



# Design Note – DN06020/D

## 10W, Dual Output Power Supply

ON Semiconductor

Device	Application	Input Voltage	Output Power	Topology	I/O Isolation
NCP1014	White goods / Appliance control	90 to 270 Vac	10W peak	DCM Flyback	Yes

Other Specifications				
	Output 1	Output 2	Output 3	Output 4
<b>Output Voltage</b>	5 Vdc	14 Vdc	N/A	N/A
<b>Ripple</b>	2%	2%	N/A	N/A
<b>Nominal Current</b>	350 mA	75 mA	N/A	N/A
<b>Max Current</b>	700 mA	500 mA (16 ms)	N/A	N/A
<b>Min Current</b>	10 $\mu$ A	10 $\mu$ A	N/A	N/A

<b>PFC (Yes/No)</b>	No
<b>Minimum Efficiency</b>	70%
<b>Operating Temp. Range</b>	0 to +60 °C
<b>Cooling Method/Supply Orientation</b>	Convection

<b>Others</b>	Tight output cross regulation to +/- 5%
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### Circuit Description

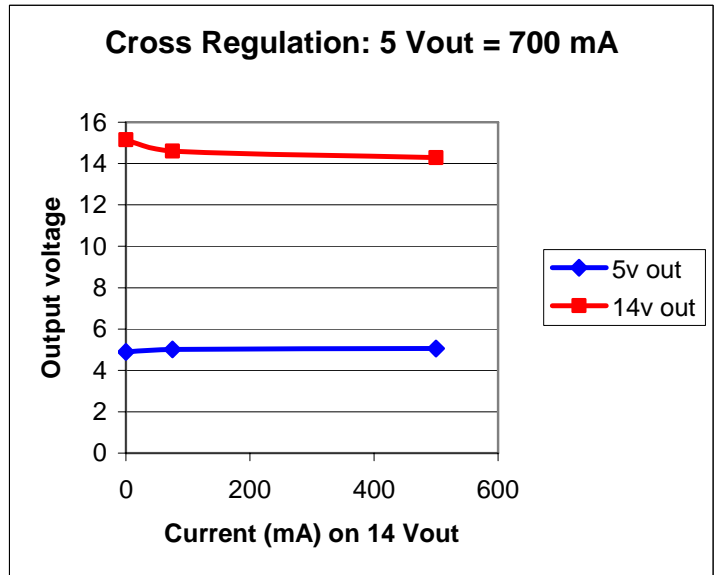
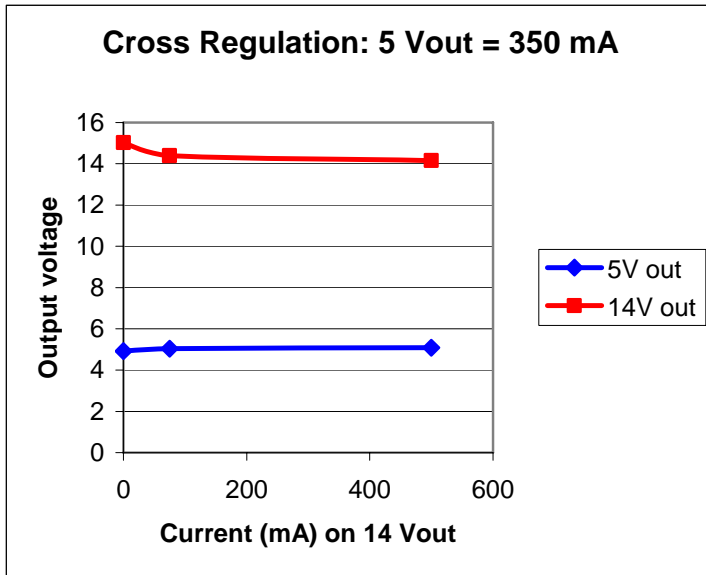
The power supply is designed around the ON Semiconductor NCP1014 monolithic current mode controller with integrated Mosfet in a discontinuous mode (DCM) flyback converter topology. The design includes a pi-network differential mode input EMI filter and resistive turn-on inrush current limiting. The 5 and 14 volt outputs are implemented using a stacked, interleaved secondary winding scheme on the flyback transformer, and summed output sensing through resistors R8 and R9. This sense implementation vastly improves cross regulation between the two outputs. The outputs are sensed, amplified and fed back to the primary controller via the commonly used TL431 and optocoupler circuit scheme. Plots of the minimal cross regulation interaction are shown in the graphs below. Schottky rectifiers are used for output diodes for maximum efficiency. The NCP1014 controller contains inherent over-current and over-temperature protection in addition to over-voltage protection in the event of an optocoupler failure.

### Key Features

- Simple, low cost, yet effective dual output off-line switcher design.
- Input EMI filter.
- Stacked secondary windings and output sense summing for excellent cross regulation.
- High efficiency Schottky rectifiers on output.
- Auxiliary Vcc winding on transformer for very low standby (no load) input power.



### Cross Regulation (measured at 120 Vac input)



### Line Regulation

Less than 20 mV change in any output under any load condition from 90 to 270 Vac.

### Efficiency

5V@350mA, 14V@75mA – 78% at 120Vac in; 70% at 230Vac  
 5V@700mA, 14V@500mA – 78% at 120Vac in; 78% at 230Vac

### No-load Input Power

285 mW @ 230 Vac  
 216 mW @ 115 Vac

# DN06020/D

## MAGNETICS DESIGN DATA SHEET

Project / Customer: ON Semiconductor - NCP1014 dual output supply

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

Schematic ID: T1

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

Core Gap: Gap for 1.4 mH

Inductance:  $L = 1.4 \text{ mH} \pm 5\%$

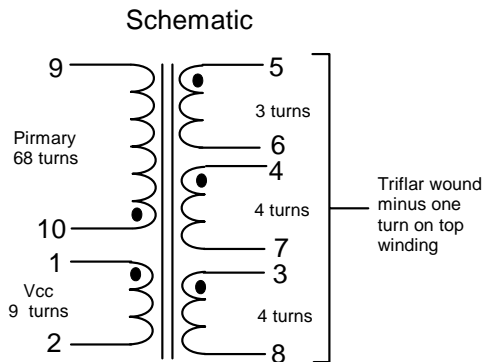
Bobbin Type: E24-25 PCB1-10 (10 pin horizontal pc mount)

### Windings (in order):

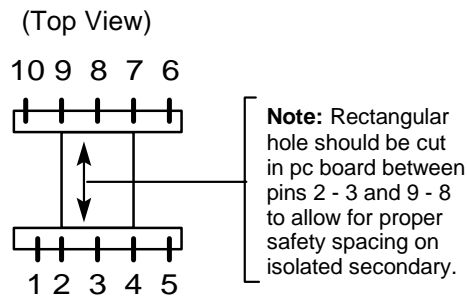
Winding # / type	Turns / Material / Gauge / Insulation Data
Vcc (1 - 2)	9 turns of #32HN spiral wound over window with 2 mm (approx) end margins. Tape insulate to 1 kV. Self-leads to pins.
Primary (10 - 9)	68 turns of #32HN over 2 layers, 34 TPL. Cuff winding ends with tape and insulate for 3 kV to next winding.
5 /14V Secondaries (3 - 8, 4 - 7, 5 - 6)	4 turns trifilar of #26 HN (3 strands, each a different color) with <u>the last turn of one strand removed</u> (for a total of 3 turns with this strand). Allow approx 2.5 mm end margins and terminate leads to pins as shown in diagram below. 3 turn winding should terminate to pins 5 and 6. Insulate with mylar tape.

Vacuum varnish assembly.

Hipot: 3 kV from 5/14V secondaries to primary/Vcc for 1 minute.



### Lead Breakout / Pinout



Proto xfms available from Mesa Power Systems, Escondido, CA. 1-800-515-8514  
Mesa part number: 13-1298

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