

→ UCC28810/UCC28810EVM-002

Description

The UCC28810EVM-002 evaluation module (EVM) is a constant-current non-isolated power supply for LED lighting applications that require high brightness, such as street, parking or area lighting. The reference design converts the universal mains (90 to 265 V_{RMS}) to a 0.9-A constant-current source to drive a 100-W LED load.

The UCC28810EVM-002 is a two-stage design. The first stage, a transition-mode circuit with PFC, ensures that the design meets various standards such as the EN61000-3-2. The PFC circuit converts the AC input to a regulated DC voltage, which can be configured as a boost-follower PFC or a fixed output voltage. The boost-

follower PFC tracks the AC input's peak voltage for increased efficiency at low-line operation. The PFC's DC output voltage is then regulated to a fixed value in the region of 396 V_{DC}. The second stage of the design also uses transition mode but is configured as a buck converter. It converts the PFC output voltage to a fixed 0.9-A current to drive an LED load. The second stage accepts PWM dimming inputs (either externally or from an onboard circuit) and appropriately toggles itself on or off.

Key Features

- High-power AC/DC LED driver with PFC
- Ideal for street, parking or area lighting
- Universal-input, non-isolated design
- Tightly regulated LED current
- PWM dimming, 200 Hz to 1 kHz
- High efficiency through dimming
- Active power-factor correction

Web Links

Datasheets, user's guides, samples:
www.ti.com/sc/device/UCC28810

Reference designs:

www.ti.com/powerreferencedesigns

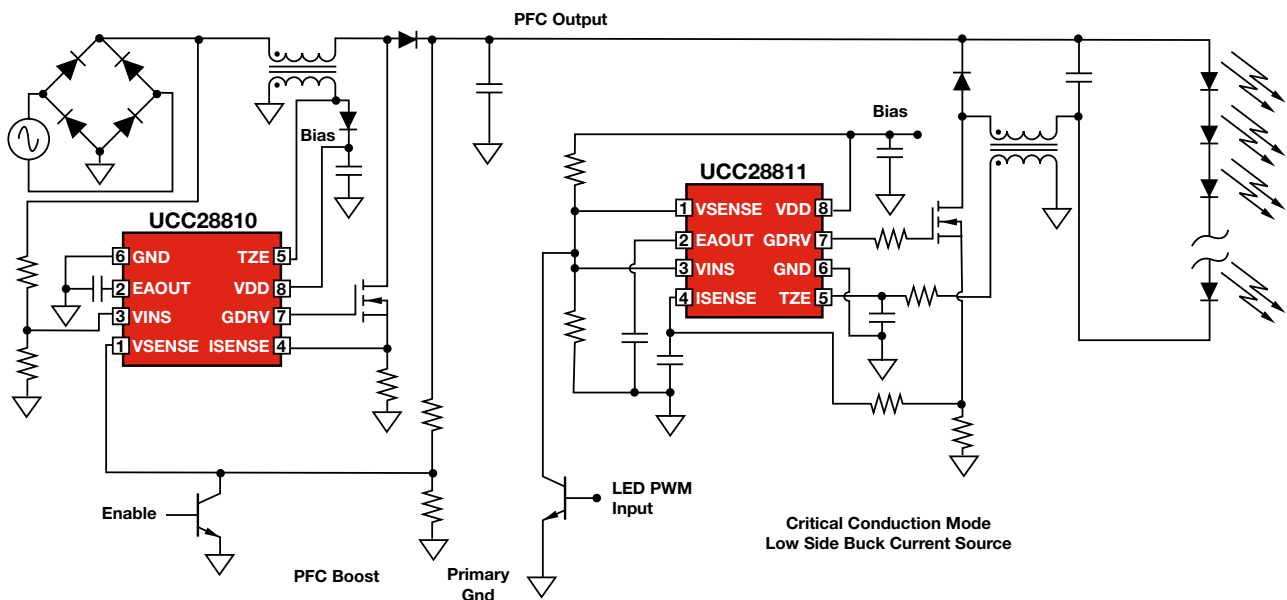
EVM:

www.ti.com/ucc28810evm-002

Design Specifications

Description	Parts	V _{IN} (AC) Range	V _{OUT} (DC) Range	Number of LEDs	I _{OUT} (max)	P _{OUT} (max)	Eff.	PFC	ISO	Dimming In	Dimming Out	EVM
UCC28810 EVM002 100-W LED lighting driver	UCC28810 UCC28811	90 265	55 100	15-30	900 mA	100 W	93%	Yes	No	PWM	PWM	Yes

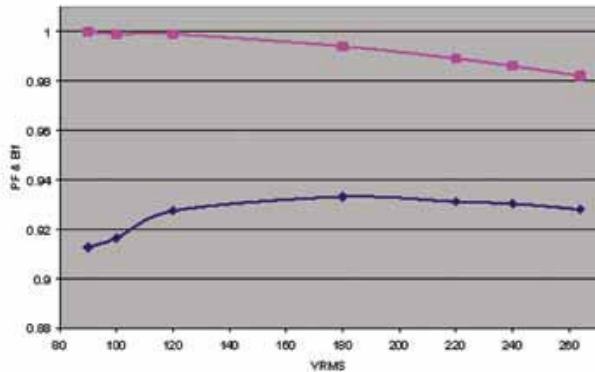
UCC28810EVM-002 Block Diagram



UCC28810/UCC28810EVM-002

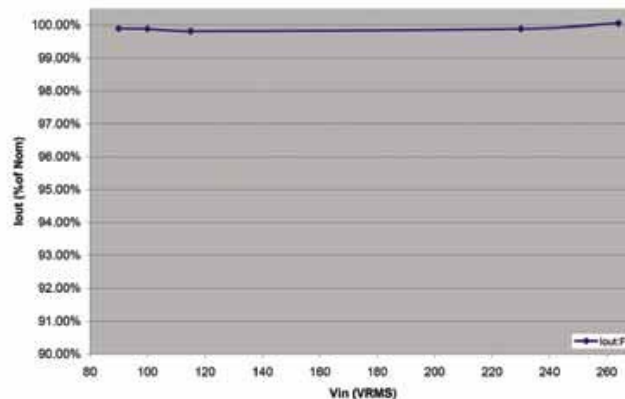


Efficiency and Power Factor vs. Line Voltage



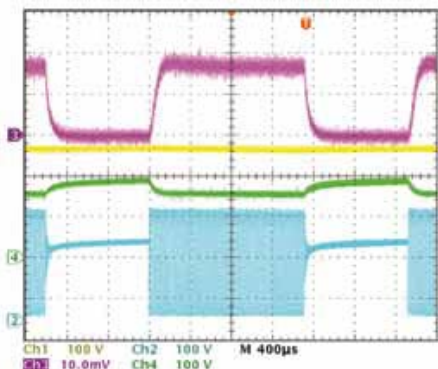
UCC28810EVM-002 efficiency and power factor vs. line voltage 30 Cree XRE LED's at 900 mA.

Line Regulation 30 LEDs at 900 mA, (98 W)



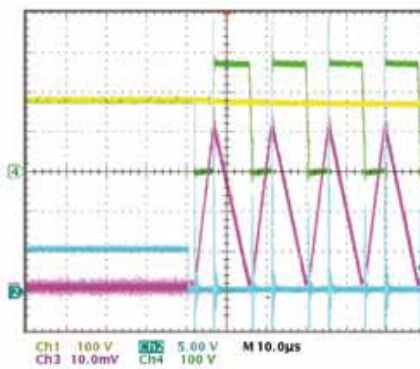
LED current regulation as a function of line voltage.

PWM Dimming Waveforms



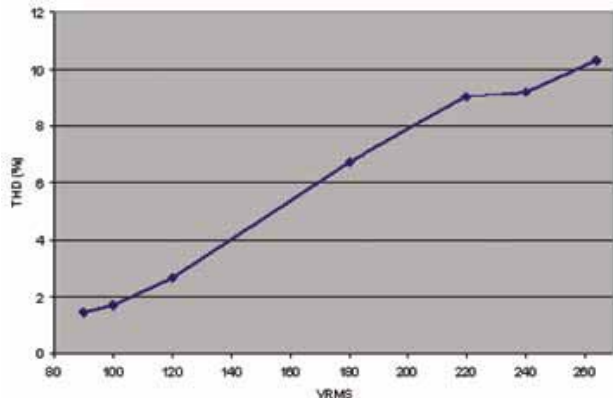
UCC28810EVM-002 transition mode buck PWM response. Ch1: Buck V_{IN} , Ch2: Buck V_{DS} , Ch3: LED current (0.5 A/Div), Ch4: LED voltage. Ch1 and Ch4 share GND reference.

PWM Dimming Response



UCC28810EVM-002 transition mode buck PWM response (expanded). Ch1: LED V_{OUT} , Ch2 PWM, Ch3 buck inductor current 500 mA/Div, Ch4 V_{DS} Ch1 and Ch4 Share GND reference.

THD Factor vs. Line Voltage



UCC28810EVM-002 THD vs. line voltage 30 Cree XRE LED's at 900 mA.

110-Watt, Constant-Current, Isolated Driver with PFC

→ UCC28810/UCC28810EVM-003: SimpLEDTM Drive™

Description

The UCC28810EVM-003 evaluation module (EVM) is an off-line AC-to-DC LED current driver with PFC for applications such as street, high-bay, and medium- or large-infrastructure lighting. The UCC28810EVM-003 is a three-stage converter design that delivers up to 110 W. The first stage is a universal input boost-PFC circuit providing a 305- to 400-VDC output. The second stage is a low-side buck circuit providing the controlled current source, and the third stage is a series of two half-bridge DC/DC transformers that provides isolation of multiple LED strings.

This patent-pending solution provides an easily scalable and cost-effective method of driving multiple LED strings. The UCC28810EVM-003 implements

single-reference current control and universal dimming (via AM or PWM) for all LEDs. The reference design effectively drives a large number of LEDs connected in series, but the voltage on the LED strings is safe (low) and isolated from the AC line. The multistring architecture is more cost-effective than an architecture with a constant voltage plus a buck stage for each LED string. The LED-driver architecture is readily scalable to very high power levels. Excellent LED current matching between strings is achieved with this architecture. The UCC28810EVM-003 achieves high efficiency (91%), high power density and a high power factor. The control stage is a simple and robust design, and the EVM protects against scenarios with open and short LED strings.

Key Features

- SimpLEDTM high-power dimmable AC/DC LED driver with PFC
- Ideal for street, high-bay or infrastructure lighting
- Isolated from the AC line
- Readily scalable to higher power levels
- LED current matching between strings
- High efficiency and power density
- Active power-factor correction

Web Links

Reference designs:

www.ti.com/powerreferencedesigns

Datasheets, user's guides, samples:

www.ti.com/sc/device/UCC28810

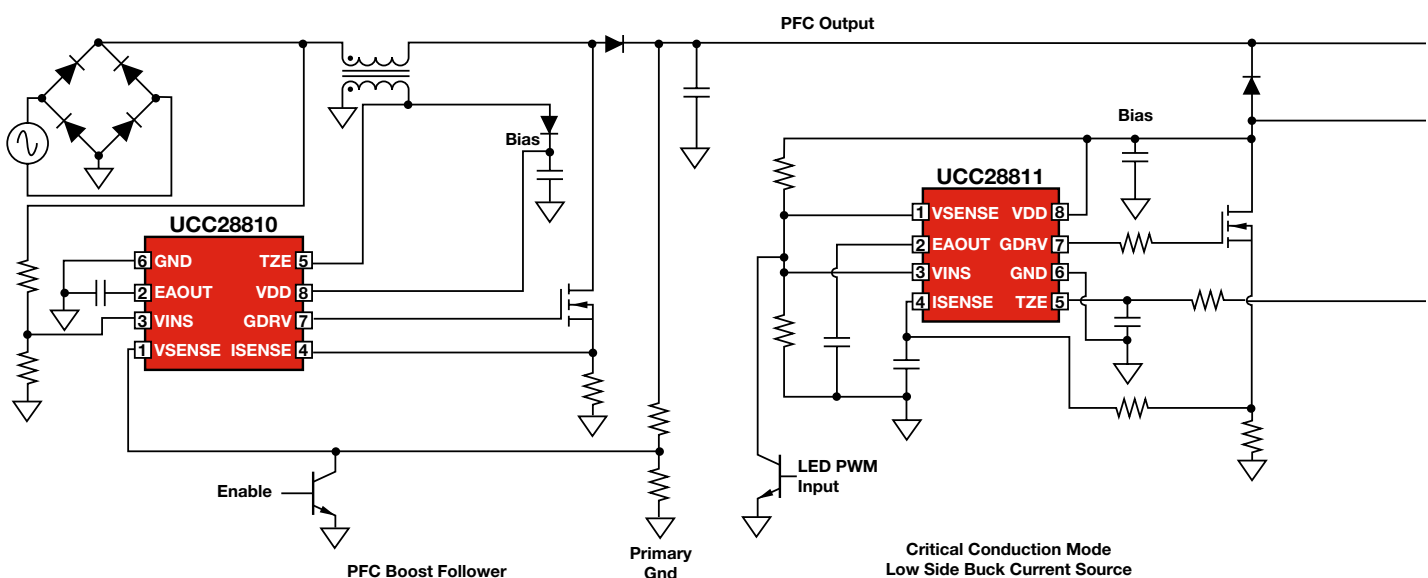
EVM:

www.ti.com/ucc28810evm-003

Design Specifications

Description	Parts	V _{IN} (AC) Range	V _{OUT} (DC) Range	Number of LEDs	I _{OUT} (max)	P _{OUT} (max)	Eff.	PFC	ISO	Dimming In	Dimming Out	EVM
UCC28810 EVM003 100-W isolated multi-string LED lighting driver w/multiple transformers	UCC28810 UCC28811 TPS92020	90, 265	22 V, 60 V	4X (7 - 15)	500 mA	110 W	91%	Yes	Yes	PWM	PWM	Jul-09

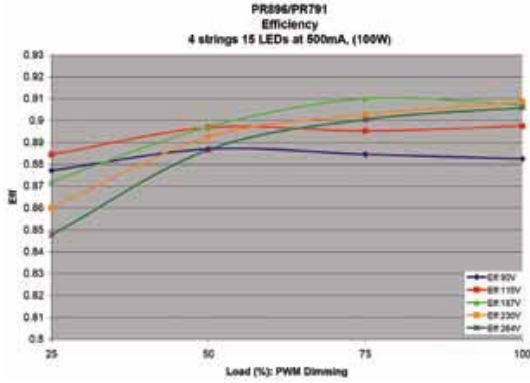
UCC28810EVM-003 Block Diagram



UCC28810/UCC28810EVM-003

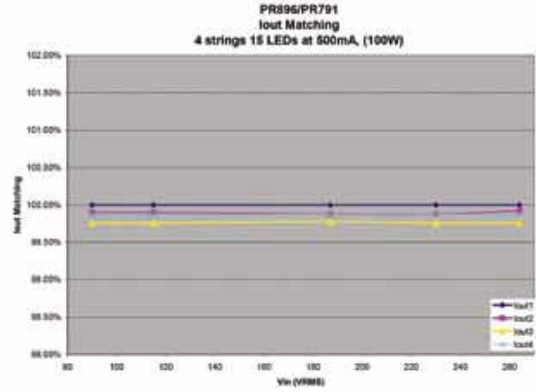


Efficiency vs. Line Voltage



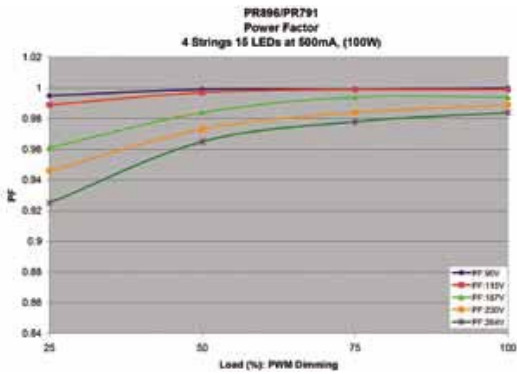
UCC28810EVM-003 efficiency vs. line voltage and load 4 x 15 Cree XRE LED's at 500 mA.

I_{OUT} Matching vs. Line Voltage



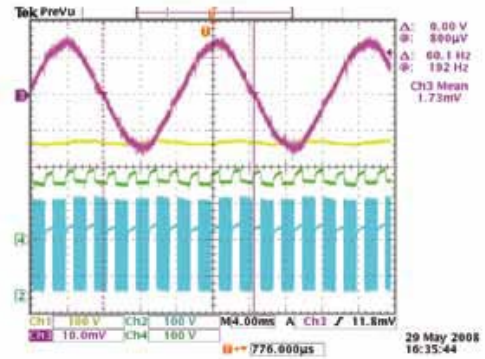
UCC28810EVM-003 I_{OUT} matching vs. line voltage 4 x 15 Cree XRE LED's at 500 mA.

Power Factor vs. Line Voltage

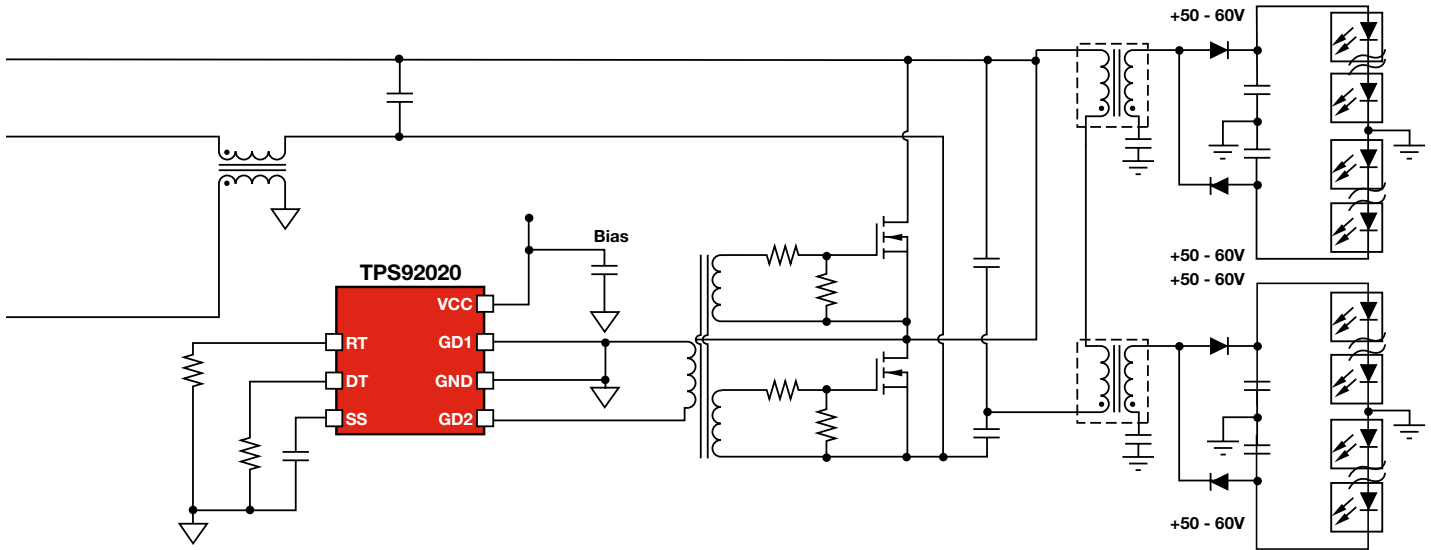


UCC28810EVM-003 power factor vs. line voltage 4 x 15 Cree XRE LED's at 500 mA.

UCC28810EVM-003 AC Input Current During PWM Dimming



Ch1: V_{BUCK+}, Ch2: Buck V_{DS}, Ch3: AC line current 1A/Div, Ch4: V_{BUCK-} - Ch1 and Ch 4 share GND reference.



→ TPS92020, UCC28810/1



Description

This reference design uses the UCC28810, UCC28811 and TPS92020 for an isolated, off-line, 240-W LED driver for high-bay and streetlight applications. The driver has three stages: a power-factor-correction (PFC) stage, a buck stage and an isolation stage. The PFC and buck stages both operate in critical-conduction mode. The isolation stage is a half-bridge converter with an option to adopt a multi-transformer configuration. A constant output current is controlled within the buck stage to provide 3 A to the LED strings, with an output voltage ranging from 70 V to 85 V.

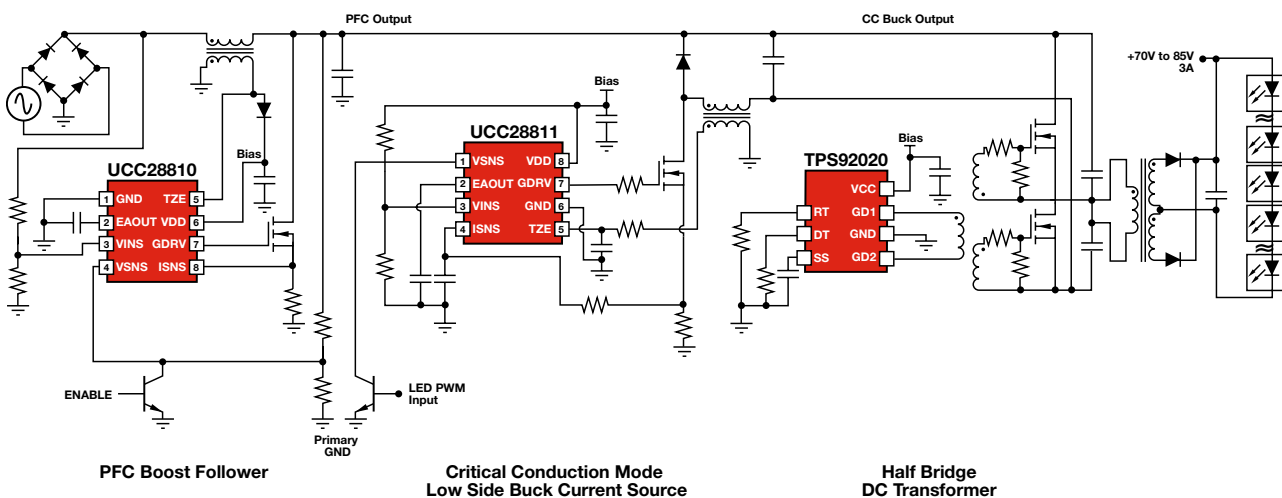
Web Links

Datasheets, user's guides, samples:
www.ti.com/sc/device/TPS92020,
www.ti.com/sc/device/UCC28810 or
www.ti.com/sc/device/UCC28811

Design Specifications

Parameter	Test Conditions	Minimum	Typical	Maximum	Unit
Input voltage	—	108	120/277	305	V _{RMS}
Power factor	—	0.990	—	—	—
Output current	—	—	3	—	Amp
Output ripple	C _{OUT} = 4.4 μF	—	300	—	mA _{pp}
Output voltage	—	70	—	85	Volts
Efficiency	—	87	—	—	%

TPS92020, UCC28810/1 Schematic

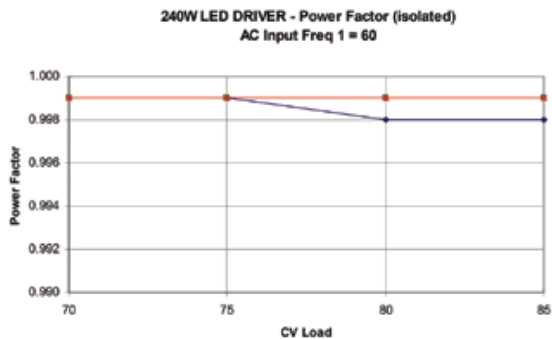


For more reference designs, see: www.ti.com/powerreferencedesigns

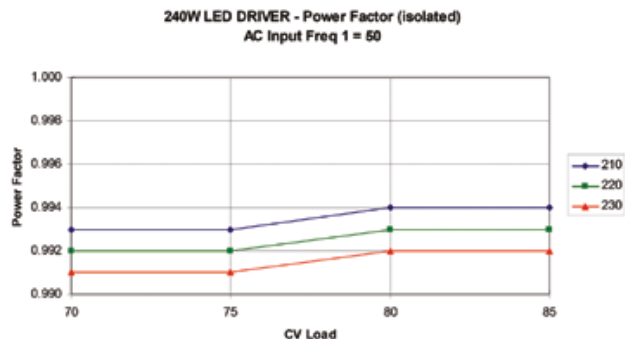
TPS92020, UCC28810/1



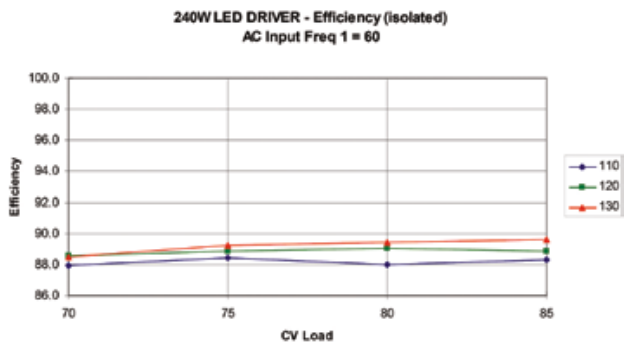
Power Factor



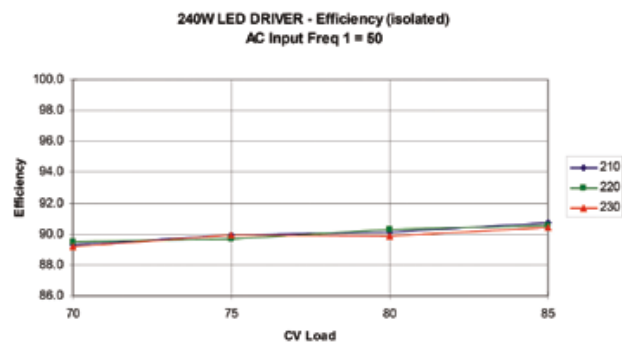
Power Factor



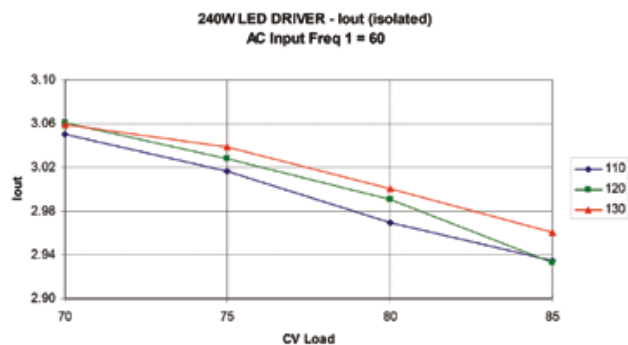
Efficiency



Efficiency



Load Regulation



Load Regulation

