

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.



ON Semiconductor

DN06007/D

Design Note – DN06007/D

Wide Input Range (20 Vdc to 140 Vdc) DC to DC Converter

Device	Application	Input Voltage	Output Power	Topology	I/O Isolation
NCP1031	Industrial	20 to 140 Vdc	2.5 W	Flyback	Yes

Other Specifications

	Output 1	Output 2	Output 3	Output 4
Output Voltage	5.0 Vdc (1%)	12.0 Vdc (5%)	N/A	N/A
Ripple	100 mV	100 mV	N/A	N/A
Nominal Current	180 mA	100 mA	N/A	N/A
Max Current	180 mA	100 mA	N/A	N/A
Min Current	50 mA	10 mA	N/A	N/A

PFC (Yes/No)	No
Minimum Efficiency	55%
Operating Temp Range	-10 to +60 °C

Circuit Description

The 2.5 W dc to dc converter utilizes the NCP1031 monolithic controller (U1) in a discontinuous mode flyback converter. An optional EMI filter comprised of C1, C11, and L1 is also included. A simple, isolated voltage feedback scheme is implemented with zener Z1 and optocoupler U2 to control the feed back pin of U1 and regulate the 5 V output. The flyback transformer (T1) utilizes a “stacked” winding configuration for the 12 V output to improve its cross regulation. Input under- and over- voltage shut down can be configured by selecting the correct values for R6, 7 and 8 (see NCP1031 data sheet on onsemi.com).

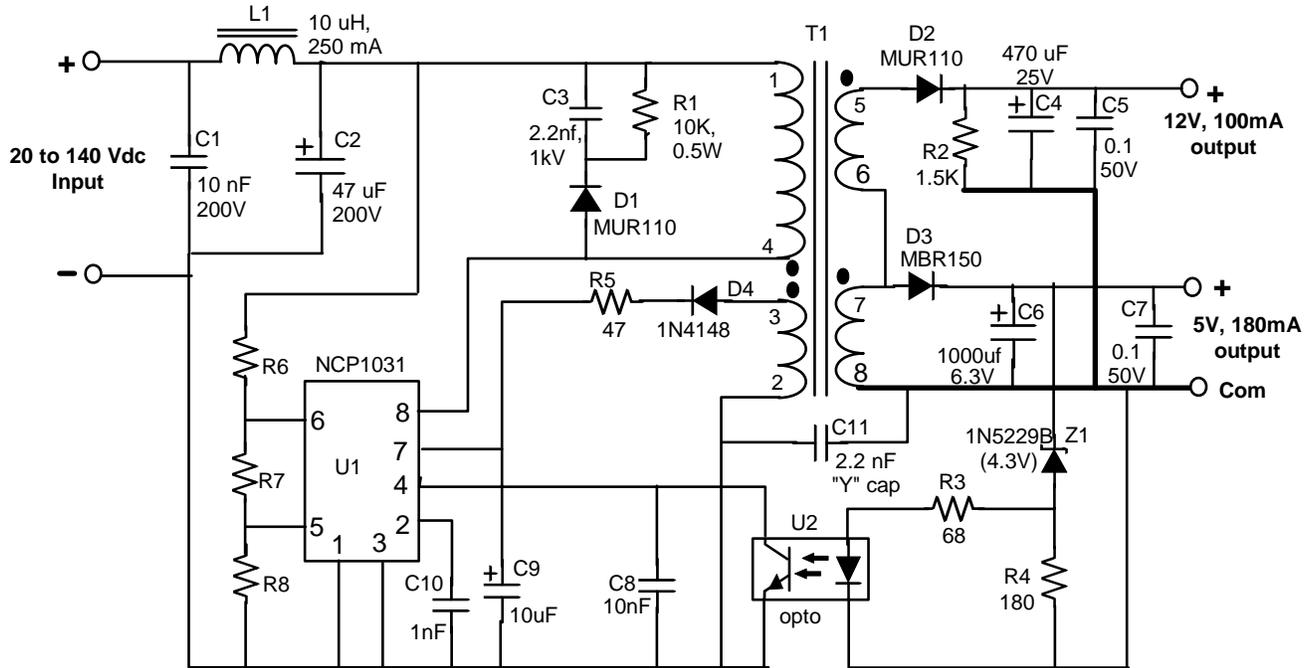
Key Features

- Very wide range input: 20 to 140 Vdc.
- Monolithic PWM controller with 200 V MOSFET
- Dual outputs with “stacked” windings
- Input EMI filter
- Extremely simple design with few components
- 200 kHz switching frequency

DN06007/D

Schematic

WIDE RANGE INPUT, 2.5 W DC-DC CONVERTER



NOTES:

1. Crossed lines on schematic are not connected.
2. U2 is Vishay SFH6156A-4 optocoupler or similar.
3. R6, R7, and R8 set input OV and UV trip points. See NCP1031 data sheet to determine values.
4. Z1 sets 5V output voltage ($V_{out} = V_z + 0.9V$ approximately.)
5. C1, C11, and L1 are for EMI compliance (optional).
6. C10 sets switching frequency to 200 kHz.
7. See magnetics design sheet for T1 details.

DN06007/D

Magnetics Design Data Sheet

Part Description: 3 watt, 200 kHz dual output flyback transformer

Schematic ID: T1

Core Type: Ferroxcube EF16 (E16/8/5); 3C95 material or similar

Core Gap: Gap for 85 - 100 uH

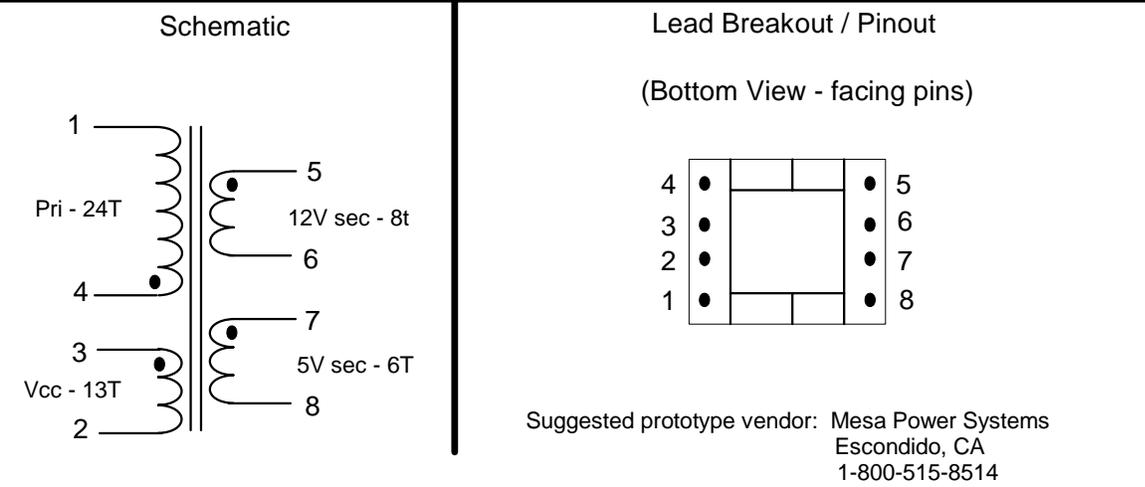
Inductance: 90 uH nominal

Bobbin Type: 8 pin horizontal mount for EF16

Windings (in order):

Winding # / type	Turns / Material / Gauge / Insulation Data
Vcc/Boost (2 - 3)	13 turns of #28HN spiral wound over 1 layer. Insulate with mylar tape for 250V min. insulation to next winding.
Primary (1 - 4)	24 turns of #28HN over 1 layer. Insulate for 1.5 kV to the next winding with mylar tape.
5V/12V Secondary (7 - 8, 5 - 6) (stacked winding)	6 turns of two different color strands of #28HN bifilar wound with two additional turns with one of the colors (8 total). This will be the 12V winding. The winding should be centered on the primary with 2 mm end margins (approximately.) Terminate as shown in the schematic below with the 8 turn (12V) winding terminating to pins 5 & 6 and The 5V winding (6 turns) terminating to pins 7 & 8.

Hipot: 1.5 kV from Vcc boost & primary to secondary



© 2006 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