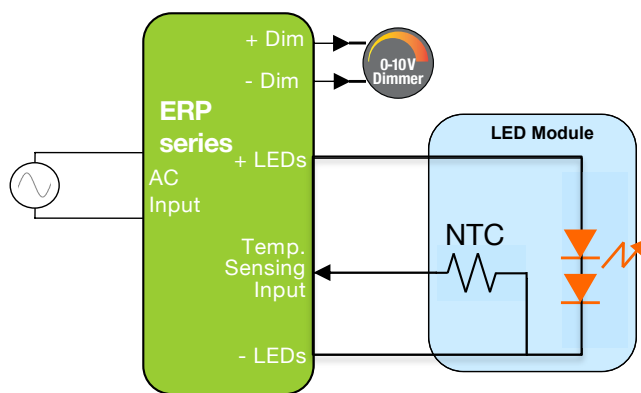


High Power Density Constant Current LED Drivers with 0-10 V Dimming

Input Voltage Range	Max. Output Power	Output Voltage	Output Current	Efficiency	Max. Case Temperature	THD	Power Factor	Dimming Method	Dimming Range
90 to 305 Vac maximum	40 W	16 to 54.5 Vdc	350 mA to 1400 mA	≥ 90% typical	90°C (measured at the hot spot)	< 20%	> 0.9	0 - 10V	10 - 100%




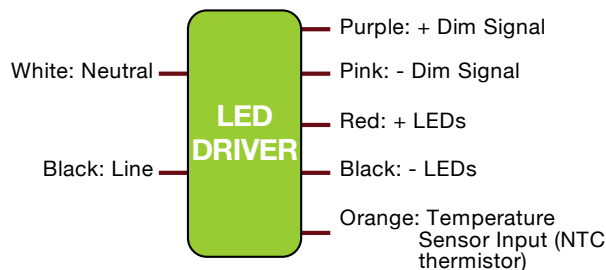
PLASTIC CASE:
L 70 x W 40 x H 27 mm
(L 2.76 x W 1.57 x H1.06 in)



APPLICATION DIAGRAM

FEATURES

- Highest power density in the market: 8.5 W/in³
- Protections: output open load, over-current and short-circuit (hiccup), and over-temperature with auto recovery
- Conducted and radiated EMI: FCC part 15 Class B (120 Vac) /Class A (277 Vac) and EN55015 (CISPR 15) compliant
- Enables ENERGY STAR® and DLC (DesignLight Consortium®) luminaire compliance
- IP64-rated case with silicone encapsulation
- 90°C maximum case hot spot temperature
- 50,000 hours lifetime
- Class 2 power supply
- Double-insulated power supply between input and output (class II) 
- Worldwide safety approvals



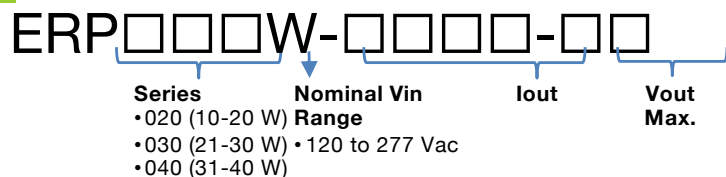
WIRING DIAGRAM

APPLICATIONS

- Commercial lighting & residential lighting
- Architectural lighting
- Tunnels and street lighting
- Wide-area downlights

High Power Density Constant Current LED Drivers with 0-10 V Dimming

1 - ORDERING INFORMATION - MODEL DESCRIPTION




ERP Part Number	Nominal Input Voltage (Vac)	Iout (mA)	Max Output Power (W)	Vout Min (Vdc)	Vout Nom (Vdc)	Vout Max (Vdc)	No Load Voltage (Vdc)
ERP020W: 10 to 20 W							
ERP020W-0700-23.5	120 - 277	700	16.5	17.5	21.9	23.5	30.6
ERP030W: 21 to 30 W							
ERP030W-0600-42	120 - 277	600	25.2	31.5	39	42	50
ERP040W: 31 to 40 W							
ERP040W-1400-24.5	120 - 277	1400	32.9	17.5	21.9	23.5	30.6

For additional options of output current and output voltage, contact your sales representative or send an email to: SaveEnergy@ERPPowerLLC.com

High Power Density Constant Current LED Drivers with 0-10 V Dimming

2 - INPUT SPECIFICATION (@25°C ambient temperature)

	Units	Minimum	Typical	Maximum	Notes
Input Voltage Range (Vin)	Vac	90	120/230/240/277	305	
Input Frequency Range	Hz	47	60 / 50	63	
Power Factor (PF)		0.9	> 0.9		<ul style="list-style-type: none"> •At nominal input voltages, nominal LED load (nominal Vout) and rated output current •For ERP020W models, PF ≥ 0.9 at 277 Vac and max LED load (maximum Vout)
Inrush Current	A			50 A peak	At any point on the sine wave and 25°C
Leakage Current	μA			250 μA @ 120 Vac 500 μA @ 230 Vac 600 μA @ 277 Vac	Measured per IEC60950-1
Input Harmonics	Complies with IEC61000-3-2 for Class C equipment				
Total Harmonics Distortion (THD)				20%	<ul style="list-style-type: none"> •At 120 Vac only and nominal LED load (nominal Vout) •Complies with DLC (DesignLight Consortium) technical requirements v2.0
Efficiency			90%	-	At nominal input voltage
Isolation	Meets UL60950-1 for class II reinforced/double insulation power supply 				

High Power Density Constant Current LED Drivers with 0-10 V Dimming

3 - OUTPUT SPECIFICATION (@25°C ambient temperature)

	Units	Minimum	Typical	Maximum	Notes
Output Voltage (Vout)	Vdc	16		54.5	See ordering information for details
Output Current (Iout)	mA	350		1400	See ordering information for details
Output Current Regulation	%	-5	±2.5	5	Includes AC line voltage, load, and current set point variations
Output Current Overshoot	%	-	-	10	The driver does not operate outside of the regulation requirements for more than 500 ms during power on with nominal LED load and without dimmer.
Ripple Current	< 22.5% peak-to-peak of rated output current				<ul style="list-style-type: none"> Models with an output voltage greater than 60 V may have ripple currents up to 30% peak to peak of the rated current, depending on the LED load. Measured with a nominal LED load and nominal input voltage with no dimming. Calculated in accordance with the IES Lighting Handbook, 9th edition.
Dimming Range (% of Iout)		10%		100%	<ul style="list-style-type: none"> The dimming range will be dependent on each specific dimmer. When testing, if light is measured, dimming range is based on light output. If no light is measured, dimming range is based on percentage of output current.
Start-up Time	ms			500	The output current is >50% of rated output current within 500 ms of the application of AC power being applied. This applies under the complete range of dimming from 10% to 100% and all nominal AC input voltages.

Output Controls

+Dim Signal, -Dim Signal	The dimming input can be used to adjust the output setting via a standard commercial wall dimmer, an external control voltage source (0 to 10 Vdc), or a variable resistor when using the recommended number of LEDs. The dimming input permits 10% to 100% dimming.
Temperature Sensing Input	The temperature sensing input pin may be connected to a 100 kΩ NTC (negative temperature coefficient) thermistor. The thermistor should be located on the LED assembly to monitor its temperature. If the temperature exceeds a predetermined (90°C) set point, the output current of the LED driver module is automatically reduced to regulate the temperature of the LED at a safe level.

High Power Density Constant Current LED Drivers with 0-10 V Dimming

4 - ENVIRONMENTAL CONDITIONS

	Units	Minimum	Typical	Maximum	Notes
Operating Case Temperature (Tc)	°C	-30		+90	Case temperature measured at the hot spot •tc (see label in page 10)
Storage Temperature	°C	-40		+85	
Humidity	%	5	-	95	Non-condensing
Cooling	Convection cooled				
Acoustic Noise	dBA			24	Measured at a distance of 1 meter, without and with approved dimmers.
Mechanical Shock Protection	per EN60068-2-27				
Vibration Protection	per EN60068-2-6 & EN60068-2-64				
MTBF	≥ 250,000 hours when operated at nominal input and output conditions, and at Tc ≤ 70°C				
Lifetime	50,000 hours at 70°C maximum case hot spot temperature (see hot spot •tc on label in page 10)				

5 - EMC COMPLIANCE AND SAFETY APPROVALS

EMC Compliance			
Conducted and Radiated EMI		<ul style="list-style-type: none"> •FCC CFR Title 47 Part 15 Class B at 120 Vac and Class A at 277 Vac •EN55015 (CISPR 15) compliant at 220/230/240 Vac 	
Harmonic Current Emissions		IEC61000-3-2	For Class C equipment
Voltage Fluctuations & Flicker		IEC61000-3-3	
Immunity Compliance	ESD (Electrostatic Discharge)	IEC61000-4-2	6 kV contact discharge, 8 kV air discharge, level 3
	RF Electromagnetic Field Susceptibility	IEC61000-4-3	3 V/m, 80-1000 MHz, 80% modulated at distance of 3 meters
	Electrical Fast Transient	IEC61000-4-4	± 2 kV on AC power port for 1 minute, ±1 kV on signal/control lines
	Surge	IEC61000-4-5	± 1 kV line to line (differential mode) / ± 2 kV line to common mode ground (tested to secondary ground) on AC power port, ±0.5 kV for outdoor cables
	Conducted RF Disturbances	IEC61000-4-6	3V, 0.15-80 MHz, 80% modulated
	Voltage Dips	IEC61000-4-11	>95% dip, 0.5 period; 30% dip, 25 periods; 95% reduction, 250 periods
Transient Protection	Ring Wave		ANSI/IEEE c62.41.1-2002 & c62.41.2-2002 category A, 2.5 kV ring wave

Safety Agency Approvals			
UL	UL60950-1 recognized	UL8750 recognized	Approved for damp locations
cUL	CSA C22.2 60950-1		
CE	IEC61347-2-13 electronic control gear for LED Modules		

Safety					
	Units	Minimum	Typical	Maximum	Notes
Hi Pot (High Potential)	Vdc	4242			<ul style="list-style-type: none"> •Insulation between the input (AC line and Neutral) and the output •Tested at the RMS voltage equivalent of 3000 Vac

High Power Density Constant Current LED Drivers with 0-10 V Dimming

6 - PROTECTION FEATURES

The driver shall hiccup as a result of a short circuit, or over current fault. Removal of the fault returns the driver to within normal operation.

Short Circuit

The driver is protected such that a short from any output to return shall not result in a fire hazard or shock hazard. The driver recovers, with no damage, from a short from any output to return.

Internal Over Temperature Protection

The driver protects itself from an over-temperature condition. When an over-temperature condition is detected, the output current shall hiccup with an on and off time of at least 250 ms and a frequency of ≤ 3 Hz. The driver automatically recovers when the over-temperature condition is removed. The over temperature point corresponds to a case temperature of $>90^{\circ}\text{C}$.

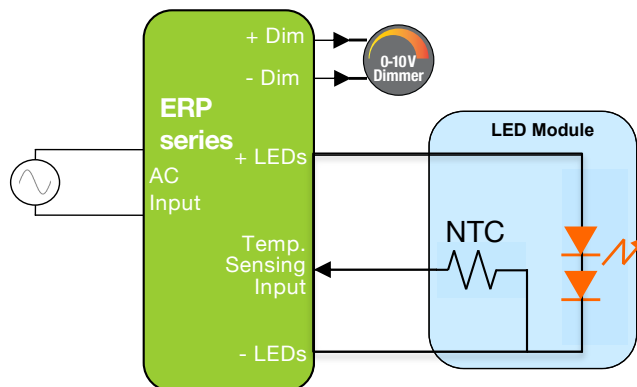
Over Current Protection

The output maintains the output current to within the constant current limit until the output voltage has dropped to below the minimum voltage allowable in the specification. See list of models on page 2. The driver enters a hiccup mode below the minimum voltage in the list of models.

High Power Density Constant Current LED Drivers with 0-10 V Dimming

7 - TEMPERATURE SENSING

Figure 1 shows the connection of a simple NTC resistor connected to the temperature sense input of the ERP020/030/040 LED driver. For best performance, the NTC resistor should be located close to the LED. With this configuration, a degree of over temperature protection of the LED is possible.



The ERP020/030/040 LED driver has been designed to operate with a 100 k Ω NTC resistor to provide a knee in the output current regulation between 90°C and 95°C. The graph in Figure 2 shows the reduction in output current as the temperature of the NTC rises above 90°C. For this example, the NTC is a surface-mount 100 k Ω device from Vishay, part number NTCS0805E3104JXT.

At temperatures less than 90°C, the temperature sense input has no effect on the driver's output current. As the temperature rises above 90°C, the output current of the driver begins to drop resulting in a reduction in the temperature at the LED.

If the temperature sense input is open, the driver defaults to the current set-point determined by the +Dim/-Dim signal pins and the maximum rated current.

Output Current versus NTC Temperature

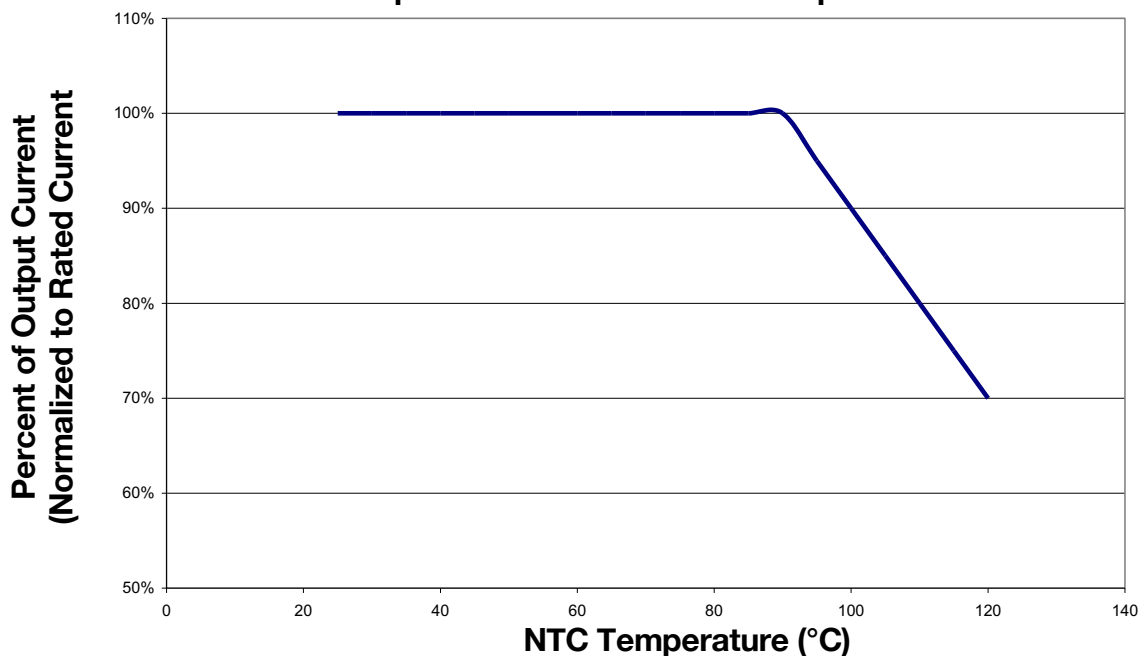


Figure 2

High Power Density Constant Current LED Drivers with 0-10 V Dimming

7 - OUTPUT DIMMING CONTROL

The ERP drivers operate only with 0-10V dimmers that sink current. They are not designed to operate with 0-10V control systems that source current, as used in theatrical/entertainment systems. Developed in the 1980's, the 0-10V sinking current control method is adopted by the International Electrotechnical Commission (IEC) as a part of their IEC Standard 60929 Annex E.

The method to dim the output current of the driver is done via the +Dim/-Dim Signal pins. The +Dim/-Dim Signal pins respond to a 0 to 10 V signal, delivering 10% to 100% of the output current based on rated current for each model. A pull-up resistor is included internal to the driver. When the +Dim input (purple) is ≤ 1 V or short circuited to the -Dim wire (pink) or to the -LED wire (black), the output current is programmed to $\leq 10\%$ of rated current. If the +Dim input is > 10 V or open circuited, the output current is programmed to 100% of rated current.

When not used, the -Dim wire (pink) and to the +Dim wire (purple) can be capped or cut off. In this configuration, no dimming is possible and the driver delivers 100% of its rated output current.

A fixed or variable resistor can be also used from the dimming input to the return to adjust the output current. Figure 3 show the relationship of the output current to a resistor connected across the 0-10V dimming input.

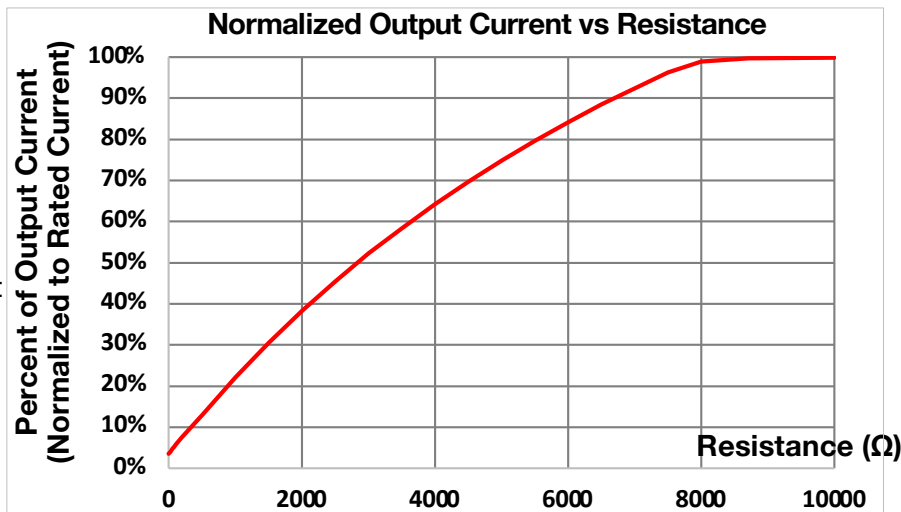


Figure 3

The maximum current supplied by the +Dim Signal pin is $< 600 \mu\text{A}$. Figure 4 shows the relationship of the output current to the dimming input voltage.

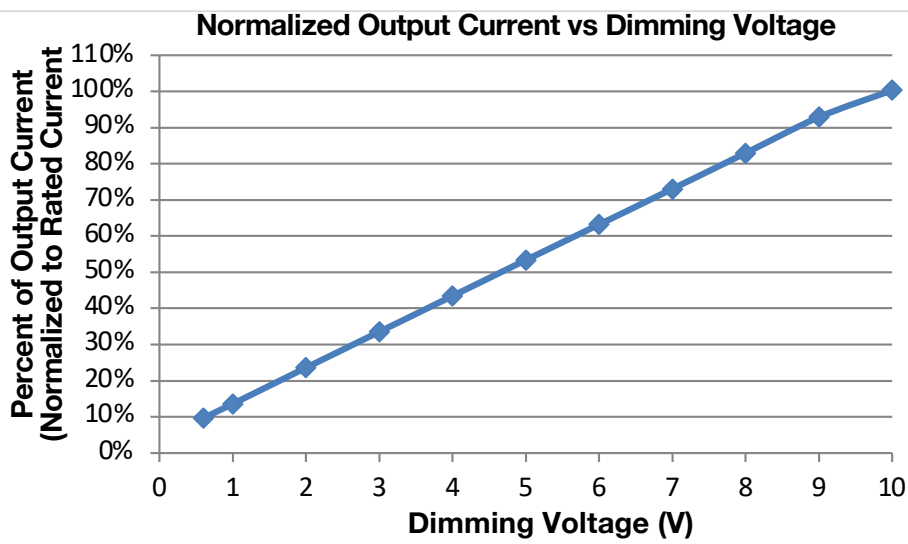


Figure 4

8 - COMPATIBLE 0-10 V DIMMERS

- Lutron, Nova series (part number NFTV)
- Lutron, Diva series (part number DVTV)

High Power Density Constant Current LED Drivers with 0-10 V Dimming

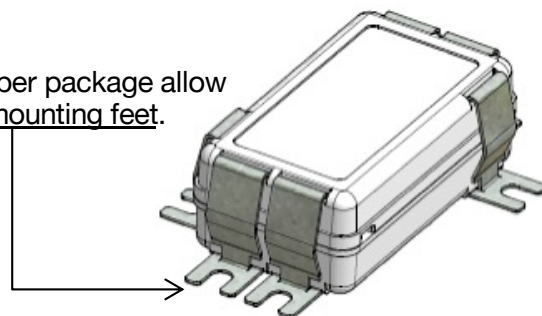
9 - MECHANICAL DETAILS

Packaging: Plastic case

I/O Connections: Flying leads, 18 AWG on power leads, 22 AWG on control leads, 152 mm (6 in) long, 105°C rated, stranded, stripped by approximately 9.5mm, and tinned. All the wires, on both input and output, have a 300 V insulation rating.

Ingress Protection: IP64 rated

Mounting Details: Universal mounting clips, and six mounting locations per package allow installer to choose the most suitable position for the mounting feet.



10 - OUTLINE DRAWINGS

Dimensions: 70 x 40 x 27 mm (2.76 x 1.57 x 1.06 in)

Volume: 75.6 cm³ (4.61 in³)

Weight: 142 g (5 oz.)

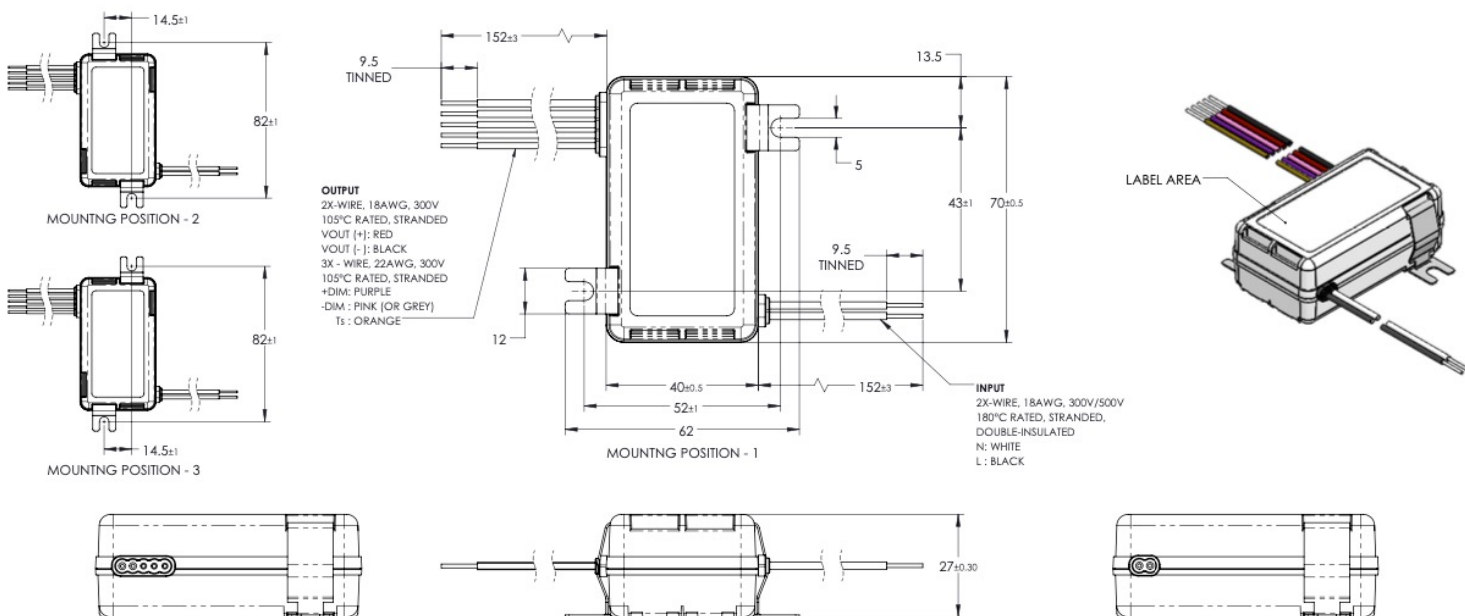


Figure 5

High Power Density Constant Current LED Drivers with 0-10 V Dimming

11- LABELING

The ERP030W-0600-42 is used in figure 4 as an example to illustrate a typical label.

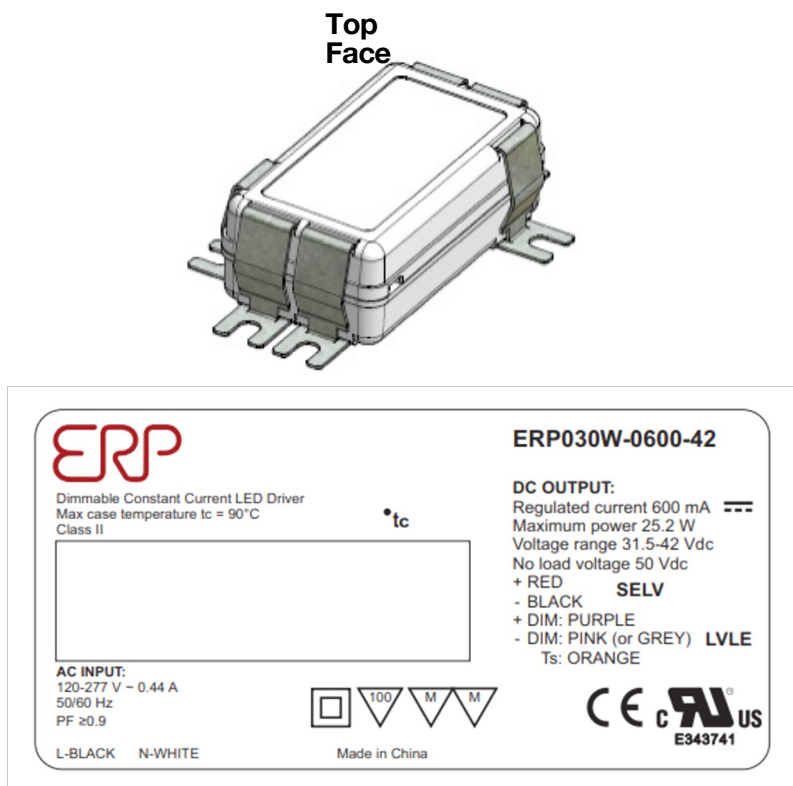


Figure 6

USA Headquarters

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Fax: +1-805-517-1411
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Moorpark, CA 93021, USA

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Zhuhai, Guangdong, China 519060

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