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**Evaluation Board (AL9910EV7)**

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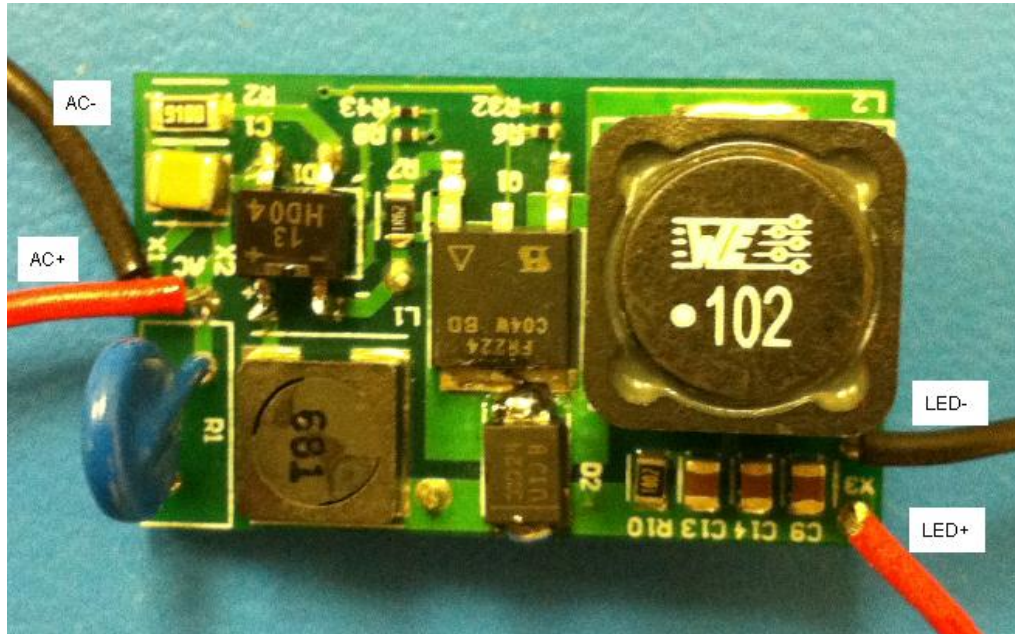


Figure 1: Top-View Evaluation Board

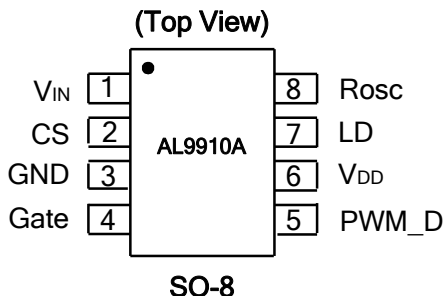
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**Features**

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- TRIAC Dimmable (compatible with most dimmers)
- Work for both forward or reverse phase dimmers
- Wide dimming range from full brightness to around ~10%
- Selectable 8W-13W output power
- Active PFC with power factor >0.9
- No electrolytic capacitor
- Long operating life
- Typical Applications: Retrofit E27, PAR38, PAR30, A19 LED Light Bulbs

## AL9910A Pin Assignment



## AL9910A Pin Description

Pin Name	Pin Number	Descriptions
V <sub>IN</sub>	1	Input voltage
CS	2	Senses LED string current
GND	3	Device ground
Gate	4	Drives the gate of the external MOSFET
PWM_D	5	Low Frequency PWM Dimming pin, also Enable input. Internal 100kΩ pull-down to GND
V <sub>DD</sub>	6	Internally regulated supply voltage. 10V nominal for AL9910A. Can supply up to 1 mA for external circuitry. A sufficient storage capacitor is used to provide storage when the rectified AC input is near the zero crossings
LD	7	Linear Dimming by changing the current limit threshold at current sense comparator
R <sub>OSC</sub>	8	Oscillator control. A resistor connected between this pin and ground sets the PWM frequency.

## Specifications

Parameter	Units	Value
AC Input Voltage	V, AC	90 - 130
Output Power	W	5 – 13
Power Factor	NA	>0.9
Efficiency	%	82%-90%
ROHS Compliance	NA	Yes

## I/O Terminals

### Test conditions:

Input Voltage: 120V<sub>AC</sub>, 60Hz

LED Output Voltage: 24V<sub>DC</sub> (8 LEDs) & 40V<sub>DC</sub> (13 LEDs)

LED Output Current: 400mA

### Connection Instructions:

AC+ Input (X1): Red – Hot

AC- Input (X2): Black - Neutral

DC LED+ Output (X3): LED+ (Red)

DC LED- Output (X4): LED- (Black)

### Board Dimension (components included):

WxLxH (in mm) = 20mm x 33mm x 19mm

## Quick Start Guide

- 1) Connect +120V<sub>AC</sub> AC power supply between AC+ and AC- headers.
- 2) Connect external 24V<sub>DC</sub> or 40V<sub>DC</sub> LEDs to the output headers between LED+ and LED-.
- 3) Turn on the AC power supply.

## List of Dimmers

Here is the current list of dimmers, which are successfully tested by our LED drivers.

- A) Lutron D-600P
- B) Lutron Skylark Contour CTCL-153PD
- C) Lutron Diva DV-603PG
- D) Lutron Diva DVCL 153PD
- E) Cooper S106P
- F) Lutron TG-600PR-LA
- G) Lutron CTCL-153PDH

## Schematic

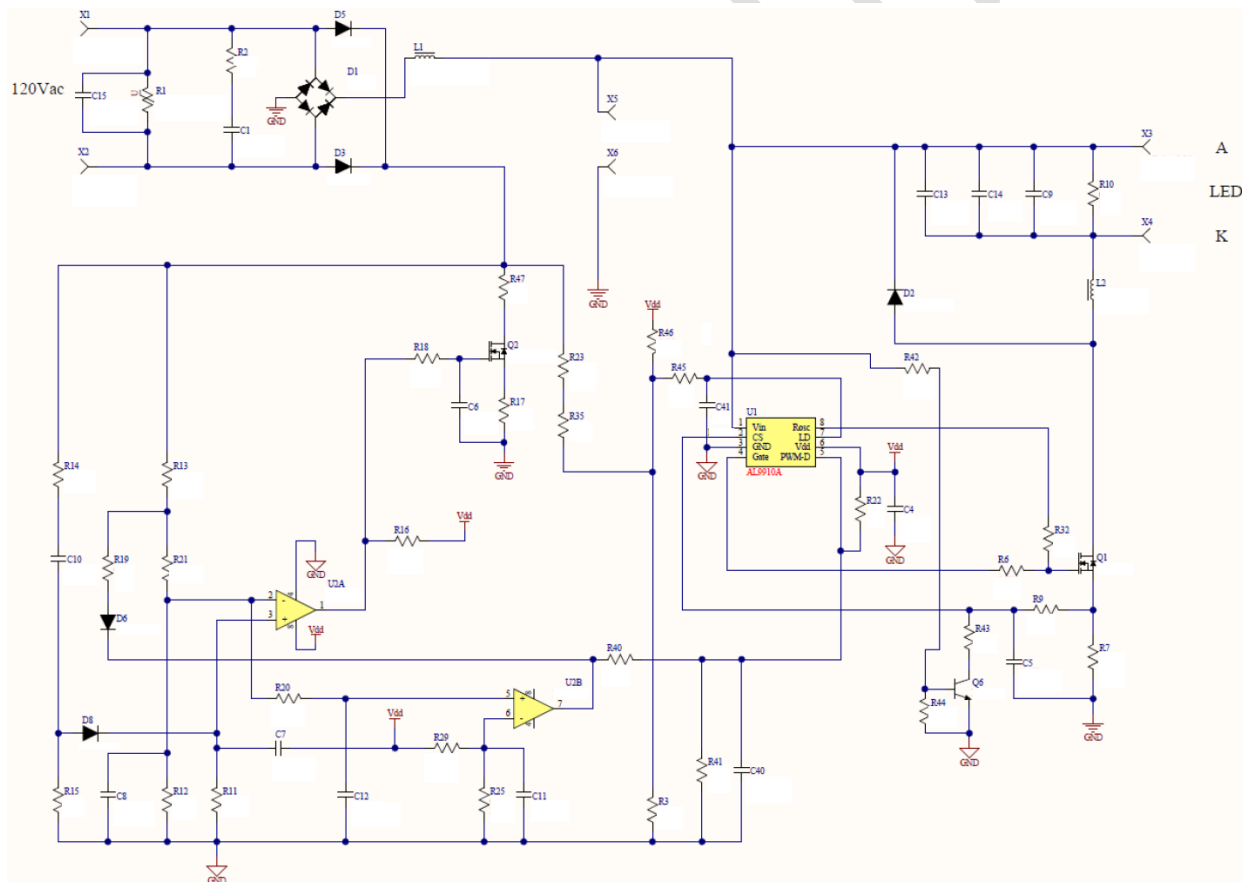


Figure 2: Evaluation Board Schematic

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**Bill of Material**


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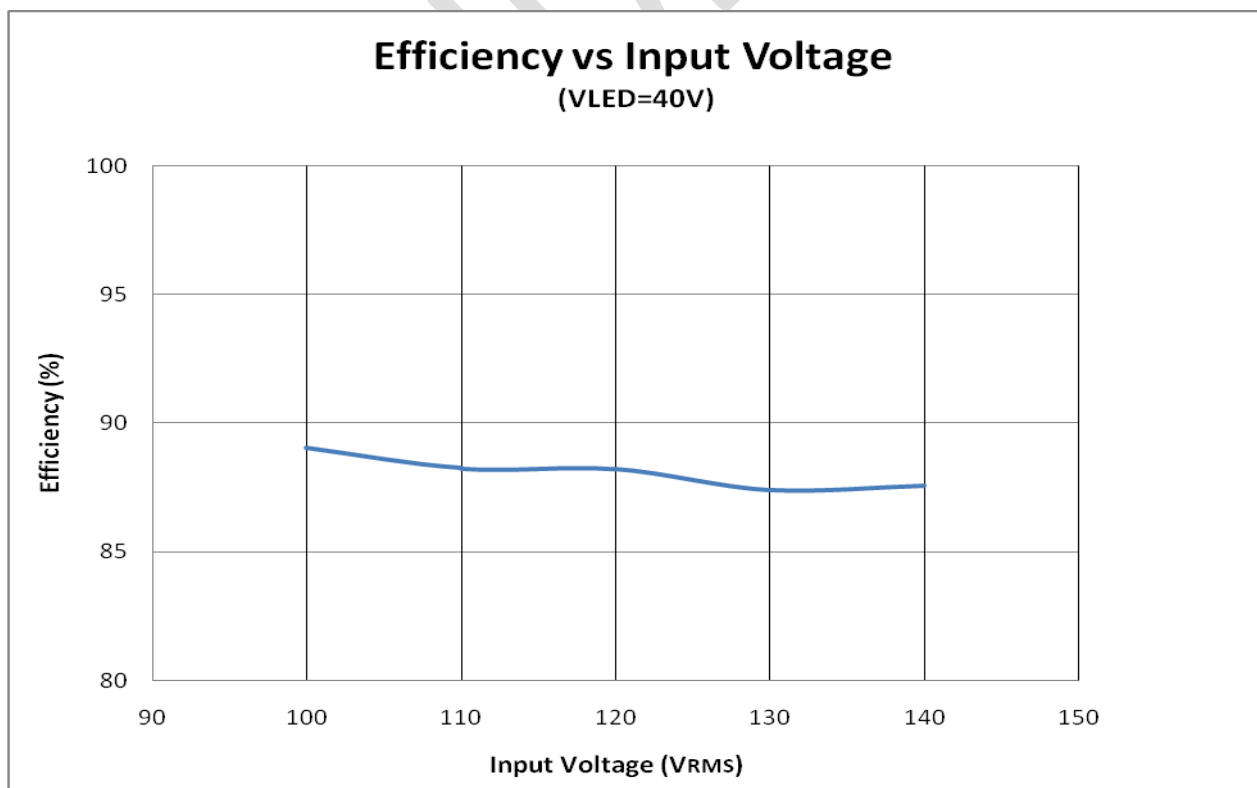
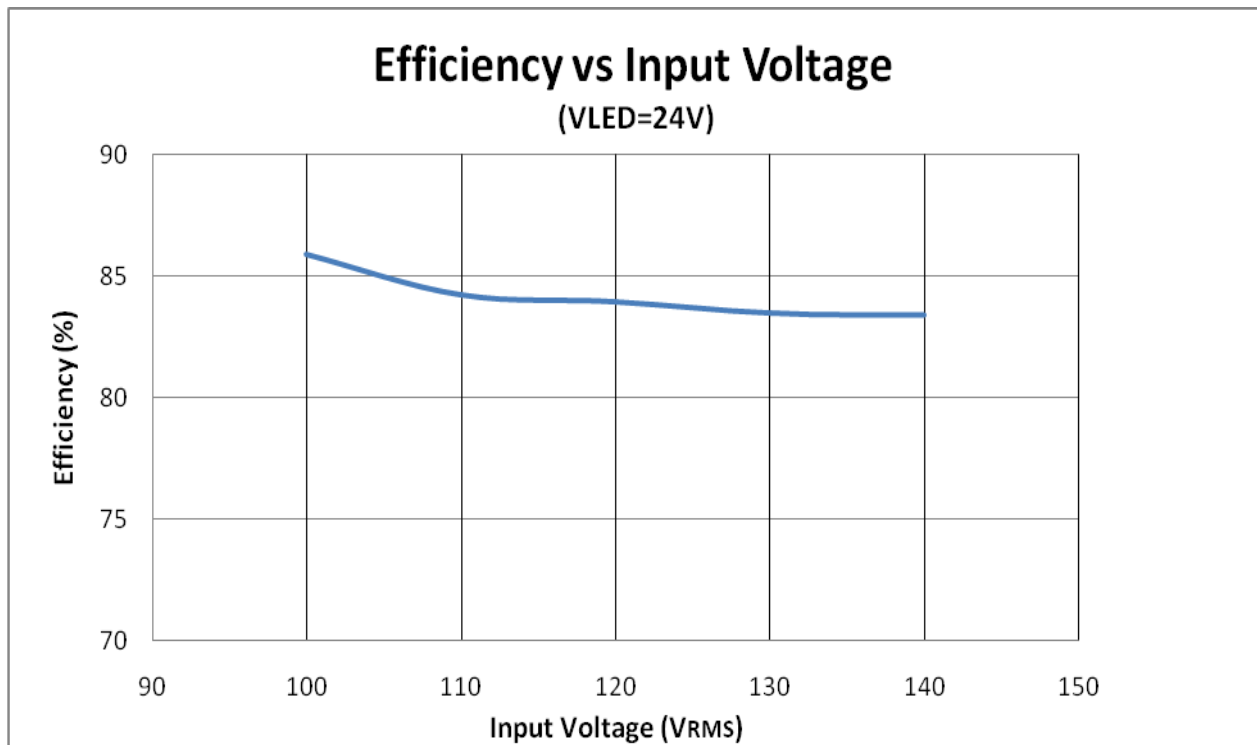
Item	Comment	Description	Size	Qty	Manufacturer	Part Number
C1	C1210 - 0.22u 250V	Multilayer Ceramic Capacitors (1210) 0.22µF 250V 10%	C1210	1	Murata	GRM32DR72E224KW01L
C4, C6, C41	C0603 - 1u 16V	Multilayer Ceramic Capacitors (0603) 1.0µF 16V 10%	C0603	3	TDK	C1608X7R1C105K
C5	C0402 - 220p 50V	Multilayer Ceramic Capacitors (0402) 220pF 50V 5%	C0402	1	Murata	GRM155R71H221JA01J
C7, C8, C12	C0603 - 0.1u 16V	Multilayer Ceramic Capacitors (0603) 0.1µF 16V 10%	C0603	3	Murata	GCM188R71C104KA37D
C9, C13, C14	C0805 - 4.7u 50V	Multilayer Ceramic Capacitors (0805) 4.7µF 50V 10%	C0805	3	TDK	C2012X5R1H475K
C10	C1206 - 1n 500V	Multilayer Ceramic Capacitors (1206) 1nF 500V 10%	C1206	1	Vishay/Vitramon	VJ1206Y102KXEAT5Z
C11	C0603 - 4.7u 10V	Multilayer Ceramic Capacitors (0603) 4.7µF 10V 10%	C0603	1	AVX	0603ZD475KAT2A
C15	C0805 - 0.022u 250V	Multilayer Ceramic Capacitors (0805) 0.022µF 250V 10%	C0805	1	TDK	CGA4J3X7R2E223K
C40	C0603 - 2.2u 16V	Multilayer Ceramic Capacitors (0603) 2.2µF 16V 10%	C0603	1	TDK	C1608X5R1C225KT
X5- X6	C0.22µF, 250V	Polyester Film Capacitor	WxLxH (mm) 5.5 x 10.3 x 15.5	1	Panasonic	ECQ-E2224JB
D1	HD04	Bridge Rectifiers 0.8A, 400V	MiniDip	1	Diodes Inc	HD04-T
D2	MURS160	Super-Fast Rectifiers 1.0A, 600V	SMB	1	Diodes Inc	MURS160-13-F
D3, D5, D8	DFLR1400	Glass Passivated Rectifier 1.0A, 400V	Power DI 123	3	Diodes Inc	DFLR1400-7
D6	1N4148WT	Fast Switching Diode 100V	SOD- 523	1	Diodes Inc	1N4148WT-7
L1	SRR6028- 681Y	Power Inductors 680µH 220mA	L6028	1	Bourns	SRR6028-681Y
L2	7447709102	Power Inductors 0.9A, 1mH	L12.5 x 12.5 x 10	1	Würth Electronics	7447709102
Q1	IRFR224	MOSFET Power N- Chan 250V, 3.8 Amp	D-PAK	1	Vishay/Siliconix	IRFR224PBF

Q2	SPD01N60C 3	MOSFET Power COOL MOS N-CH 650V, 0.8A	D-PAK	1	Infineon	SPD01N60C3
Q6	BC847C	NPN Surface Small Signal Transistor 100mA, 45V	SOT- 23	1	Diodes Inc	BC847C-7-F
R1	B72207S013 1K101	Varistors 130V, 1200A	R9D 3.6S	1	EPCOS	B72207S0131K101
R2	R1206 - 910	Chip Resistor (1206) 910Ω 1/10W 1%	R1206	1	Panasonic - ECG	ERJ-8ENF9100V
R3	R0402 - 2k	Chip Resistor (0402) 2KΩ 1/10W 1%	R0402	1	Panasonic - ECG	ERJ-2RKF2001X
R6, R40	R0402 - 22	Chip Resistor (0402) 22Ω 1/10W 1%	R0402	2	Panasonic - ECG	ERJ-2RKF22R0X
R7	R0805 - 1.62	Chip Resistor (0805) 1.62Ω 1/8W 1%	R0805	1	Vishay	CRCW08051R62FKEA
R9	R0402 - 1k	Chip Resistor (0402) 1KΩ 1/10W 1%	R0402	1	Panasonic - ECG	ERJ-2RKF1001X
R10	R0805 - 10k	Chip Resistor (0805) 10KΩ 1/8W 1%	R0805	1	Panasonic - ECG	ERJ-6ENF1002V
R11	R0402 - 2.2M	Chip Resistor (0402) 2.2MΩ 1/10W 5%	R0402	1	Panasonic - ECG	ERJ-2GEJ225X
R12	R0402 - 200k	Chip Resistor (0402) 200KΩ 1/10W 1%	R0402	1	Panasonic - ECG	ERJ-2RKF2003X
R13	R0805 - 2.2M	Chip Resistor (0805) 2.2MΩ 1/8W 1%	R0805	1	Panasonic - ECG	ERJ-6ENF2204V
R14	R0805 - 100k	Chip Resistor (0805) 100KΩ 1/8W 1%	R0805	1	Panasonic - ECG	ERJ-6ENF1003V
R15	R0402 - 4.3k	Chip Resistor (0402) 4.3KΩ 1/10W 1%	R0402	1	Panasonic - ECG	ERJ-2RKF4301X
R16	R0402 - 120k	Chip Resistor (0402) 120KΩ 1/10W 1%	R0402	1	Panasonic - ECG	ERJ-2RKF1203X
R17, R47	R1206 - 200	Chip Resistor (1206) 200Ω 1/4W 1%	R1206	2	Panasonic - ECG	ERJ-8ENF2000V
R18, R20	R0805 - 1M	Chip Resistor (0805) 1MΩ 1/8W 1%	R0805	2	Panasonic - ECG	ERJ-6ENF1004V
R19	R0402 - 1.2M	Chip Resistor (0402) 1.2MΩ 1/10W 5%	R0402	1	Panasonic - ECG	ERJ-2GEJ125X
R21	R0805 - 510k	Chip Resistor (0805) 510KΩ 1/8W 1%	R0805	1	Panasonic - ECG	ERJ-6ENF5103V
R22	R0402 - 300k	Chip Resistor (0402) 300KΩ 1/10W 1%	R0402	1	Panasonic - ECG	ERJ-2RKF3003X
R23, R35	R0805 - 390k	Chip Resistor (0805) 390KΩ 1/8W 1%	R0805	2	Panasonic - ECG	ERJ-6ENF3903V
R25	R0402 - 23.2k	Chip Resistor (0402) 23.2KΩ 1/10W 1%	R0402	1	Panasonic - ECG	ERJ-2RKF2322X
R29	R0603 - 180k	Chip Resistor (0603) 180KΩ 1/10W 1%	R0603	1	Panasonic - ECG	ERJ-3EKF1803V
R32	R0402 - 360k	Chip Resistor (0402) 360KΩ 1/10W 1%	R0402	1	Panasonic - ECG	ERJ-2RKF3603X
R41	R0402 - 750k	Chip Resistor (0402) 750KΩ 1/10W 1%	R0402	1	Panasonic - ECG	ERJ-2RKF7503X
R42	R1206 - 750k	Chip Resistor (1206)	R1206	1	Panasonic -	ERJ-8ENF7503V

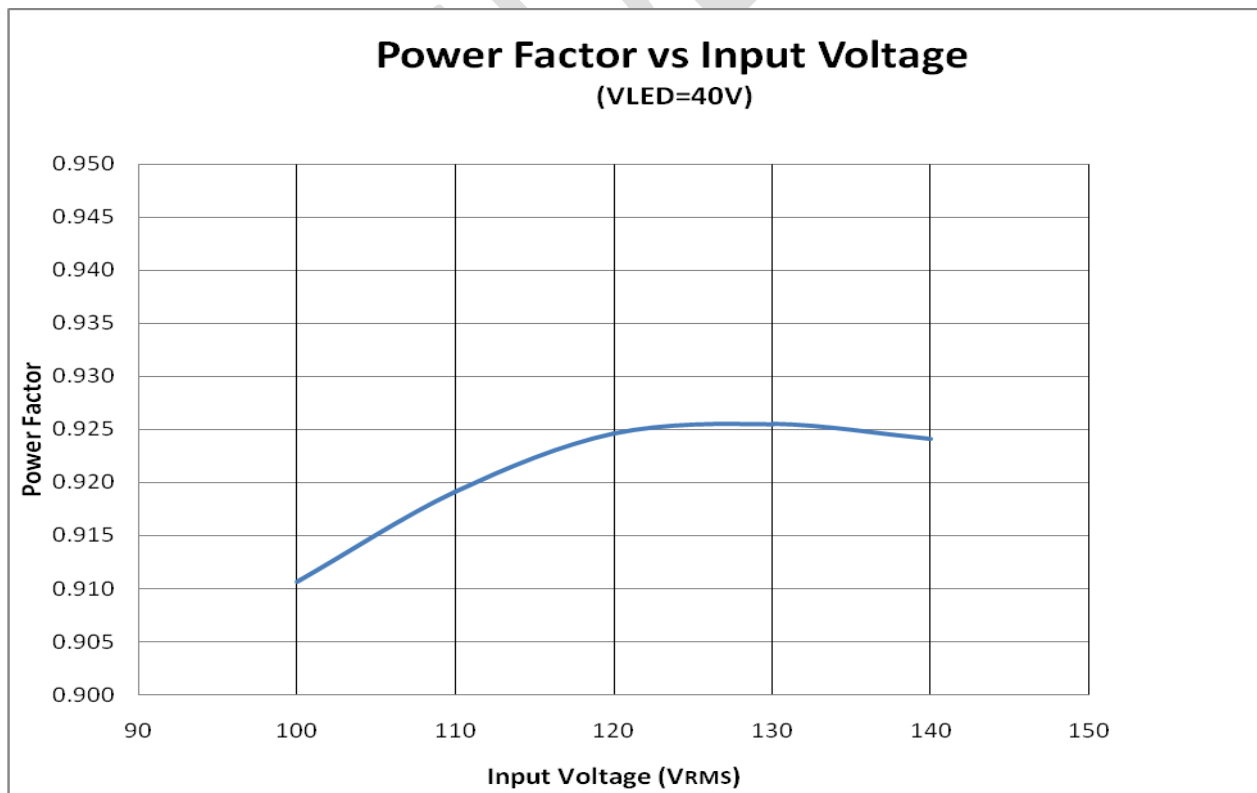
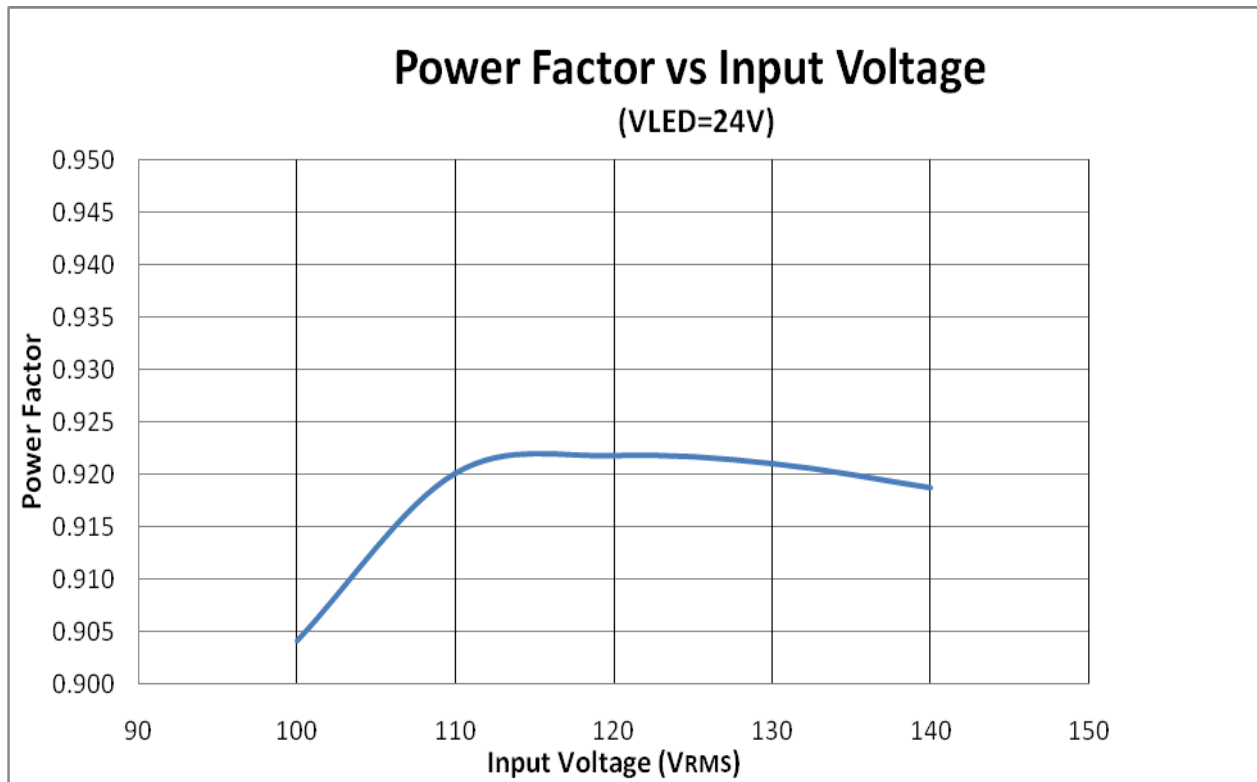
		750K $\Omega$ 1/4W 1%			ECG	
R43	R0402 - 200	Chip Resistor (0402) 200 $\Omega$ 1/10W 1%	R0402	1	Panasonic - ECG	ERJ-2RKF2000X
R44	R0402 - 4.7k	Chip Resistor (0402) 4.7K $\Omega$ 1/10W 1%	R0402	1	Panasonic - ECG	ERJ-2RKF4701X
R45	R0402 - 100k	Chip Resistor (0402) 100K $\Omega$ 1/10W 1%	R0402	1	Panasonic - ECG	ERJ-2RKF1003X
R46	R0402 - 150k	Chip Resistor (0402) 150K $\Omega$ 1/10W 1%	R0402	1	Panasonic - ECG	ERJ-2RKF1503X
U1	AL9910AS-13	LED Drivers - 10V LED Driver PWM 85 to 265VAC	SO-8	1	Diods Inc	AL9910AS-13
U2	LM2903	Comparator IC - Low Power Dual Voltage	SO-8	1	ST Microelectronics	LM2903DT

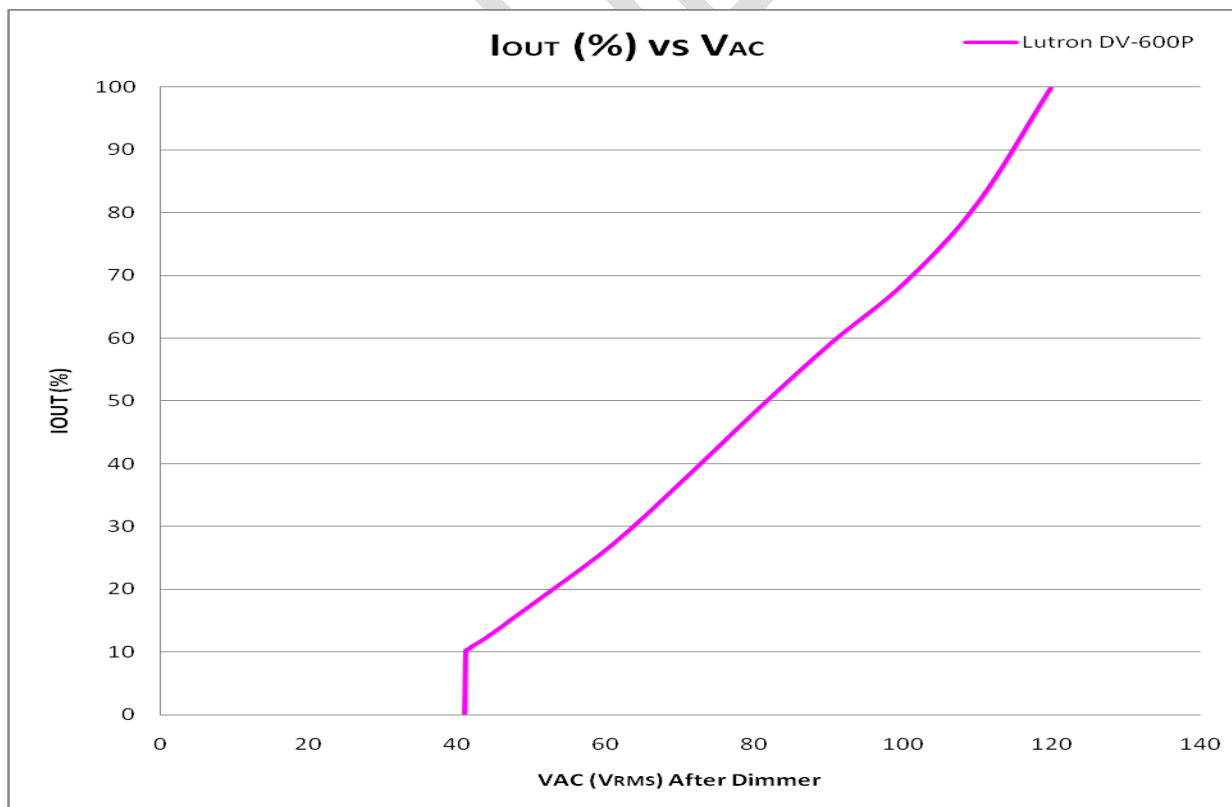
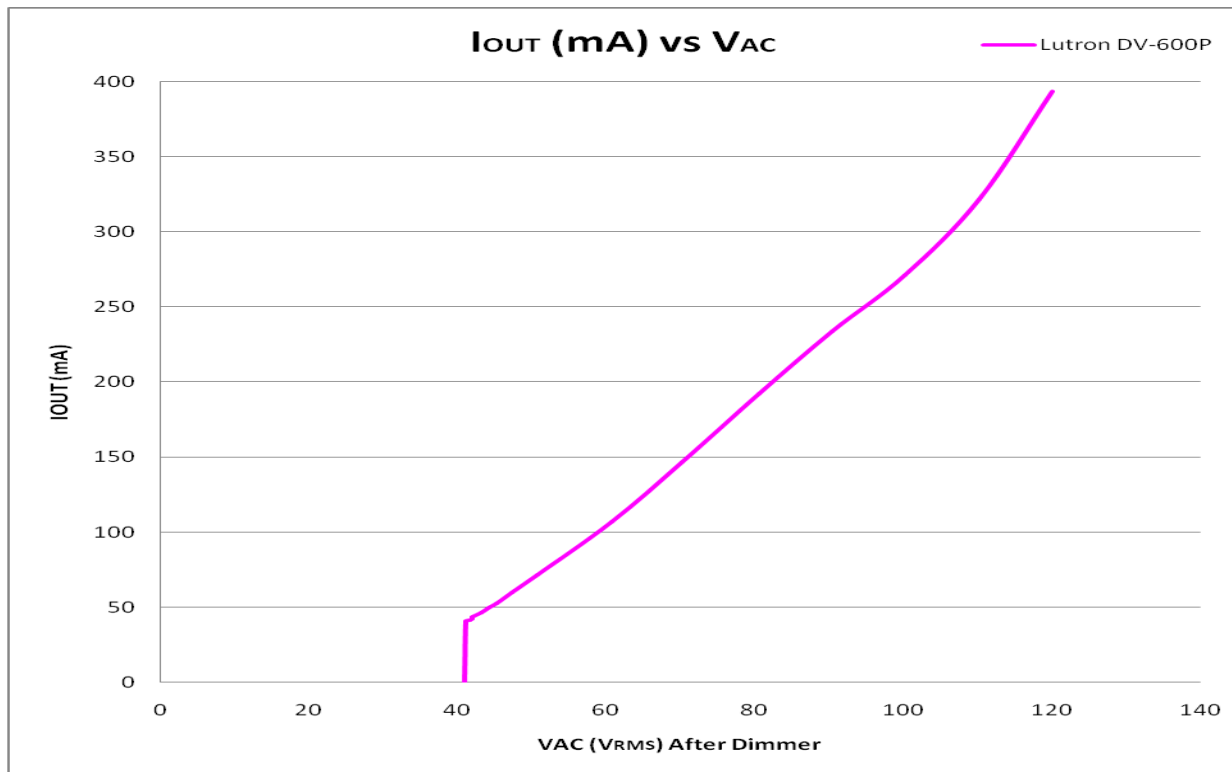
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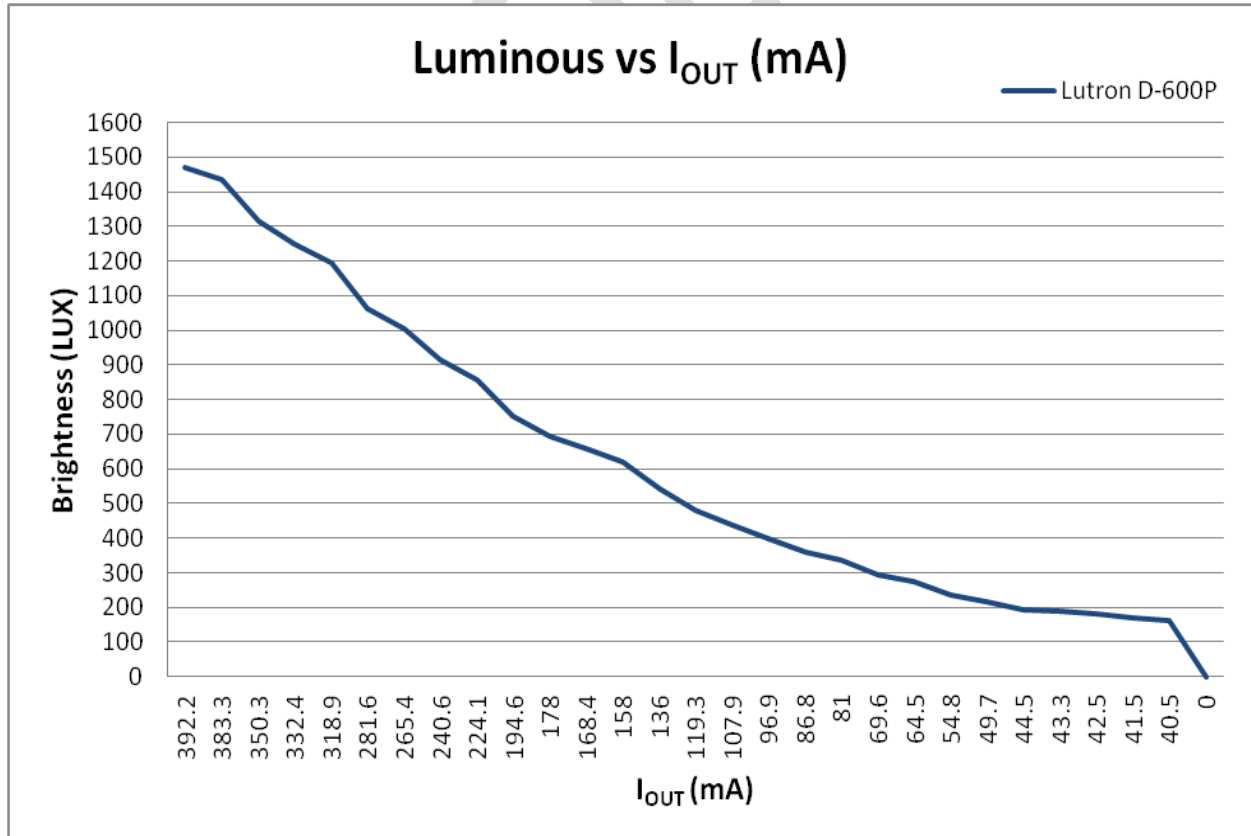
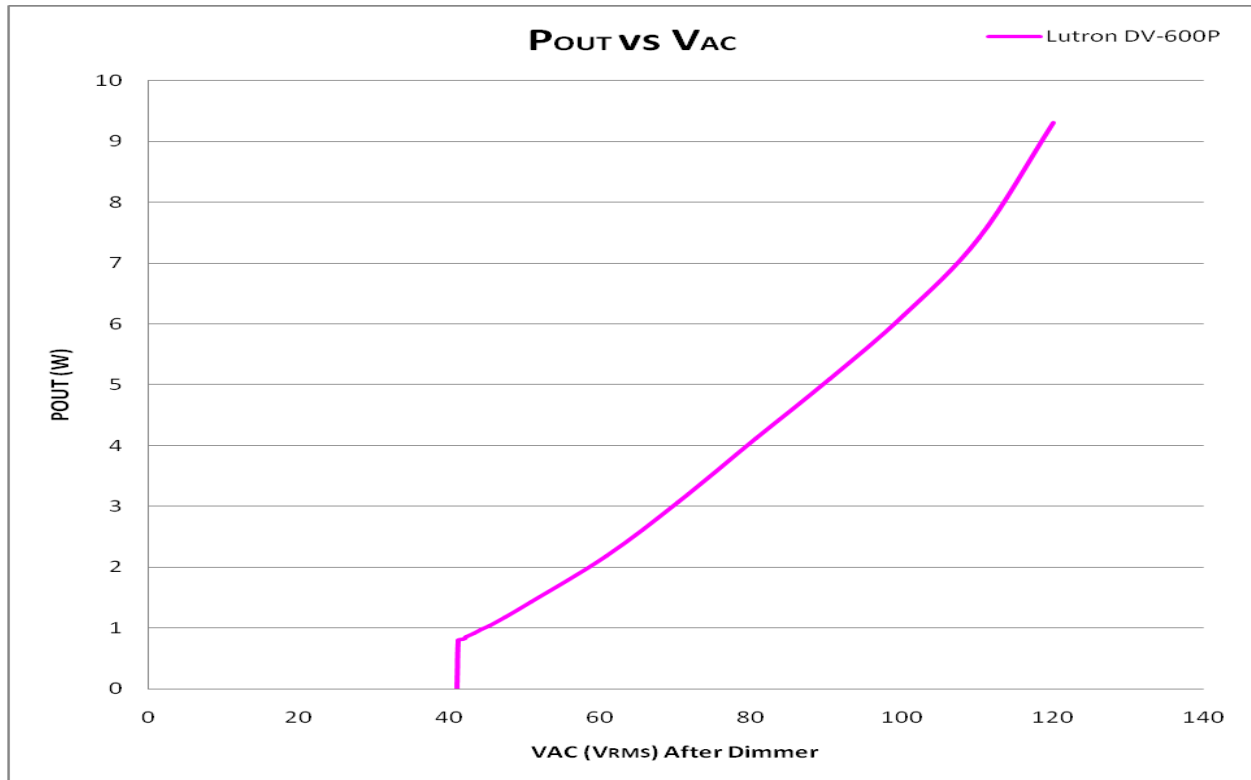
**Functional Performance**

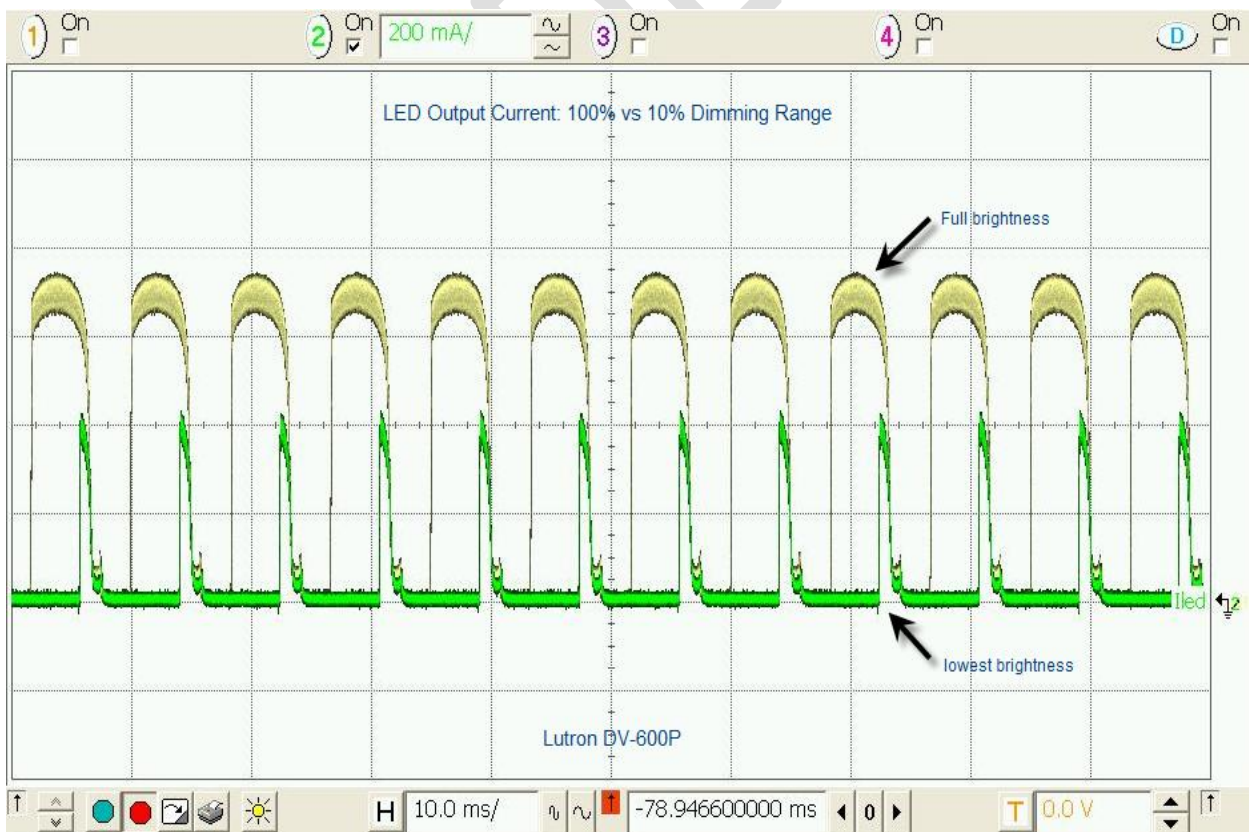
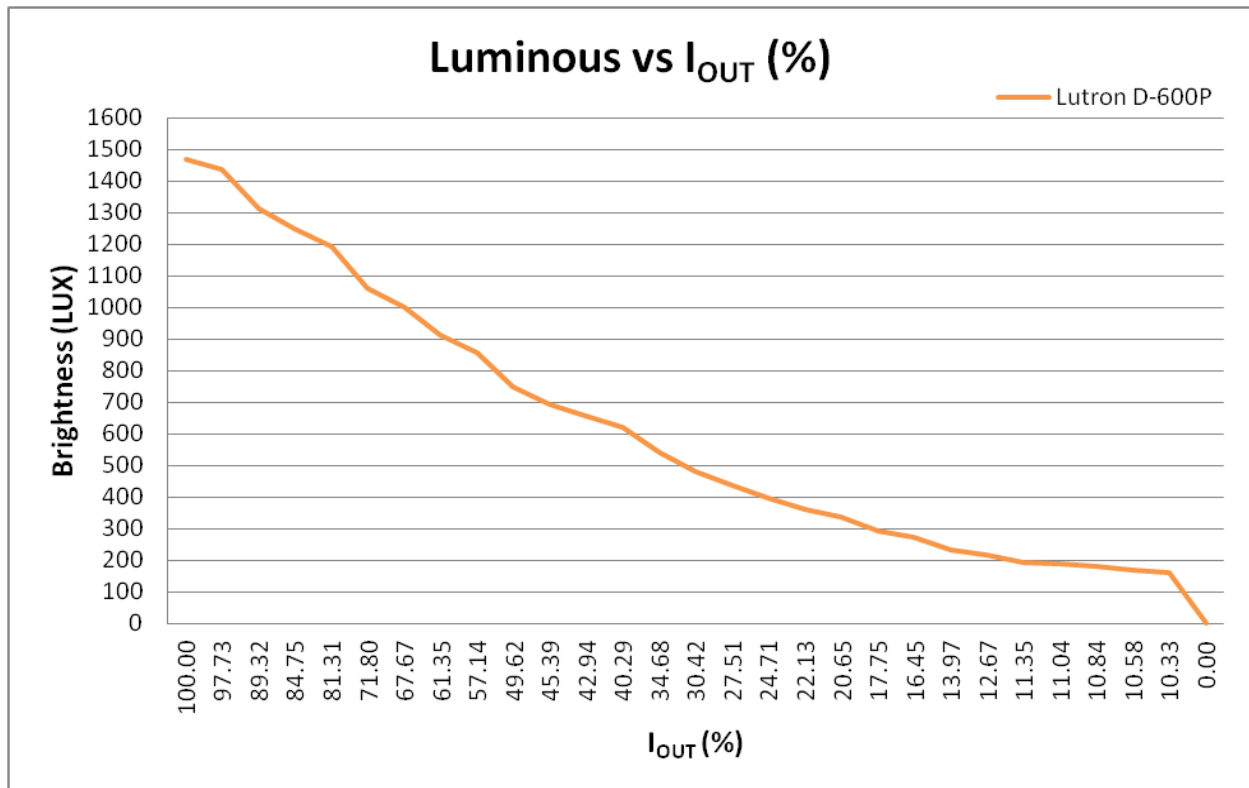












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