



High Efficiency - Low Cost LED Dimming

ON Semiconductor®

<http://onsemi.com>

DESIGN NOTE

Circuit Description

This circuit can be thought of as having two separate portions. There is a LED management portion and there is a dimmer management and PWM Signal portion.

The LED management portion charges the output capacitor to a “DC” state. The dimmer management portion provides loading current for an SCR in a dimmer and provides a gate voltage to the series pass MOSFET. The gate drive of the series MOSFET PWMs the LEDs at their peak current rating. The NSIC2050 Constant Current Regulators provides over current and over voltage protection to the LEDs. The NSI5010 limits the power consumption of the dimmer management circuit.

For optimal performance the gate voltage of the MOSFET (driven by the voltage divider of the 11 kΩ and 1.5 kΩ)

needs to be that of the threshold voltage when the input voltage to the circuit is at the minimum conduction angle.

Also some dimmers require 20 mA of loading current so the NSI50010 can be replaced with an NSI45020AT1G, but expect extra power losses.

Key Features

- Over 80% Efficiency
- Below 3.61 W
- Dimming a Function of the Dimmer’s Range
- Extremely Low BOM Cost
- Works with a Wide Variety of Dimmers

Table 1. DEVICE DETAILS

Device	Application	Input Voltage	Output Power	Topology	I/O Isolation
NSIC2050 NSI5010	AC LED Dimmable	100–127 Vac	6 W	Cap Drop and PWM Sensing	No

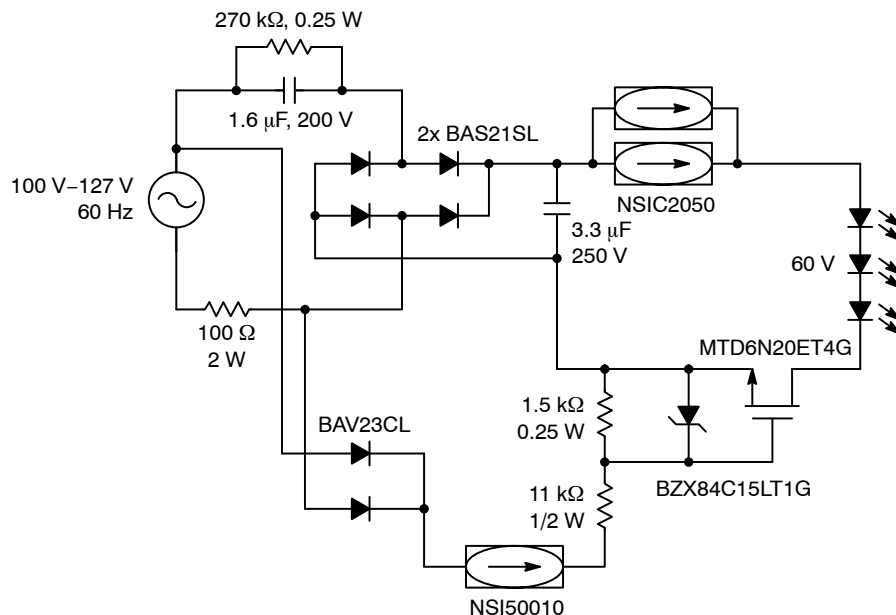


Figure 1. CCR with Dimmable Interface

DN05021/D

Table 2. OTHER SPECIFICATIONS


	Output	Unit
Output Voltage	60	V
Ripple	100	%
Nominal Current	63	mA rms
Max Current	106	mA
Min Current	0	mA

PFC (Yes/No)	No
Minimum Efficiency	80%
Inrush Limiting/Fuse	N/A (100 Ω, 2 W)

	100 V _{RMS}	127 V _{RMS}
I _{RMS(IN)}	46.46 mA	55.09 mA
PF	0.589	0.514
THD	43.97%	45.6%
I _{RMS(OUT)}	55 mA	63 mA
P _(in)	2.69 W	3.6 W

Manufacturer	Serial Number	Notes
Lutron	500-15591A	Smooth Dim Below 40%
Lutron	TGCL-153PH	Smooth Dim Below 5%
Lutron	CTCL-153PDH	Smooth Dim Below 5%
Pass & Seymour	450 W - CFL/LED	Smooth Dim Below 5%
Pass & Seymour	700 W Incandescent	Small Dead Travel

*This list is compiled from a limited selection of Dimmers.

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative