

# ON Semiconductor

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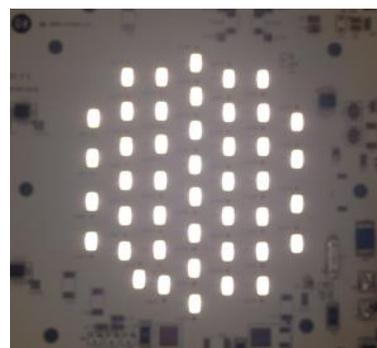
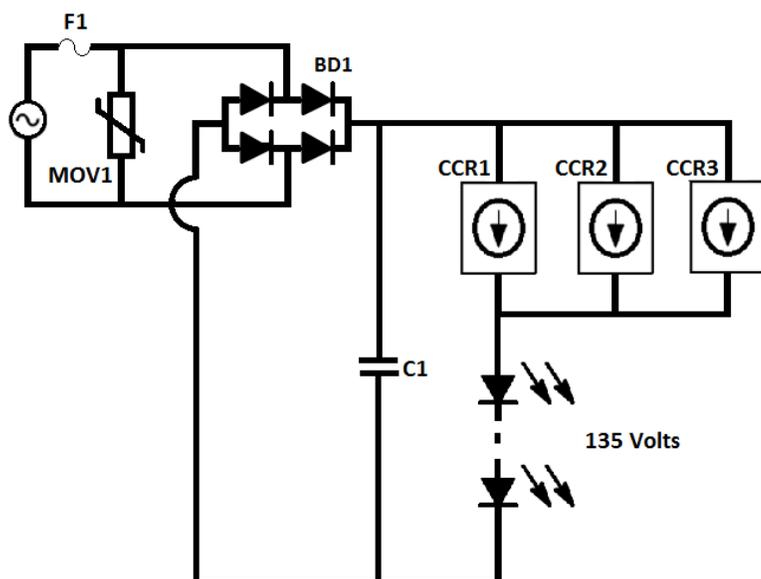
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# Low Cost Direct 120 VAC LED Lighting Circuit

Application	Input Voltage	Topology	Output Power	Input Power	Efficiency
LED Lighting, AC	110 to 130 Vac	Direct	7.7 W	9.1 W	84.7 %



## Key Features

- All surface mount components; no hand assembly of components is required
- High power factor and efficiency
- Extremely low BOM cost

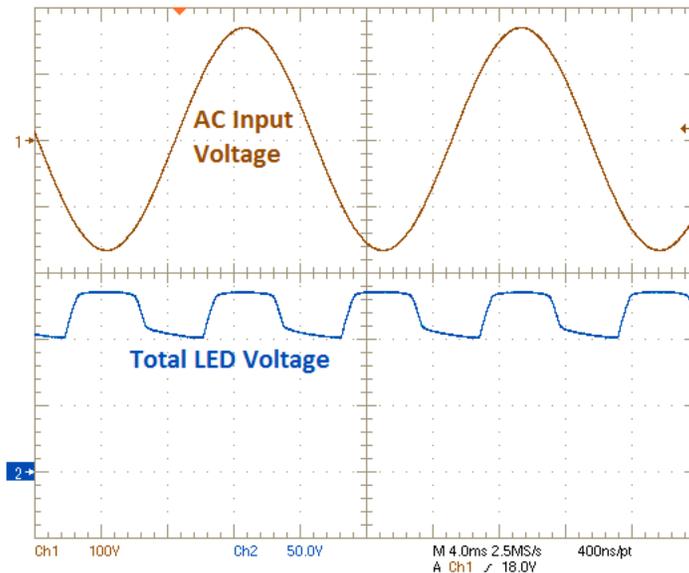
## Circuit Performance Data

Specification	110 V <sub>AC</sub>	120 V <sub>AC</sub>	130 V <sub>AC</sub>
I <sub>RMS(out)</sub> (mA)	76.2	84.1	85.6
Power Factor	0.860	0.900	0.927
THD <sub>Total</sub> (I <sub>RMS</sub> , %)	59.2	48.3	40.3
Input Power (W)	7.25	9.13	10.38
LED Power (W)	6.51	7.73	8.22
Efficiency (%)	89.8	84.7	79.2

## Circuit Operation

This is a simple LED lighting circuit for 120 V operation. The circuit will operate best with an LED voltage of 130 to 135 V. Therefore, any LEDs may be chosen as long as this requirement is satisfied. In order to adjust for different power levels it is recommended to use parallel combinations of the 20, 30, and 50 mA CCRs, whose part numbers are NSIC2020JB, NSIC2030JB, and NSIC2050JB respectively.

In normal operation the maximum voltage that appears across the Constant Current Regulator (CCR) is approximately the peak AC input voltage (120 Vac (rms) has a 169.4 V peak) minus the total LED voltage (136 with the 44 Samsung LEDs). This gives a CCR voltage of approximately  $169.4 - 136 = 33$  V. The NSIC20x0JB devices are all rated for 120 V. Therefore the circuit is capable of blocking voltages above 250 V. However, an MOV is provided for additional overvoltage protection.



The circuit is operating with an AC Input Voltage of 120 Vac (rms). Total LED voltage is approximately 136 V.

## Bill of Materials

Designator	Quantity	Description	Value	Tolerance	Footprint	Manufacturer	Manufacturer Part Number	Substitution Allowed
U1	1	Bridge Rectifier	600 V	N/A	TO-269AA	Vishay	MB6S-E3/80	Yes
Connectors	2	SMD	N/A	N/A	SMD	AVX	AVX 709296001002006	No
C1	1	Capacitor SMD	10nF, 500 V	20%	1206	Any	Any	Yes
CCR1, CCR3	2	Constant Current Regulator SMD	120V, 50mA	15%	SMB	ON Semiconductor	NSIC2050JB	No
CCR2	1	Constant Current Regulator SMD	120V, 20mA	15%	SMB	ON Semiconductor	NSIC2020JB	No
F1	1	Fuse SMD	1.5A, 250V	N/A	2-SMD	Littelfuse	044301.5DR	Yes
L1-L44	44	SMD LED	3V	N/A	SMD	Samsung	SPMWH541MD5WA T0S3	Yes
M1	1	Varistor SMD	198V, 250A	N/A	2-SMD	Littelfuse	V220CH8T	Yes

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*Design note created by Andrew Niles*