



# Universal Off-Line LED String Driver with PFC

ON Semiconductor

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

	Output 1
Output Voltage	250 to 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 Temp. Range	0 to +50°C
Cooling Method / Supply Orientation	Convection NA
Signal Level Control	No

## 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 a revised version of 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 380 to 400 Vdc, a string of 25 mA rated LEDs with a maximum series Vf 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 Vf variations (binning differences) and temperature variation effects. An LED string with a lower series Vf can be powered by

this circuit by adjusting the series zener reference voltage (Z1 through Z5) for a lower output voltage level via zener selection, however, the AC input will have to be restricted to a 120 volt mains due to the obvious performance constraints of the boost converter due to lower output voltage.

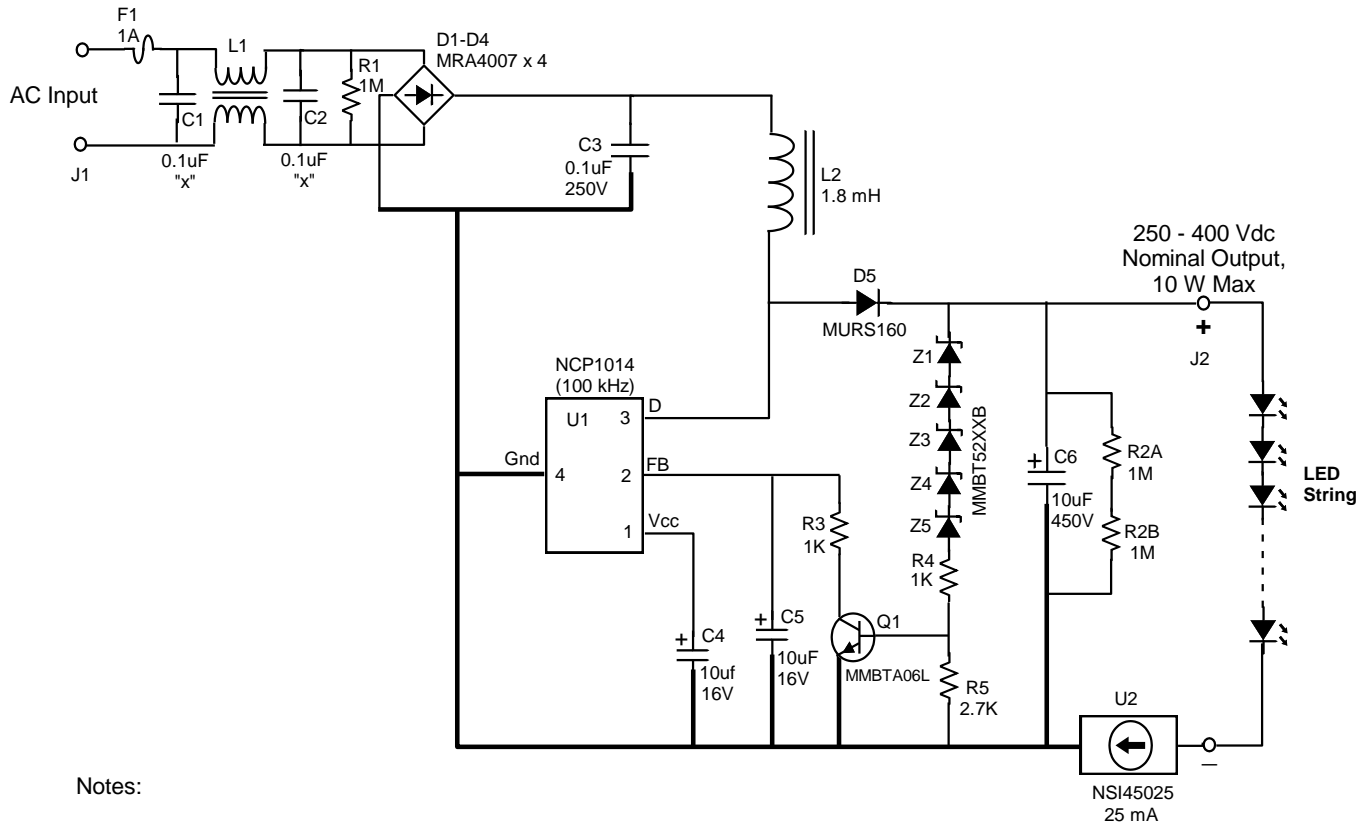
This LED driver design is ideal for new LED based replacement lamps for linear fluorescent lamps and other linear lighting application where a multitude of small, series LEDs are used to generate an area lighting source.

## 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

# DN06065/D

## Schematic



### Notes:

1. Crossed lines on schematic are not connected.
2. L1 is Coilcraft BU15-4530R7BL or similar EMI filter.
3. L2 is Coilcraft RFB1010-182L or similar (1.8 - 2.2 mH, 450 mA)
4. Zener Z1+Z2+Z3+Z4+Z5 voltage sum sets Vout nominal.
5. U2 optional constant current, series regulator.
6. Heavy schematic lines indicate recommended ground plane area.
7. U1 pin 4 requires clad for heatsinking.

### 10 Watt NCP1014 CVCC Boost Converter for High Voltage LED Strings (Rev 4)

### References:

- ON Semiconductor Design Note [DN06064](#): 12 Watt "Mini" Boost Power Factor Corrector for LED applications
- ON Semiconductor Design Note [DN06051](#): Improving the Power Factor of Isolated Flyback Converters for Residential ENERGY STAR® LED Luminaire Power Supplies
- Data sheet [NCP1014](#)
- Data sheet [NSI45025](#)

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