commercial	$0.035	
15	D3	BAV19WS	Micro Commercial	$0.035	
16	D4	BZX84-C5V1	NXP	$0.019	
17	L1	MSD7342-473ML	Coilcraft	$0.620	
18	L2	LQH32CN4R7M53L	MuRata	$0.123	4.7 uH unshielded
19	Q1	FDC3612	Fairchild	$0.280	MOSFET 100V SOT-6
20	Q2	MMBTA06	On Semi	$0.040	
21	Q3	MMBT3904	On Semi	$0.015	
22	R1	20K 0603 5%		$0.002	
23	R2	4.99K 1% 0603		$0.003	
24	R3	8.45K 1% 0603		$0.003	
25	R6	470 ohm 0603 5%		$0.002	
26	R7	1.0M 1206 1%		$0.006	
27	R8	200K 0603 5%		$0.002	

Seq.	*Ref Des.*	*Description*	*Manufacturer*	*Cost*	*Comment*
28	R10	1.6K 1206 5%		$0.004	
29	R11	1.6K 1206 5%		$0.004	
30	R12	1.6K 1206 5%		$0.004	
31	R13	20K 0603 5%		$0.002	
32	R14	220K 1206 5%		$0.004	
33	R20	47K 0603 5%		$0.002	
34	R21	47K 0603 5%		$0.002	
35	**U1**	**ADP1613**		**$0.700**	
		Total BOM Cost		$2.584	

NOTES