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Design Note – DN06007/D

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

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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

Schematic

WIDE RANGE INPUT, 2.5 W DC-DC CONVERTER
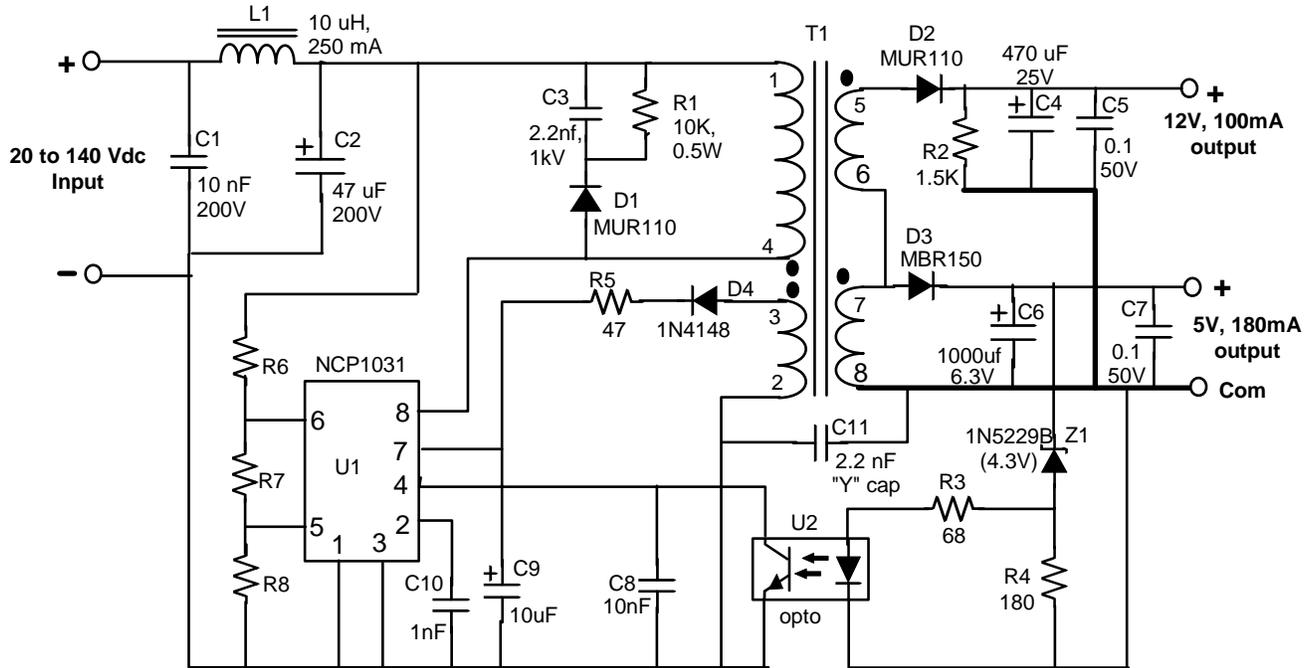
NOTES:

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 (Vout = Vz + 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.

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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 9approximately.) 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
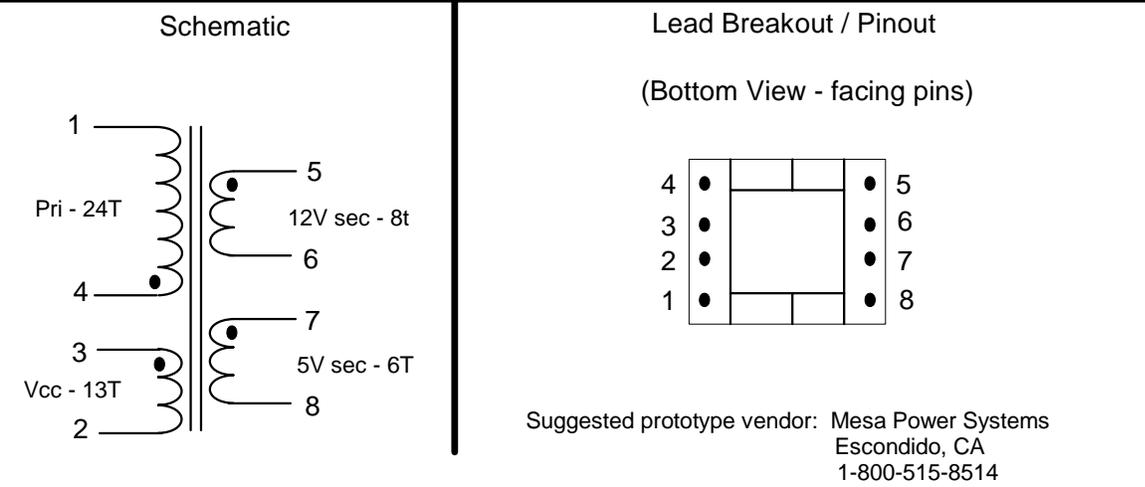
Schematic	Lead Breakout / Pinout

(Bottom View - facing pins)

1

Pri - 24T

5

12V sec - 8t

6

4

3

Vcc - 13T

7

5V sec - 6T

8

2

4   5
3   6
2   7
1   8

Suggested prototype vendor: Mesa Power Systems
Escondido, CA
1-800-515-8514

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