

FEATURES

- Input - Output partially isolated to prevent ground loops
- Direct primary-secondary feedback through differential op amp provides accurate Vout control
- Better than 82% efficiency
- Frequency foldback for short circuit ruggedness
- Withstands brief 40V load dump input.

DESCRIPTION

This is a 10V - 14 input isolated flyback converter which uses the ADP1621 controller and an AD8691 operational amplifier. The target application of this converter is for powering a portable media player from the accessory power outlet of an automobile. The input-output isolation (-4V to +14V on audio output ground relative to input power ground) is provided to prevent ground loops between the power accessory plug and the connection from the media player to the car audio system.

The AD8691 op amp operates as a 0.25 gain differential amplifier for feedback. This amplifier tolerates this small isolation voltage with tight output voltage regulation from 0 mA to full load, but without the disadvantages that accompany an optocoupler-based feedback scheme. If the differential voltage between input ground and output ground exceeds the design limits, the op amp common mode input range can be violated which would cause the output to lose regulation. To prevent damage caused by common mode voltages beyond the design specification, zener diode D4 shuts down the converter via the ADP1621 SDSN pin during excessive audio ground excursions in the negative direction, and D5 accomplishes the same for positive excursions.

Resistors R31 and R32 are available to bring the common mode range into symmetry. Placing R31 = R32 = 27.4K 1% will improve the common mode range to make it approximately -12V to +12V. Diodes D4 and D5 will need to be adjusted to afford appropriate protection.

For the widest common mode range, replace U2 with a RRIO type such as AD8515 and use R31 = R32 = 13.3K.

When the converter is running normally, U2 output turns on Q2 to cause the ADP1621 to operate at 500 KHz. During output short circuit conditions, low U2 output turns off Q2 which lowers the switching frequency to 100 KHz so as to provide "frequency foldback" to reduce the output current for short circuit ruggedness.

The schematic diagram includes two alternative snubber designs. C9, D6, R11, R12 form a damped RCD clamp, which is the more-conventional approach. Instead of these parts, C2 = 10 nF and R20 = 10 ohms 1206 can be used as a SEPIC-related snubber. This provides a slight advantage in efficiency and BOM cost but it couples some additional common mode noise into the output. C3 should be increased to at least 33 nF or so in order to bypass common mode output current if the SEPIC snubber option is used.

Rev. A

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

Rail	Volts Min	Volts Nom	Volts Max	<i>Current</i>
+5V	4.9	5	5.1	0 - 1.2 Amps DC
Vinput	30	45	60	----

TABLE OF CONTENTS

Features	1
Description	1
Revision History	2

TABLE OF FIGURES

Figure 1. Schematic Diagram of Flyback Converter.....	3
Figure 2. Foldback Current Limiting (measured using SEPIC snubber)	6

REVISION HISTORY

02/23/2010—Revision A: Tested Prototype

Figure 1. Schematic Diagram of Flyback Converter

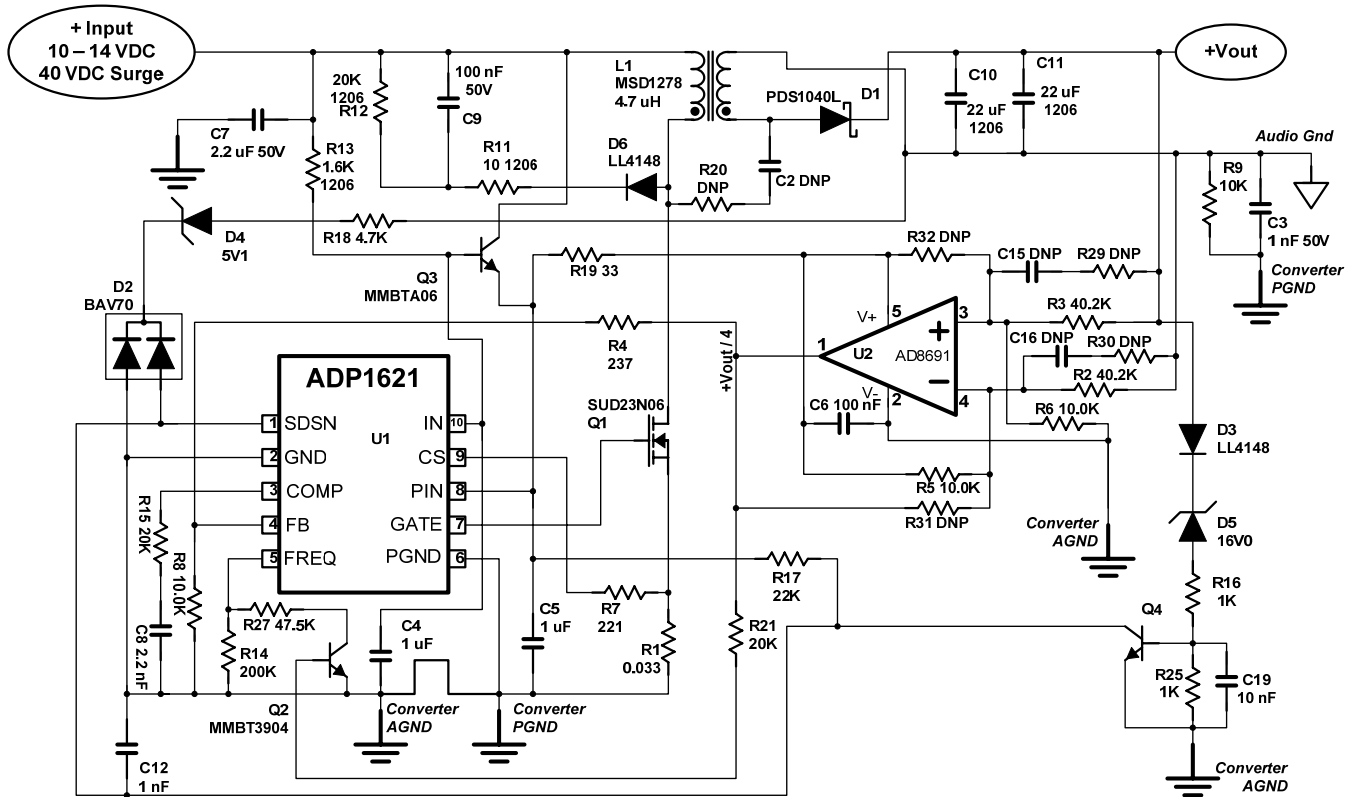


Table 2. Bill of Materials

Sequence	Ref Designation	Description
1	C2	DNP
2	C3	10 nF 50V X7R
3	C4	1 uF X5R 10V 0603
4	C5	1 uF X5R 10V 0603
5	C6	100 nF X7R 16V 0603
6	C7	2.2 uF GRM31CR71H225KA88
7	C8	2.2 nF X7R 25V 0603
8	C9	100 nF
9	C10	22 uF 10V X5R 1206
10	C11	22 uF 10V X5R 1206

Sequence	Ref Designation	Description
11	C12	1 nF X7R 25V 0603
12	C15	DNP
13	C16	DNP
14	C19	10 nF 50V X7R
15	D1	PDS1040L
16	D2	BAV70
17	D3	MMSD4148
18	D4	MMBZ5231
19	D5	MMBZ5246
20	D6	MMSD4148
21	L1	MSD1278 4.7 uH
22	Q1	SUD23N06 Vishay
23	Q2	MMBT3904
24	Q3	MMBTA06
25	Q4	MMBT3904
26	R1	Res 0.033 ohms 5% RL1220T-R033-J
27	R2	Res 40.2K 0603 1%
28	R3	Res 40.2K 0603 1%
29	R4	Res 237 0603 1%
30	R5	Res 10.0K 0603 1%
31	R6	Res 10.0K 0603 1%
32	R7	Res 221 ohms 1%
33	R8	Res 10.0K 0603 1%
34	R9	Res 10K 0603 5%
35	R11	Res 10 ohms 1206
36	R12	Res 1K 1206 5%
37	R13	Res 1.6K 1206 5%

Sequence	Ref Designation	Description
38	R14	Res 200K 0603 1%
39	R15	Res 20K 0603 5%
40	R16	Res 1K 0603 5%
41	R17	Res 10K 0603 5%
42	R18	Res 4.7K 0603 5%
43	R19	Res 33 Ohms 0603 5%
44	R20	DNP
45	R21	Res 20K 0603 5%
46	R25	Res 1K 0603 5%
47	R27	Res 47.5K 0603 1%
48	R29	DNP
49	R30	DNP
50	R31	DNP
51	R32	DNP
52	U1	ADP1621
53	U2	AD8691

Figure 2. Foldback Current Limiting (measured using SEPIC snubber)

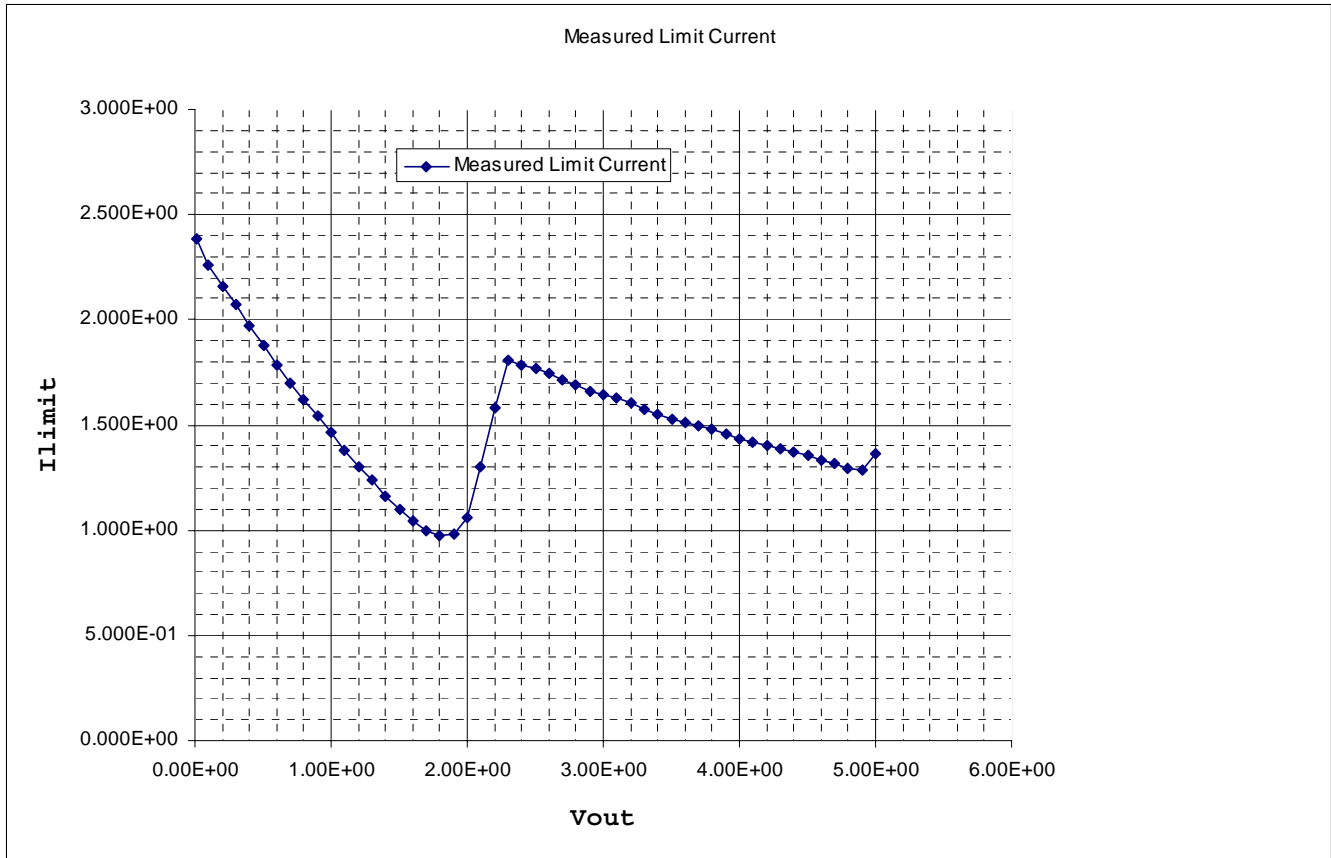


Table 3. Spot Efficiency Measurement

Vin	Amps Input	Watts Input	Vout	Amps Output	Watts Output	Efficiency
1.207E+01	6.040E-01	7.290E+00	4.997E+00	1.200E+00	5.996E+00	82.26%

NOTES