ON Semiconductor

Design Note – DN06005/D

3 Output, 10 W Off-line Power Supply

Device	Application	Input Voltage	Output Power	Topology	I/O Isolation
NCP1014	Auxiliary off-line power supply for appliances	90 to 270 Vac	10 W	Flyback	Yes

Other Specifications				
	Output 1	Output 2	Output 3	Output 4
Output Voltage	5 V	12 V	-5 V isolated	N/A
Ripple	100 mV	100 mV	25 mV	N/A
Nominal Current	750 mA	300 mA	250 mA	N/A
Max Current	1 A	500 mA	400 mA	N/A
Min Current	50 mA	10 mA	0	N/A

PFC (Yes/No)	No
Minimum Efficiency	68%
Operating Temp Range	0 to +60°C
Cooling Method/Supply Orientation	Convection

Others	Isolated negative 5 volt output with tight regulation.

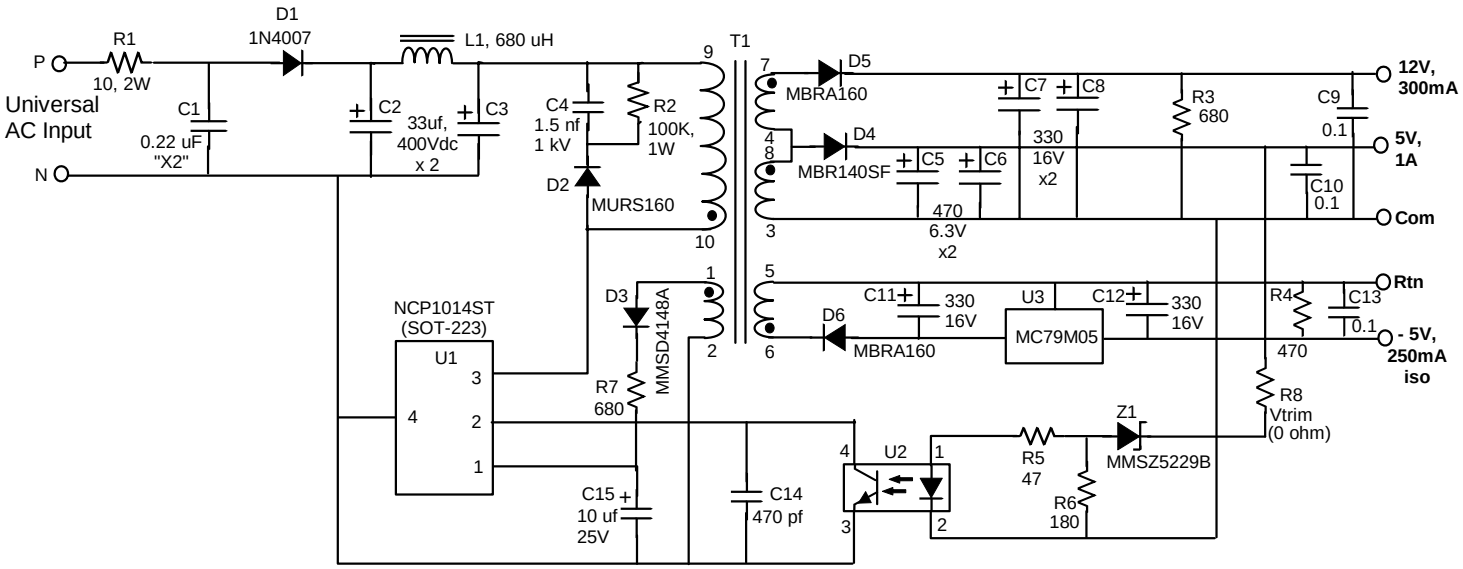
Circuit Description

This universal input, off-line switchmode power supply provides 3 mains isolated and regulated outputs. The converter circuit is a flyback based topology utilizing ON Semi's NCP1014 monolithic switcher in an SOT-223 package. The output provides 5 and 12 volts with an additional negative 5 volt output that is isolated galvanically from the other two outputs. For simplicity, the AC input is half-wave rectified via D1 and conducted EMI is attenuated by C1 and L1. A standard bridge rectifier can be substituted if desired with lower line frequency ripple. U1 is power by an aux winding on T1 for very low standby power when the supply is unloaded. Voltage sensing, and feedback from the main 5 volt output is accomplished with a simple zener diode (Z1) and optocoupler circuit. The transformer secondary utilizes a stacked winding configuration for the 5 and 12 volt outputs which provides good cross regulation with the 5 volt output. Tight regulation is provided on the isolated – 5 volt output via a 3-terminal regulator.

Key Features

- Useful for powering telecom, LAN, appliance and industrial controls where low power is required.
- Extremely simple and low cost design.
- 10 watt output with 12 watt surge capability with properly heatsunk SOT-223 package for U1.
- 90 to 270 Vac universal input range.
- Isolated – 5 volt output with high regulation and low output ripple.
- Conducted EMI filter.
- Half-wave input rectifier for low cost.
- Output short circuit protection and overvoltage protection from open optocoupler.

Schematic



NOTES:

1. L1 is Coilcraft RFB0807-681L 680 uH, 350 mA inductor.
2. Output common is connected to line neutral. This should be a pcb ground plane area.
3. See Magnetics Data Sheet for T1 construction details.
4. U1 is 100 kHz, SOT-223 version of NCP1014 controller. Pin 4 tab should be soldered to copper clad ground plane for best heatsinking.
5. R1 is optional inrush limiter.
6. U2 is Vishay H11A817A optocoupler or equivalent.
7. R8 is optional voltage trimming resistor - adding resistance increases Vout.
8. If full bridge input rectifier is used in place of D1, then C2 and C3 can be 22 uF, 400V caps.

NCP1014 Based 10W Triple Output Power Supply
ON Semiconductor Design Group

MAGNETICS DESIGN DATA SHEET

Project / Customer: ON Semiconductor - NCP1014 triple output supply

Part Description: 10 watt flyback transformer; triple output, universal input

Schematic ID: T1

Core Type: E25/10/6 (E24/25); 3C90 material or similar

Core Gap: Gap for 1.45 mH nominal

Inductance: L (mH) = 1.4 to 1.5 mH

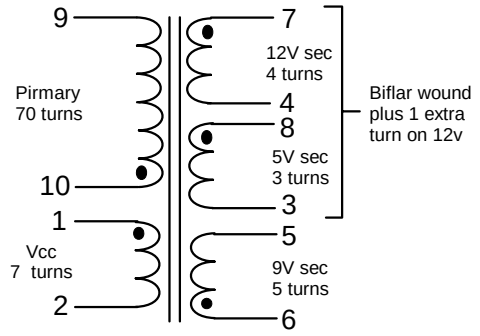
Bobbin Type: E24-25 PCB1-10 (10 pin horizontal pc mount)

Windings (in order):

Winding # / type	Turns / Material / Gauge / Insulation Data
Vcc (1 - 2)	7 turns of #32HN spiral wound over window with 2 mm end margins. Tape insulate to 1 kV. Self-leads to pins.
Primary (10 - 9)	70 turns of #32HN over 2 layers, 35 TPL. Insulate with tape for 1 kV to next winding. Self-leads to pins.
5/12V Secondary (8 - 3, 7 - 4)	3 turns biflar of two different colors of #26HN flat wound over primary with 2 mm end margins. Continue winding 1 extra turn with one of the colors (4 turns total) - this will be the 12V winding. Self-leads to pins per diagram below. Insulate with tape for 3 kv to next winding.
9V Isolated Sec. (5 - 6)	5 turns of #26HN spiral wound over previous winding. allow 3 mm end margins. Insulate with tape.

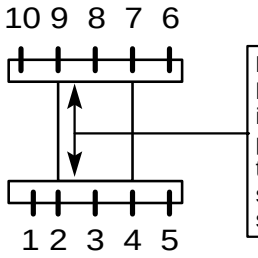
Hipot: 3 kV from primary/Vcc to 5/12/-5V secondaries for 1 minute.

Schematic



Lead Breakout / Pinout

(Top View)



Note: Rectangular hole should be cut in pc board between pins 2 - 3 and 8 - 9 to allow for proper safety creepage on secondaries.

Proto xfmrs available from Mesa Power Systems, Escondido, CA. 1-800-515-8514

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