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Universal Off-Line LED String Driver with PFC

DESIGN NOTE

Circuit Description

This Design Note describes an up to 10 watt, off-line universal input, LED string driver with power factor correction (PFC). It incorporates the NCP1014 “mini” boost power factor corrector circuit described in ON Semiconductor Design Note DN06064 in conjunction with ON Semiconductor’s new NSI45025 series constant current regulator. This latter device is a 2-pin part which can be inserted in series with a string of LEDs and provide a highly stable constant current and withstand a compliance voltage from 2 to 45 volts.

Assuming a typical output from the PFC of 400 Vdc, a string of 25 mA rated LEDs with a total series V_f of 375 volts can be powered with this circuit, and currents from 10 to 35 mA are possible with the use of other versions of this constant current regulator family. The 45 Vdc

compliance voltage of the NSI45025 will easily compensate for LED V_f variations (binning differences) and temperature variation effects.

This LED driver design is ideal for new LED based replacement lamps for linear fluorescent lamps and other linear lighting application where a multitude of small LEDs are used to generate an area lighting source.

Key Features

- Power Factor (PF) Better than 0.9 for Agency Compliance
- Supports Universal Input Range with a Single Design while Achieving Power Factor Correction
- High Tolerance to LED Binning Variations and Temperature Effects
- Input EMI Filter and In-rush Limiting

Table 1. DEVICE DETAILS

Device	Application	Input Voltage	Output Power	Topology	I/O Isolation
NCP1014 NSI45025	Off-line LED Driver with PFC	90–265 Vac	10 W (14 W max)	Boost PFC + Constant Current Source	None

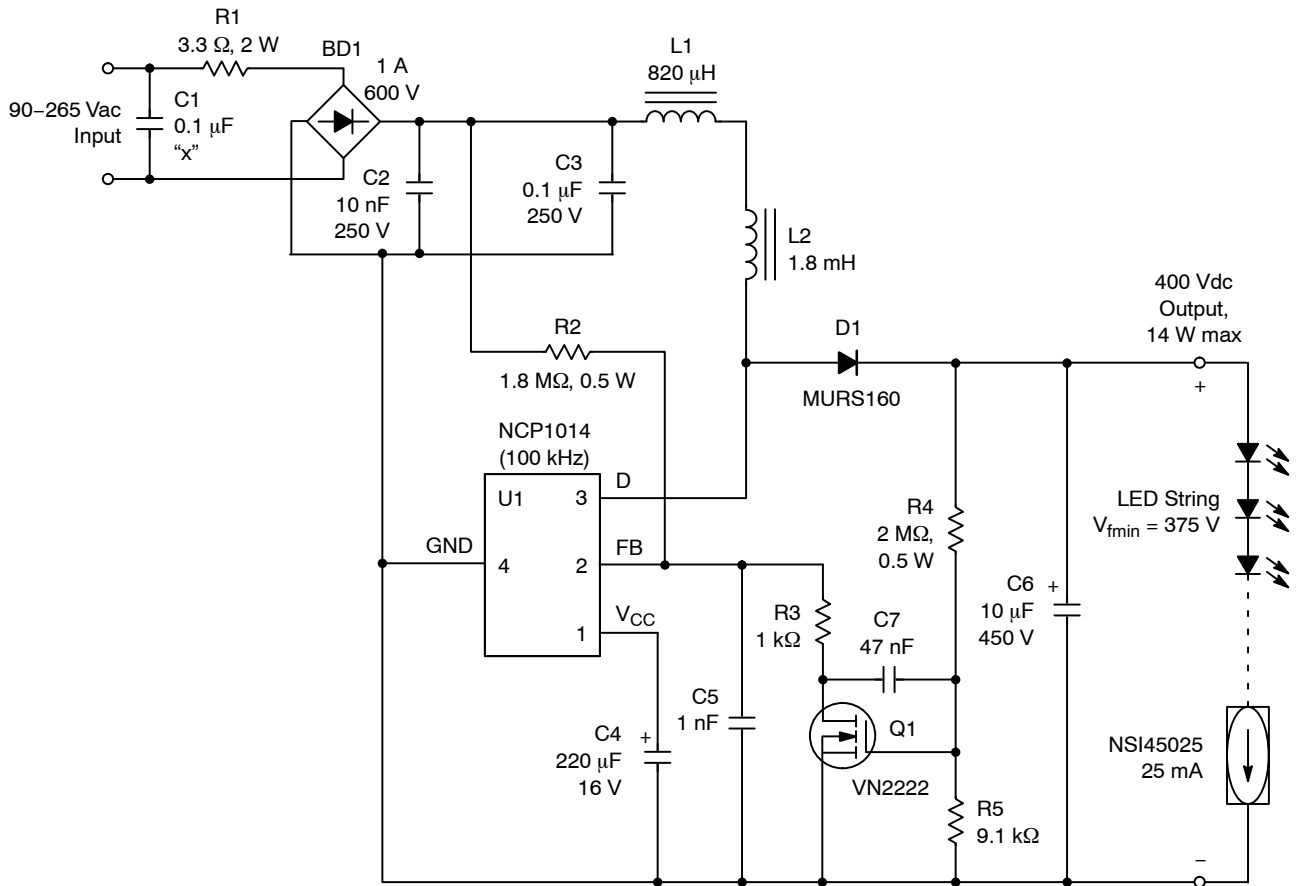
Table 2. OTHER SPECIFICATIONS

	Output 1	Unit
Output Voltage	400	Vdc
Ripple	< 10	%
Nominal Current	25	mA
Max Current	35	mA
Min Current	10	mA

PFC (Yes/No)	Yes
Minimum Efficiency	80%
Inrush Limiting/Fuse	Yes
Operating Temperature Range	0 to +50°C
Cooling Method/Supply Orientation	Convection/NA
Signal Level Control	No

DN06065/D

SCHEMATIC



Notes:


1. Crossed lines on schematic are not connected.
2. L1 is Coilcraft RFB0807-821L (820 μ H, 320 mA).
3. L2 is Coilcraft RFB1010-182L (1.8 mH, 450 mA).
4. R5 sets V_{OUT} nominal.

Figure 1. Schematic

REFERENCES

- [1] ON Semiconductor Design Note DN06064/D:
12 Watt “Mini” Boost Power Factor Corrector for LED applications
- [2] ON Semiconductor Design Note DN06051/D:
Improving the Power Factor of Isolated Flyback Converters for Residential ENERGY STAR® LED Luminaire Power Supplies
- [3] Data sheet NCP1014/D
- [4] Data sheet NSI45025/D

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