

Design Example Report

Title 1.8W non-isolated Power Supply us LNK304				
Specification	Input: 85-265V _{AC} Output: 12V/150mA			
Application	tion Home Appliance			
Author	Power Integrations Applications Department			
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Objective

This report lists a design for a single output offline non-isolated power supply for white goods low cost applications.

- Highly integrated solution
- Lowest possible component count
- No optocoupler or zener diode required for regulation
- Integrated thermal overload protection with automatic recovery
- Less then 300mW no-load consumption
- Very high efficiency at full load

The products and applications illustrated herein (including circuits external to the products and transformer construction) may be covered by one or more U.S. and foreign patents or potentially by pending U.S. and foreign patent applications assigned to Power Integrations. A complete list of Power Integrations' patents may be found at www.powerint.com.

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Important Note:

This board is designed to be non-isolated. Please take necessary safety precautions.

Design Reports contain a power supply design specification, schematic, bill of materials, and transformer documentation. Performance data and typical operation characteristics are included. Typically only a single prototype has been built.

Introduction

This document is an engineering report describing a 12V, 150mA non-isolated power supply using a LNK304 from Power Integrations.

This document contains the power supply specification, schematic, bill of materials and measurements results.

2 Power Supply Specification

Description	Symbol	Min	Тур	Max	Units	Comment
Input						
Voltage	V _{IN}	85		265	V_{AC}	
Frequency	f _{LINE}	47	50/60	63	Hz	
Outputs						
Output Voltage	V _{out}		12		V	[±10%]
Output Ripple Voltage	V _{RIPPLE}			n.sp.	mV	20 MHz Bandwidth
Output Current	I _{OUT}		150		mA	
Total Output Power						
Continuous Output Power	P _{OUT}		1.8		W	
Peak Output Power	P _{OUT_PEAK}				W	
Ambient Temperature	Т _{АМВ}	0		70	°C	Open frame

Table 1 - Power Supply Specifications

3 Schematic

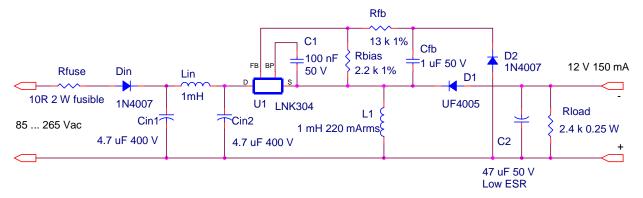


Figure 1 - Complete Schematic

4 Circuit Description

The LNK304 is used in a non-isolated buck-boost topology. The voltage across L1 is rectified and smoothed by D1 and C2 during U1's off-time. To a first order the forward voltage drop of D2 (slow diode used in the tests) and D1 (must be an ultrafast) can be considered similar. Therefore the voltage across Cfb tracks the output voltage. The voltage across Cfb is sensed and regulated via the resistor divider Rfb-Rbias connected to U1's FB pin. The LNK304 switching algorithm regulates the FB pin to 1.65V +/- 7% over temperature. A small pre-load resistor has been added (Rload with 5mA current consumption) for operation down to 0mA output current.

Bill Of Materials

Ref	Description	Uprice	QTY
Rfuse	10R 2W fusible	0.0400	1
Din	1N4007	0.0072	1
Cin1, Cin2	4u7 400V	0.0570	2
Lin	1mH	0.0290	1
C1	100nF	0.0100	1
D1	1 UF4005		1
Rbias	2K2 1%	0.0033	1
Rfb	13K 1%	0.0033	1
Cfb	1uF 50V	0.0100	1
D2	1N4007	0.0072	1
Rload	oad 2K4 5% 0.25W		1
L1	1 1mH 220mArms		1
C2	47uF 50V		1
U1	LNK304P		1

Table 2 - Bill of Materials

Performance Data

All measurements performed at room temperature, 50 Hz input frequency.

6.1 Efficiency

6.1.1 Full load efficiency

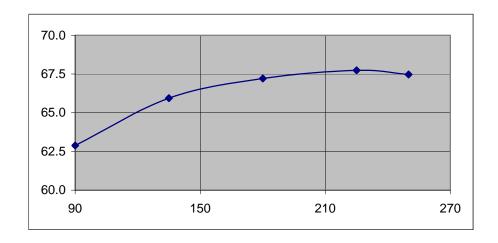


Figure 2 – Efficiency measurements vs. input voltage (@150mA load)

6.1.2 No load consumption

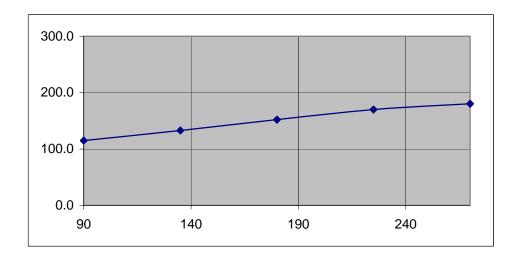


Figure 3 - Input power in mW at no load output

6.2 Regulation

6.2.1 Line regulation

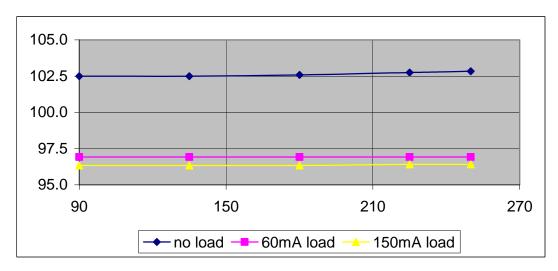


Figure 4 – Output voltage tolerance (in % of the nominal output voltage level)

Vs. input voltage, @ 0.150mA load

6.2.2 Load regulation

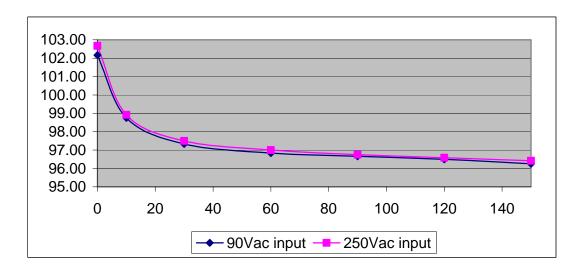


Figure 5 - Load regulation (in % of the nominal output voltage level)

7 Revision History

Date 4/8/05	Author TP	Revision 1.0	Description & changes Initial release	Reviewed VC/JC / AM

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