Design Example Report

Title	***1.8W non-isolated Power Supply using LNK304***
Specification	Input: 85-265V_{AC} Output: 12V/150mA
Application	Home Appliance
Author	Power Integrations Applications Department
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Revision	1.0

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

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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.

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1 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	Typ	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	T_{AMB}	0		70	°C	Open frame

Table 1 – Power Supply Specifications

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3 Schematic

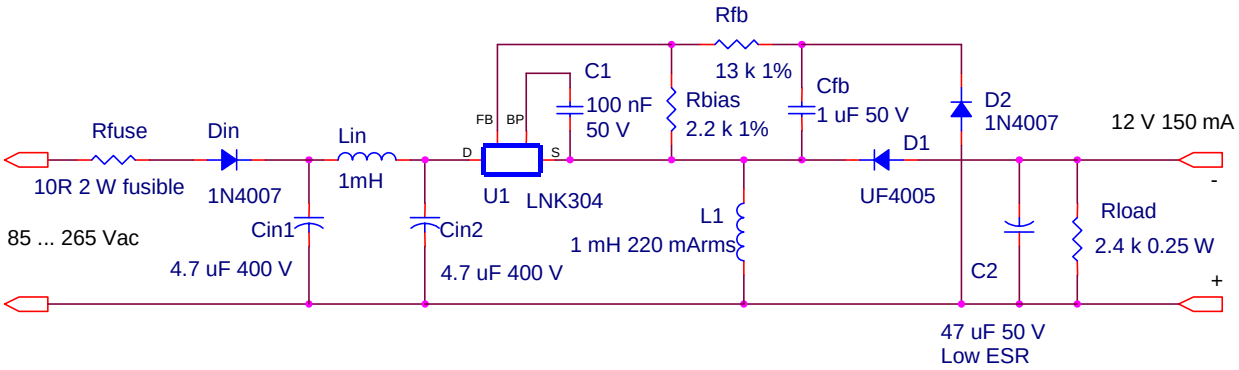

Figure 1 – Complete Schematic

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.

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5 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	UF4005	0.0450	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	2K4 5% 0.25W	0.0015	1
L1	1mH 220mArms	0.0700	1
C2	47uF 50V	0.0450	1
U1	LNK304P	0.0000	1

Table 2 - Bill of Materials

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6 Performance Data

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

6.1 Efficiency

6.1.1 Full load efficiency

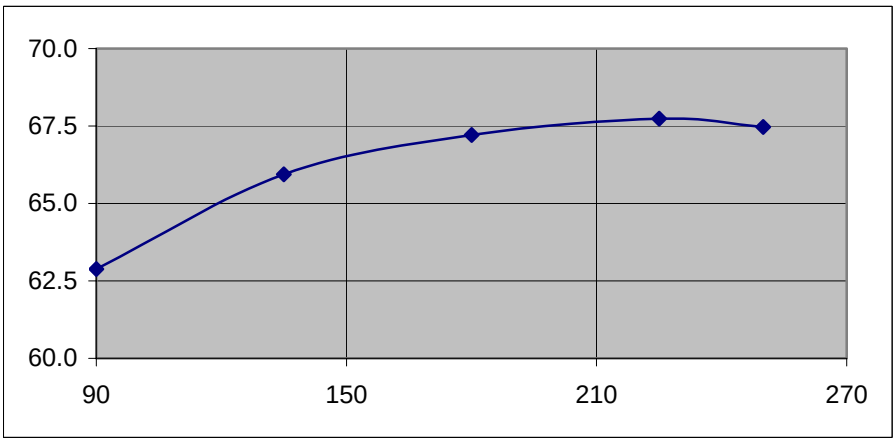

Figure 2 – Efficiency measurements vs. input voltage (@150mA load)

6.1.2 No load consumption

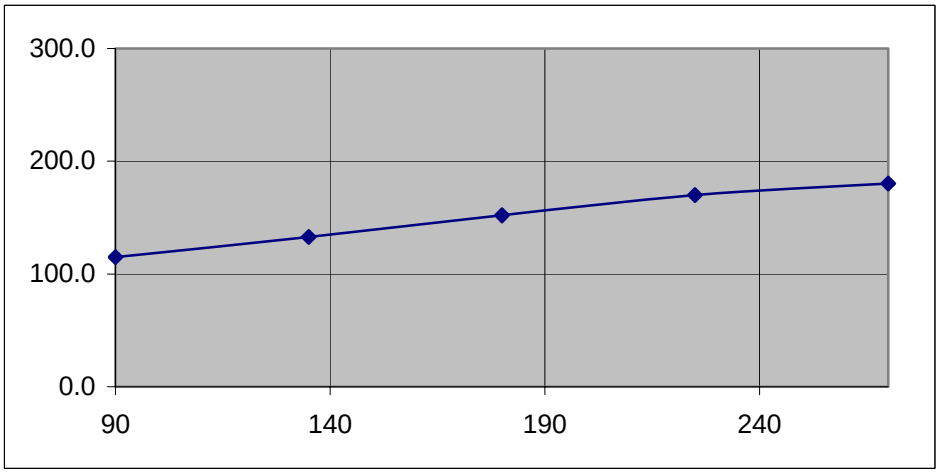

Figure 3 - Input power in mW at no load output

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6.2 Regulation

6.2.1 Line regulation

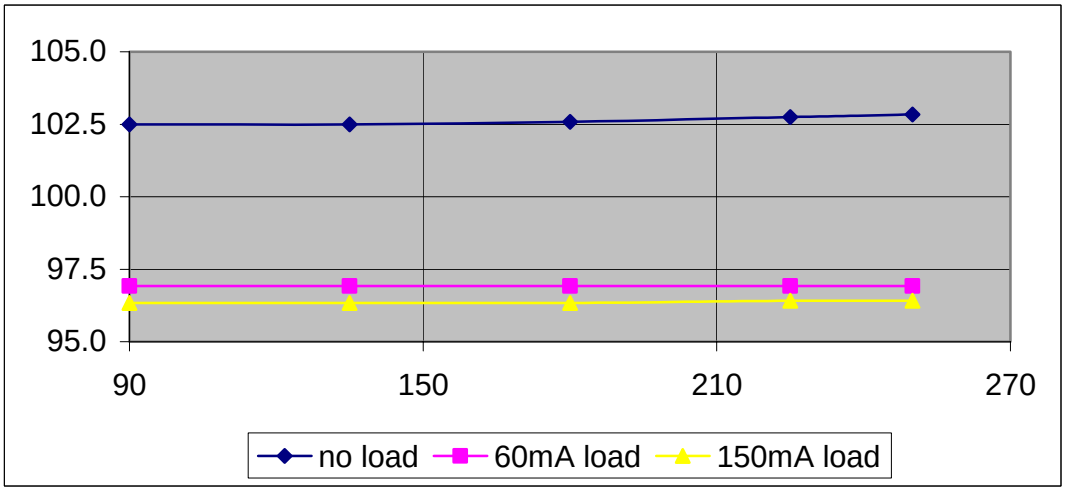

Figure 4 – Output voltage tolerance (in % of the nominal output voltage level)

Vs. input voltage, @ 0.150mA load

6.2.2 Load regulation

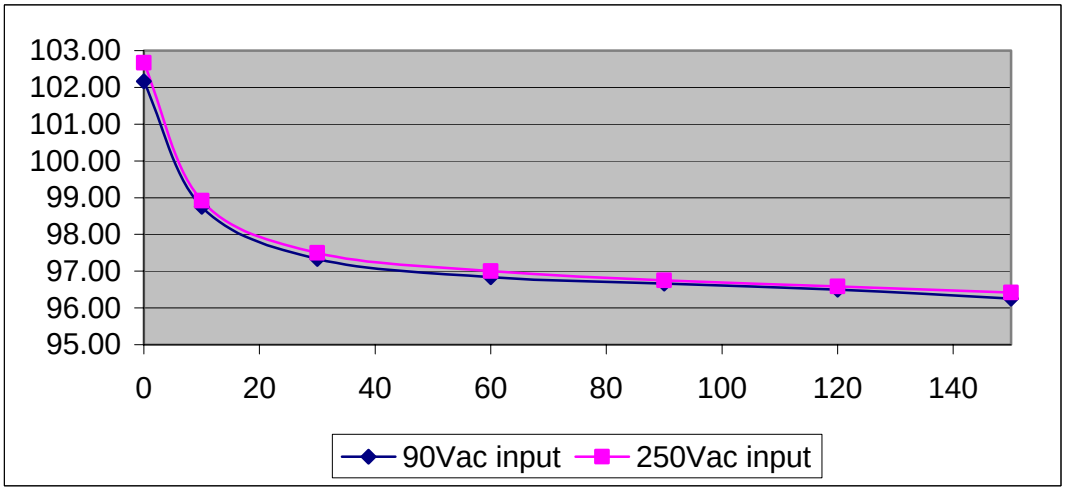

Figure 5 - Load regulation (in % of the nominal output voltage level)

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7 Revision History

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

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