

ON Semiconductor

Is Now

onsemi™

To learn more about onsemi™, please visit our website at
www.onsemi.com

onsemi and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.

**A 24 Vin, 40 Watt, Low Cost, DC-to-DC Converter**

ON Semiconductor

Device	Application	Input Voltage	Output Power	Topology	I/O Isolation
NCP1251B NCP431	Instruments, Telecom and Industrial Equipment	20 - 32 Vdc	40 Watts	DCM Flyback	Yes

Other Specification

	Output 1	Output 2	Output 3	Output 4
Output Voltage	12 Vdc	N/A	N/A	N/A
Ripple	< 2%	N/A	N/A	N/A
Nominal Current	3 Amps	N/A	N/A	N/A
Max Current	3.3 Amps	N/A	N/A	N/A
Min Current	zero	N/A	N/A	N/A

PFC (Yes/No)	No
Minimum Efficiency	>75%
Inrush Limiting / Fuse	Fuse
Operating Temp. Range	0 to 50C
Cooling Method / Supply Orientation	Convection NA
Signal Level Control	No

Others	Input EMI filter
---------------	------------------

Circuit Description

This Design Note describes a very simple, low cost, yet high performance dc-to-dc converter using ON Semiconductor's NCP1251B current mode controller (TSOP6 package) and the NCP431 programmable zener (SOT23 package).

The 65 kHz flyback converter design operates in discontinuous conduction mode (DCM) and uses the conventional optocoupler (U2) feedback scheme for the voltage loop. Vcc for the NCP1251 current mode controller is derived directly from the dc input voltage via D2 and R1. The Design Note provides the complete circuit and transformer design details for a 12 volt, 3 amp output version. Other output voltages from 3.3 up to 28 Vdc are easy to implement by modifying the values (or ratings) of R8, R11, R12, C9, D5 and T1's secondary turns.

Over-current limiting is provided by sensing the peak current in the MOSFET Q1 via R6. Once the 800 mV threshold level on U1's pin 4 is exceeded the circuit will go a "hiccup" mode until the over-current condition is removed. A Vcc OVP circuit is implemented via Z1, while D1 (and fuse F1) provide reverse voltage polarity for the dc input.

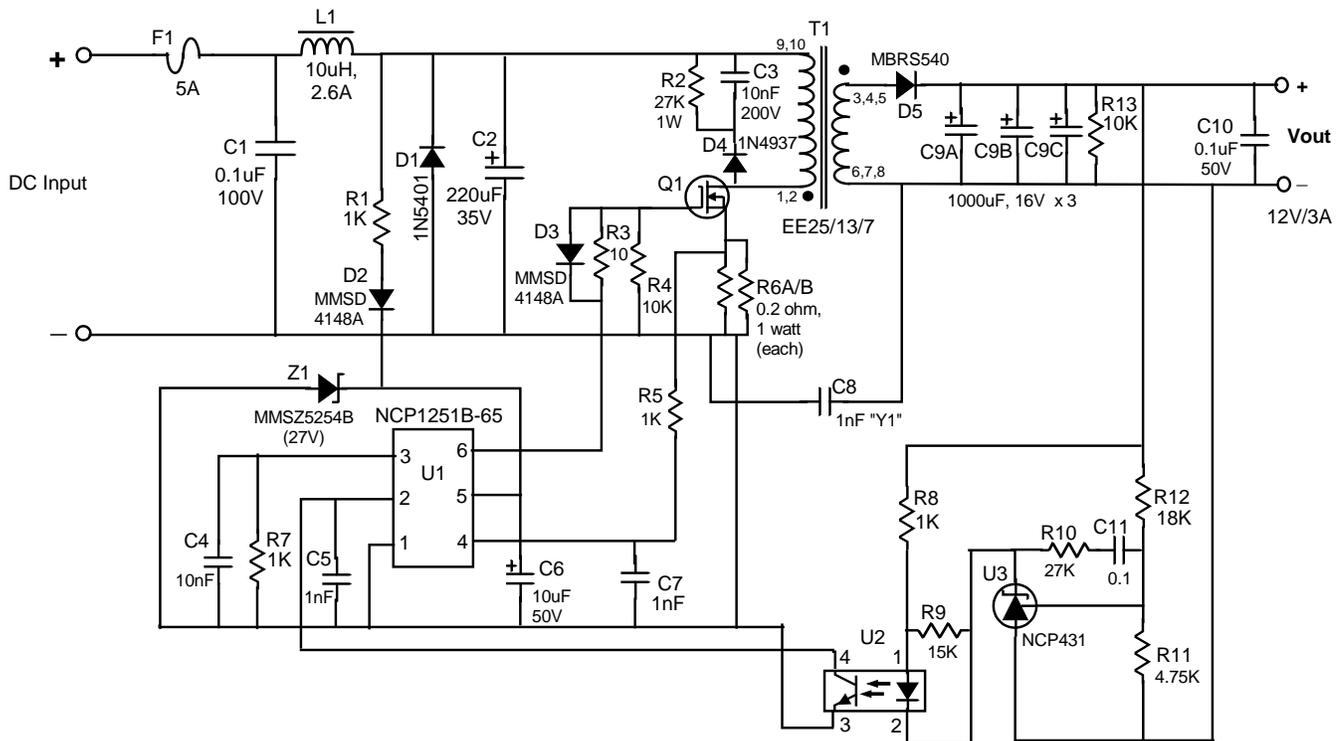
Depending on the application, it may be necessary to add a small pi-network ripple filter to the output as shown in the lower section of the schematic below.

Key Features

- Input EMI filter (L1, C1) for input EMI compliance
- Schottky output rectifier for high efficiency
- Current mode control
- Small pc board footprint
- Low cost component

DN05032/D

Schematic

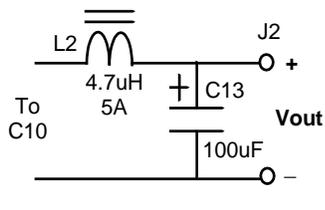


NOTES:

1. Crossed lines on schematic are NOT connected.
2. U2 is NEC PS2561L-1 or equivalent optocoupler (CTR > 50%).
3. L1 is Würth 744 772 100 inductor (10 uH, 2.6A)
4. Output caps (C9A/B/C) are radial lead, low impedance types (UCC LXV series or similar).
5. R12 sets Vout.
6. R6A/B sets max output current (0.1 ohms, 2W total for 40Woutput)
7. D1 is for reverse input polarity protection.
8. Q1 is an NTP6410AN on small TO-220 heatsink.
9. See drawing for T1 details.

40 Watt NCP1251B-65 DC/DC Converter (28Vin/65kHz) Rev. 2

Optional Ripple Filter



© 2012 ON Semiconductor.

Disclaimer: ON Semiconductor is providing this design note "AS IS" and does not assume any liability arising from its use; nor does ON Semiconductor convey any license to its or any third party's intellectual property rights. This document is provided only to assist customers in evaluation of the referenced circuit implementation and the recipient assumes all liability and risk associated with its use, including, but not limited to, compliance with all regulatory standards. ON Semiconductor may change any of its products at any time, without notice.

Design note created by Frank Cathell, e-mail: f.cathell@onsemi.com

MAGNETICS DESIGN DATA SHEET

Project / Customer: ON Semiconductor - 40 watt, 12V/3AV NCP1251 DC-DC Flyback

Part Description: 45 watt flyback transformer, 12V/3 amp out, 24 Vdc nominal input

Schematic ID: T1

Core Type: EE25/13/7 ferrite core; 3C90 material or similar

Core Gap: Gap for 22 uH +/- 10% across primary (pins 1 - 10)

Inductance: 22 uH nominal (+/- 10%) on primary

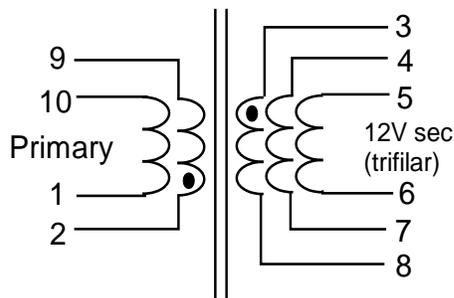
Bobbin Type: 10 pin horizontal mount for EE25/13/7 core

Windings (in order):

Winding # / type	Turns / Material / Gauge / Insulation Data
Primary (1,2 - 10,9)	12T of 2 strands of #24 mag wire bifilar over 1 layer. Insulate to 1 kV to next winding. Self leads to separate pins as shown in schematic below..
12V Secondary (3,4,5 - 8,7,6)	7 turns of 3 strands of #24 wound trifilar over one layer. Self leads to single pins for each wire as shown in drawing below. Insulate with tape for 1 kV breakdown.

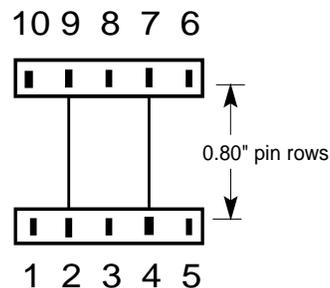
Hipot: 1 kV from primary to secondary for 1 minute.

Schematic



Lead Breakout / Pinout

(Bottom View of Bobbin)



DN05032/D

References:

NCP1251 Data Sheet: http://www.onsemi.com/pub_link/Collateral/NCP1251-D.PDF

NCP1250/1251 Application Notes: AND8453/D, AND8468/D, AND8469/D, AND8488/D

NCP1251 Design Notes: DN05012, DN05017, DN05028, DN05029

NCP1031 DC-DC Converter Data Sheet: http://www.onsemi.com/pub_link/Collateral/NCP1030-D.PDF

NCP1030/1031 Application Notes: AND8119/D, AND8247/D

NCP1030/1031 Design Notes: DN06007, DN06046