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Design Note – DN06002/D

1 W, Dual Output, Off-line Converter

Device	Application	Input Voltage	Output Power	Topology	I/O Isolation
NCP1012	Auxiliary off-line power supply for appliances	85 to 270 Vac	1 W	Buck/Flyback	None

Other Specifications				
	Output 1	Output 2	Output 3	Output 4
Output Voltage	- 5 V	- 12 V	N/A	N/A
Ripple	100 mV	200 mV	N/A	N/A
Nominal Current	100 mA	50 mA	N/A	N/A
Max Current	100 mA	50 mA	N/A	N/A
Min Current	10 mA	0 mA	N/A	N/A

PFC (Yes/No)	Passive due to low input C
Minimum Efficiency	70%
Operating Temp Range	0 to +55 °C
Cooling Method/Supply Orientation	Convection

Circuit Description

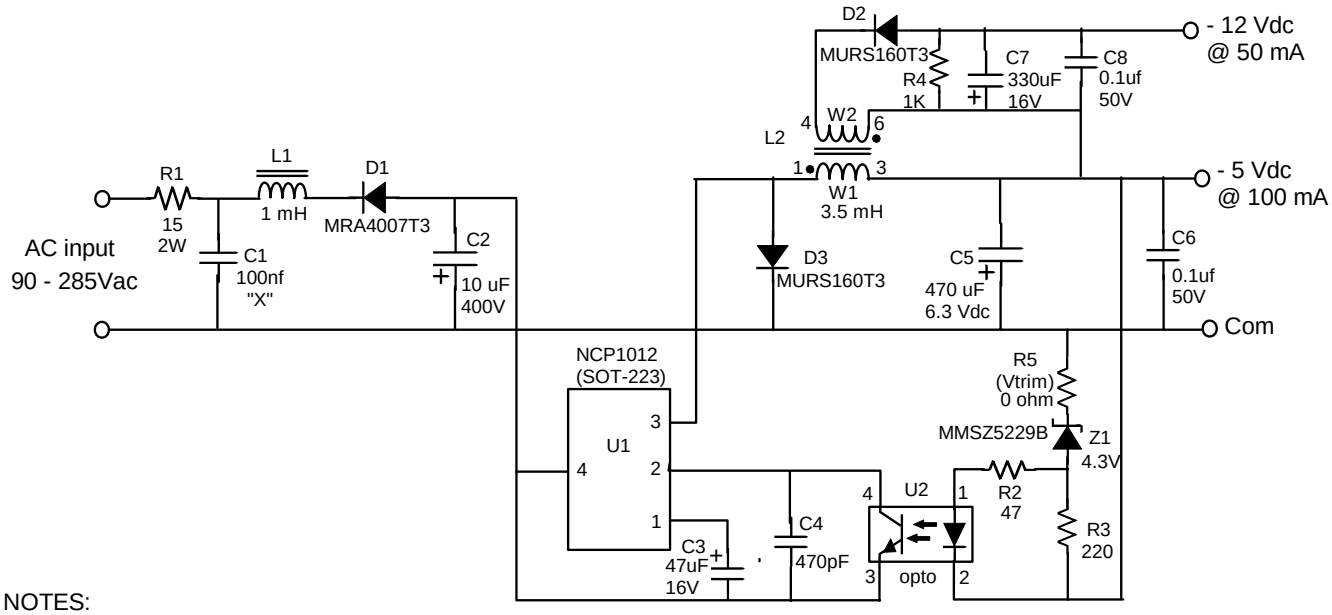
This design is intended for low power applications where 5 V and/or 12 V may be necessary for control circuits in appliances or similar devices in which mains isolation is not required and low cost and simplicity are mandatory. The topology is an off-line buck converter configured for a 5 volt negative output with an additional negative 12 volt output derived from a secondary flyback winding on the buck choke. The schematic notes detail how this circuit can be converted for positive outputs if desired.

The input section uses half-wave rectification for simplicity and allows the output common to be referenced to the mains neutral line. An input EMI filter is provided for conducted emissions compliance. Good output cross regulation is achieved on the 12 V output with the use of stacked windings in the buck choke. Regulation feedback is achieved with a simple zener diode and optocoupler circuit that also provides the required offset floating for the NCP1012 controller.

Key Features

- Extremely simple and cost effective low power supply to provide non-isolated, low voltage outputs.
- Good cross regulation due to stacked windings in the buck choke.
- Low cost monolithic NCP1012 integrated controller with self-biased Vcc used for buck converter.
- EMI filter on AC input for agency compliance.
- Output polarities easily reversible without component changes.
- Over current protection.
- 2 watt capability if NCP1014 is used for U1.

Schematic



NOTES:

1. Crossed lines on schematic are not connected.
2. U1 should have ground tab (pin 4) soldered to expanded ground plane area for good heatsinking (SOT-223 recommended package).
3. U2 is Vishay H11A817A optocoupler or equivalent
4. R1 provides inrush limiting at turn-on (optional).
5. C5 capacitance value dependent on max Vout ripple; 470 uF min recommended.
6. L1 is Cooper/Bussmann UP2B-102R inductor (Uni-Pac series - 1 mH, 0.3 A) or similar.
7. L2 is P18/11/I ferrite core (1811 pot core without hole) on 6 pin pc mount bobbin;
   W1 is 92 turns of #32HN (0.25 mm dia) magnet wire wound over 4 layers (23 turns per layer).
   W2 is 115 turns of #32 HN magnet wire woundover 5 layers (23 turns per layer).
   Core should be gapped to give an inductance of 3.4 to 3.6 mH across W1.
8. R5 is option voltage trim resistor - increasing resistance increases Vout.
9. For positive outputs: reverse diodes D1, D2, and D3; apply dc input to pin 3 of U1 and output will be on pin 4; reverse voltage sensing so cathode of zener goes to 5V output and pin 2 of U2 (opto) goes to output common; reverse polarity of input and output caps C2, C5 and C7.

NCP1012 1 Watt, Dual Output Converter
ON Semiconductor Applications Group

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