



ON Semiconductor

DN06006/D

Design Note – DN06006/D

1 A, 12 W Constant Current Off-Line LED Driver

Device	Application	Input Voltage	Output Power	Topology	I/O Isolation
NCP1027	Off-line Constant Current LED Driver	90 to 265 Vac	12 W max	Flyback	No line isolation

Other Specifications

	Output 1	Output 2	Output 3	Output 4
Output Voltage	15 V max	N/A	N/A	N/A
Ripple	< 250 mV	N/A	N/A	N/A
Nominal Current	1 A	N/A	N/A	N/A
Max Current	1.1 A	N/A	N/A	N/A

PFC (Yes/No)	No
Minimum Efficiency	70%
Cooling Method/Supply Orientation	Convection

Circuit Description

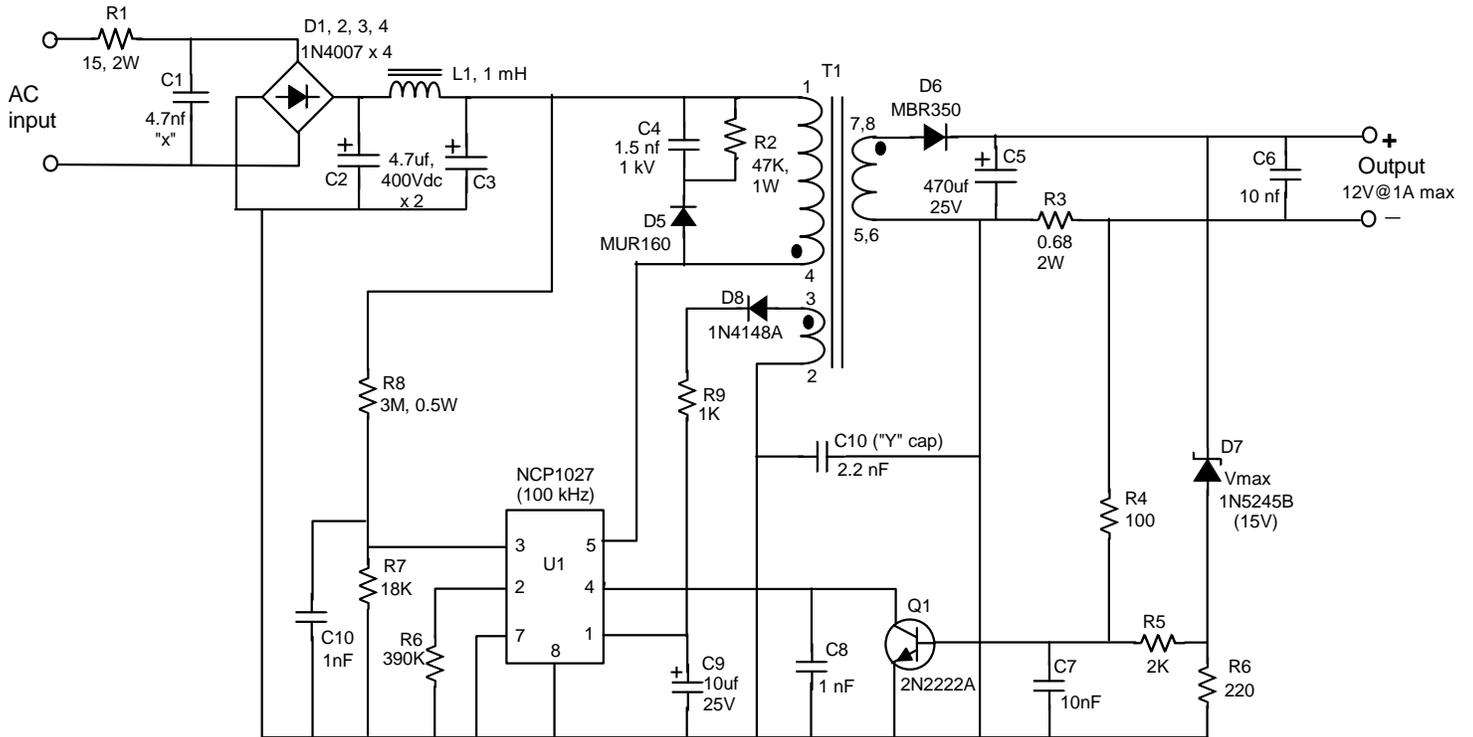
The LED driver circuit uses an NCP1027 monolithic controller in a 1 amp, 12 watt constant current output flyback converter. Both current and peak voltage control are achieved by the use of transistor Q1, zener D7, and current sense resistor R3. The circuit provides a regulated current output down to about 7 volts dc and clamps the output to about 15 volts under no load conditions. The level of Vcc control bias on U1 is set by R9 and will depend on the characteristic Vf of the total LED load that reflects to the output. The circuit includes and optional EMI filter (C1, L1, and C10), and brownout protection whose level is set by R7 and R8.

Key Features

- Constant current output with voltage clamp
- Simple flyback circuit using NCP1027
- Conducted EMI filter
- Universal AC input (90 to 265 Vac)
- Non-isolated output for simplicity

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Schematic



NOTES:

1. L1 is Coilcraft part RFB0807-102 (1 mH @ 250 mA) for EMI compliance.
2. See Magnetics Data Sheet for T1 construction details (EF-16 core & horizontal bobbin.)
3. D7 zener sets $V_{out\ max}$: $V_{out} = V_z + 0.65V$.
4. R3 sets max current: $I_{max} = 0.7/(R_{total})$.
5. Fuse resistor recommended for R1.
6. Crossed schematic lines are not connected.
7. R7, R8 sets brownout voltage shutdown level.
8. R9 value may vary depending on output voltage level dependence on LED V_f total.

**Constant Current LED Supply
with Peak Voltage Limit
and Universal AC Input**

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MAGNETICS DESIGN DATA SHEET

Project / Customer: ON Semiconductor - NCP1027 Off-line LED Supply

Part Description: 13 watt flyback transformer, 100 kHz, 12V / 1.0 A

Schematic ID: T1

Core Type: EF16 (E16/8/5); 3C90 material or similar

Core Gap: Gap for 1.1 mH

Inductance: 1.1 mH +/-5%

Bobbin Type: 8 pin horizontal mount for EF16

Windings (in order):

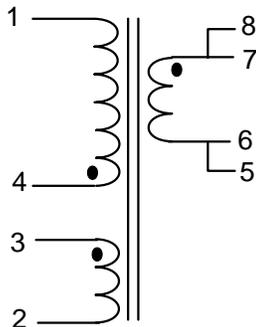
Winding # / type	Turns / Material / Gauge / Insulation Data
Vcc/Boost (2 - 3)	12 turns of #32HN spiral wound over 1 layer. Insulate with 1 layer of tape (500V insulation to next winding)
Primary (1 - 4)	105 turns of #32HN over 3 layers, 35 TPL. Insulate for 3 kV to next winding.
12V Secondary (5, 6 - 7, 8)	10 turns of 2 strands of #26HN flat wound over 1 layer Insulate with tape.

Vacuum varnish assembly.

Note: Transformer available from Mesa Power Systems, Escondido, CA; 1-800-515-8514
Part number 13-12-1000

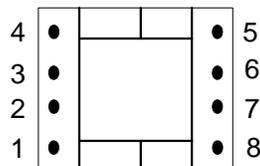
Hipot: 3 kV from boost/primary to secondary for 1 minute.

Schematic



Lead Breakout / Pinout

(Bottom View - facing pins)



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