TLM Series

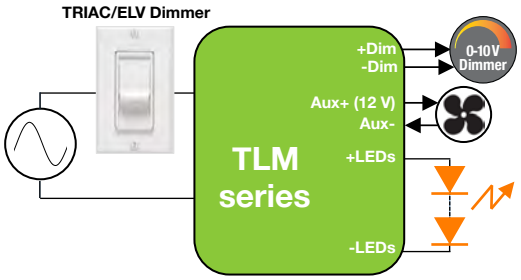
TLM90 81-90 W
TLM160 151-160 W

Tri-Mode Dimming™ (TRIAC, ELV & 0-10 V) High Power CC LED Drivers with 0.01-100% Dimming Range and with 12 V / 100 mA Auxiliary Output

Input Voltage	Max. Output Power	Output Voltage	Output Current	Efficiency	Max. Case Temperature	THD	Power Factor	Dimming Method	Dimming Range
120 to 277 Vac typical	160 W	30 to 85 Vdc	1.8 to 2.1A CC	up to 90% typical	90°C (measured at the hot spot)	< 20%	> 0.9	Forward-Phase, Reverse-Phase & 0 - 10V	0.01 - 100% (% of Iout)

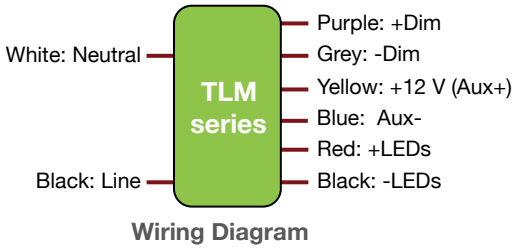
CC: Constant Current

Aluminum Case:
L 101.6 x W 50.8 x H 38.5mm
(L 4 x W 2 x H 1.52 in)



FEATURES

- Diming range: **0.01% – 100%** with ETC, Leprecon and Elation stage lighting AC phase dimmers
- +12 V/100 mA auxiliary output to power external fan, motion or ambient light sensor, or wireless module
- TRIAC and ELV dimming only at 120 Vac
- Conducted and radiated EMI: Compliant with FCC CFR Title 47 Part 15 Class A at 120 Vac & 277 Vac
- Complies with ENERGY STAR® luminaire specification and DLC (DesignLight Consortium®) technical requirements
- IP66-rated case with silicone-based potting
- 90°C maximum case hot spot temperature
- Worldwide safety approvals



Wiring Diagram

TYPICAL APPLICATIONS

- Stage. Theatrical lighting
- Studio lighting

5 Year Warranty

Tri-Mode Dimming™ (TRIAC, ELV & 0-10 V) High Power CC LED Drivers with 0.01-100% Dimming Range and with 12 V / 100 mA Auxiliary Output

1 - ORDERING INFORMATION - MODEL DESCRIPTION

TLM□□□□-□□□□-□□

Power Level
• 160 (151 - 160 W)

Nominal Vin
• W (120 to 277 Vac)

Iout

Vout Max.

Ordering Part Number	Input Voltage Range (Vac)	Max Output Power (W)	Iout (A)	Vout min (Vdc)	Vout Nom (Vdc)	Vout Max (Vdc)	No Load Voltage (Vdc)
TLM90W: 81 to 90 W							
TLM090W-2.1-42	120 to 277	88.2	2.1	30	37.8	42	50
TLM160W: 151 to 160 W							
TLM160W-1.8-85	120 to 277	153.0	1.8	68	76.5	85	100

Notes:
- *Forced air cooling or heatsink base plate (aluminum baseplate: 210mm x 200mm x 2mm) is required for total continuous power exceeding 120 W*
- *For additional options of output current and output voltage, contact your sales representative or send an email to: SaveEnergy@erp-power.com*

Tri-Mode Dimming™ (TRIAC, ELV & 0-10 V) High Power CC LED Drivers with 0.01-100% Dimming Range and with 12 V / 100 mA Auxiliary Output

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

	Units	Minimum	Typical	Maximum	Notes
Input Voltage Range (Vin)	Vac	90	120, 230, 277	305	The rated output current for each model is achieved at Vin ≥ 115 Vac and at Vin ≥ 209 Vac, at nominal load.
Input Frequency Range	Hz	47	60	63	
Power Factor (PF)		0.9	> 0.9		At nominal input voltage and with nominal LED voltage
Input Current (Iin)	A			1.8	At 120 Vac nominal input voltage
Inrush Current	Meets NEMA-410 requirements				At any point on the sine wave and 25°C
Leakage Current	µA			500 µA	Measured at nominal input voltage per IEC60950-1
Input Harmonics	Complies with IEC61000-3-2 for Class C equipment				
Total Harmonics Distortion (THD)				20%	•At nominal input voltage and nominal LED voltage •Complies with DLC technical requirements
Efficiency	%	-	up to 90%	-	Measured with nominal input voltage, a full sinusoidal wave form and without dimmer connected
Isolation	The AC input to the main DC output is isolated and meets Class II reinforced/double insulation power supply ⧈				

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

	Units	Minimum	Typical	Maximum	Notes
MAIN CONSTANT CURRENT OUTPUT					
Output Voltage (Vout)	Vdc				See ordering information for details
Output Current (Iout)	A				•See ordering information for details •The rated output current for each model is achieved at Vin ≥ 115 Vac and at Vin ≥ 209 Vac, at nominal load.
Output Current Regulation	%	-5		5	•At nominal AC line voltage •Includes 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	≤ 40% of rated output current for each model				•Measured at nominal LED voltage and nominal input voltage without dimming. •Calculated in accordance with the IES Lighting Handbook, 9th edition.
Dimming Range (% of Iout)	%	0.01		100	•The dimming range is dependent on each specific dimmer. It may not be able to achieve 0.01% dimming with some dimmers. •Dimming performance is optimal when the driver is operated at its nominal output voltage matching the LED nominal Vf (forward voltage). Dimming performance may vary when the driver is operated near its minimum output voltage.
Start-up Time	s			1	•With nominal LED voltage, nominal AC line voltage and without dimmer attached. •The startup time to see light output (about 10% of rated current) is ≤ 1 sec. •The startup time from AC turn on to current regulation band is ≤ 3 sec.

12 V AUXILIARY CONSTANT VOLTAGE OUTPUT					
Output Voltage (Vout)	Vdc	10.2	12	13.2	The voltage regulation is +10%/-15% and the ripple voltage shall be ≤ 0.4V.
Output Current (Iout)	mA		100		

Tri-Mode Dimming™ (TRIAC, ELV & 0-10 V) High Power CC LED Drivers with 0.01-100% Dimming Range and with 12 V / 100 mA Auxiliary Output

4 - 0-10 V DIMMING CONTROL (@25°C ambient temperature)

	Units	Minimum	Typical	Maximum	Notes
+Dim Signal, -Dim Signal	The SLM series operate only with 0-10V dimmers that sink current. The method to dim the output current of the driver is done via the +Dim/-Dim Signal pins. The +Dim/-Dim signal pins 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 0.01% to 100% dimming.				
Dimming Range (% of Iout)	%	0.01		100	•The dimming range is dependent on each specific dimmer. It may not be able to achieve 0.01% dimming with some dimmers. •Dimming performance is optimal when the driver is operated at its nominal output voltage matching the LED nominal Vf (forward voltage). Dimming performance may vary when the driver is operated near its minimum output voltage.
Current Supplied by the +Dim Signal Pin	mA			2.5	
Isolation	The 0-10 V circuit is isolated from the AC input and meets Class II reinforced/double insulation power supply. ⧈				

5 - ENVIRONMENTAL CONDITIONS

	Units	Minimum	Typical	Maximum	Notes
Operating Ambient Temperature (Ta)	°C	-40		50	
Maximum Case Temperature (Tc)	°C			+90	Case temperature measured at the hot spot •tc (see label in page 9)
Storage Temperature	°C	-40		+85	
Humidity	%	5	-	95	Non-condensing
Cooling	Forced air cooling or heatsink base plate (aluminum baseplate: 210mm x 200mm x 2mm) is required for total continuous power exceeding 120 W.				
Acoustic Noise	dBA			24	Measured at a distance of 1 meter, without any dimmers
Mechanical Shock Protection	per EN60068-2-27				
Vibration Protection	per EN60068-2-6 & EN60068-2-64				
MTBF	> 200,000 hours when operated at nominal input and output conditions, and at Tc ≤ 70°C				
Lifetime	50,000 hours at Tc ≤70°C maximum case hot spot temperature (see hot spot •tc on label in page 9)				

Tri-Mode Dimming™ (TRIAC, ELV & 0-10 V) High Power CC LED Drivers with 0.01-100% Dimming Range and with 12 V / 100 mA Auxiliary Output

6 - EMC COMPLIANCE AND SAFETY APPROVALS

EMC Compliance			
Conducted and Radiated EMI		FCC CFR Title 47 Part 15 Class A at 120 Vac and Class A at 277 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 a 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	± 4 kV line to line (differential mode) /± 4 kV line to common mode ground (tested to secondary ground) on AC power port, ±0.5 kV for outdoor cables. Check the ordering information as other models have different surge protection levels.
	Conducted RF Disturbances	IEC61000-4-6	3 V, 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	UL8750 recognized
cUL	CAN/CSA C22.2 No. 250.13-14 LED equipment for lighting applications

Safety					
	Units	**Minimum**	**Typical**	**Maximum**	**Notes**
Hi Pot (High Potential)	Vdc	2500			• Insulation between the input (AC line and Neutral) and the output • Tested at the RMS voltage equivalent of 1768 Vac

7 - PROTECTION FEATURES

Under-Voltage (Brownout)
The SLM series provides protection circuitry such that an application of an input voltage below the minimum stated in paragraph 1 (Input Specification) shall not cause damage to the driver.

Short Circuit
The SLM series is protected such that a short from any output to return shall not result in a fire hazard or shock hazard. In the event of a short, the driver shuts down and latches off as a result of short circuit fault for main output. Removal of fault and AC recycling returns the driver to normal operation.

Internal Over temperature Protection
The SLM series incorporates circuitry that prevents internal damage due to an over temperature condition. An over temperature condition may be a result of an excessive ambient temperature or as a result of an internal failure. When the over temperature condition is removed, the driver shall automatically recover.

Output Open Load
When the LED load is removed, the output voltage of the SLM series is limited to 1.3 times the maximum output voltage of each model.

Tri-Mode Dimming™ (TRIAC, ELV & 0-10 V) High Power CC LED Drivers with 0.01-100% Dimming Range and with 12 V / 100 mA Auxiliary Output

8 - PHASE-CUT DIMMING

The TLM series offers Tri-Mode dimming™ compatibility with phase-cut ELV dimmers, TRIAC dimmers with DMX controllers and with 0–10V dimmers. TRIAC and ELV dimming is only offered at 120 Vac. Figures 1 and 2 show the typical output current versus conduction angle at nominal input voltage.
The minimum current (0.01% of maximum current) is attained when the dimming angle is ≤ 23 degree.

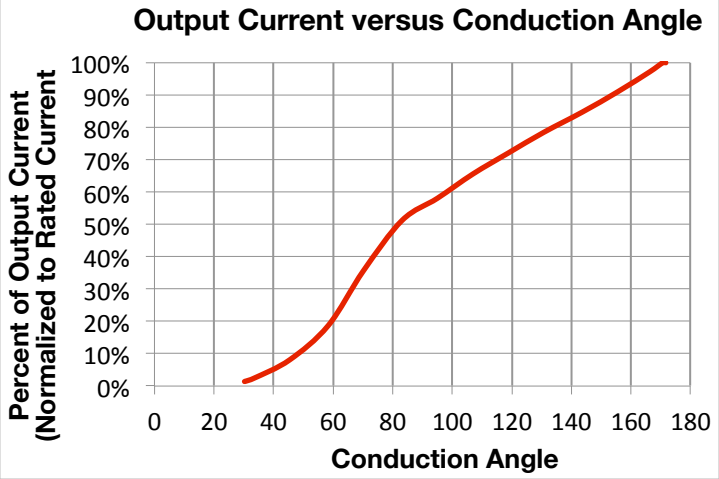


Figure 1

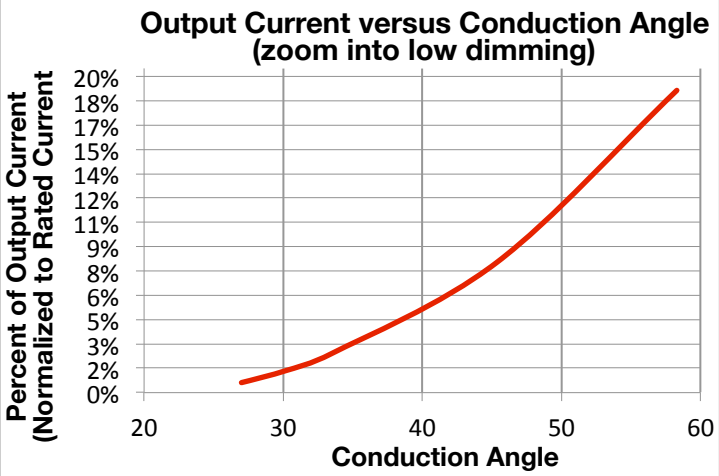


Figure 2

9 - COMPATIBLE PHASE-CUT ELV DIMMERS and TRIAC DIMMERS

120 VAC ELV DIMMERS

Manufacturer	Series	Type
Leviton	Vizia	VPE06-1L
Lutron	Diva	DVELV-303P
Lutron	Skylark	SELV-300P
Leviton	Illumatech	IPE04-1L
Lutron	Maestro	MAELV-600
Lutron	Faedra	FAELV-500
Lightolier	Sunrise	ZP260QE

120 VAC TRIAC DIMMERS WITH DMX CONTROLLERS

Manufacturer	Series	Type
ELATION	DP-DMX20L	DMX
ELATION	CYBER PAK	DMX
LEPRECON	ULD-340	DMX
ETC	SMART BAR	DMX

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10 - 0-10 V DIMMING

The TLM 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 apart 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 1% 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 short circuited to the –Dim wire (grey) or to the –LED wire (black), there is no output current. When the +Dim input (purple) is ≤ 1 V, the output current is programmed to ≤ 10% of rated current. If the +Dim input is >10V or open circuited, the output current is programmed to 100% of the rated current.
When not used, the –Dim wire (grey) 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.

The maximum source current (flowing from the driver to the 0-10V dimmer) supplied by the +Dim Signal pin is ≤ 2.5 mA.

Figure 3 shows the 0-10V dimming transfer function.

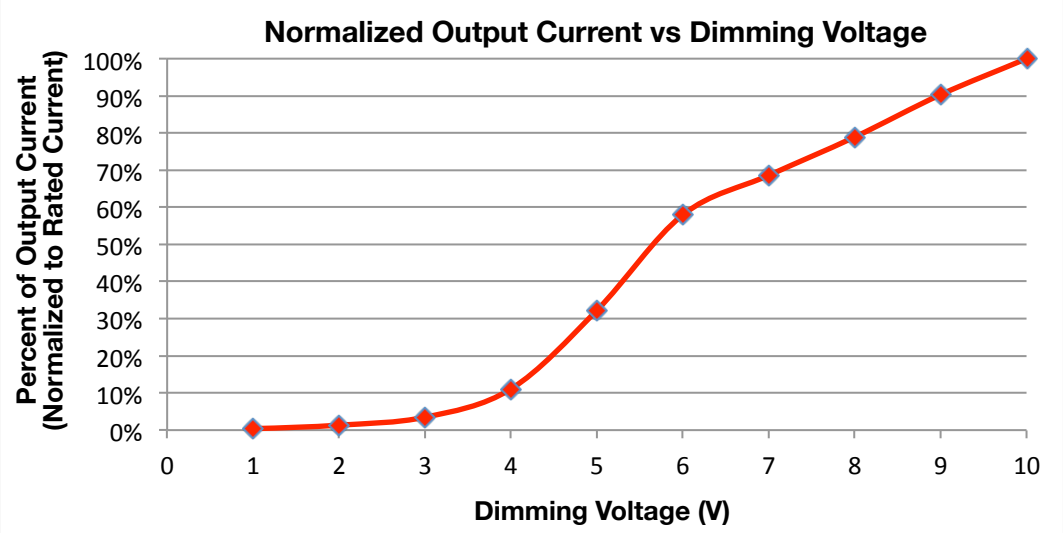

Figure 3

11 - COMPATIBLE 0-10 V DIMMERS

- Lutron, Nova series (part number NFTV)
- Lutron, Diva series (part number DVTV)
- Leviton: IllumaTech IP710-DL

Tri-Mode Dimming™ (TRIAC, ELV & 0-10 V) High Power CC LED Drivers with 0.01-100% Dimming Range and with 12 V / 100 mA Auxiliary Output

12 - MECHANICAL DETAILS

Packaging Options: Aluminum extruded case

I/O Connections: Flying leads, 18 AWG on power leads, 18 AWG on control leads, 203 mm (8 in) long, stranded, stripped by approximately 9.5mm, and tinned. All the wires, on both input and output, have a 300 V insulation rating.

Ingress Protection: IP66 rated

Mounting Instructions: The driver must be secured on a flat surface through the four mounting tabs, shown here below in the case outline drawings.

For power exceeding 120 W, it is recommended to use forced air cooling or a heatsink base plate (aluminum baseplate: 210mm x 200mm x 2mm).

13 - OUTLINE DRAWINGS

Dimensions: L 101.6 x W 50.8 x H 38.5 mm (L 4.0 x W 2.0 x H 1.52 in)

Volume: 198.7 cm^3 (12.13 in^3)

Weight:

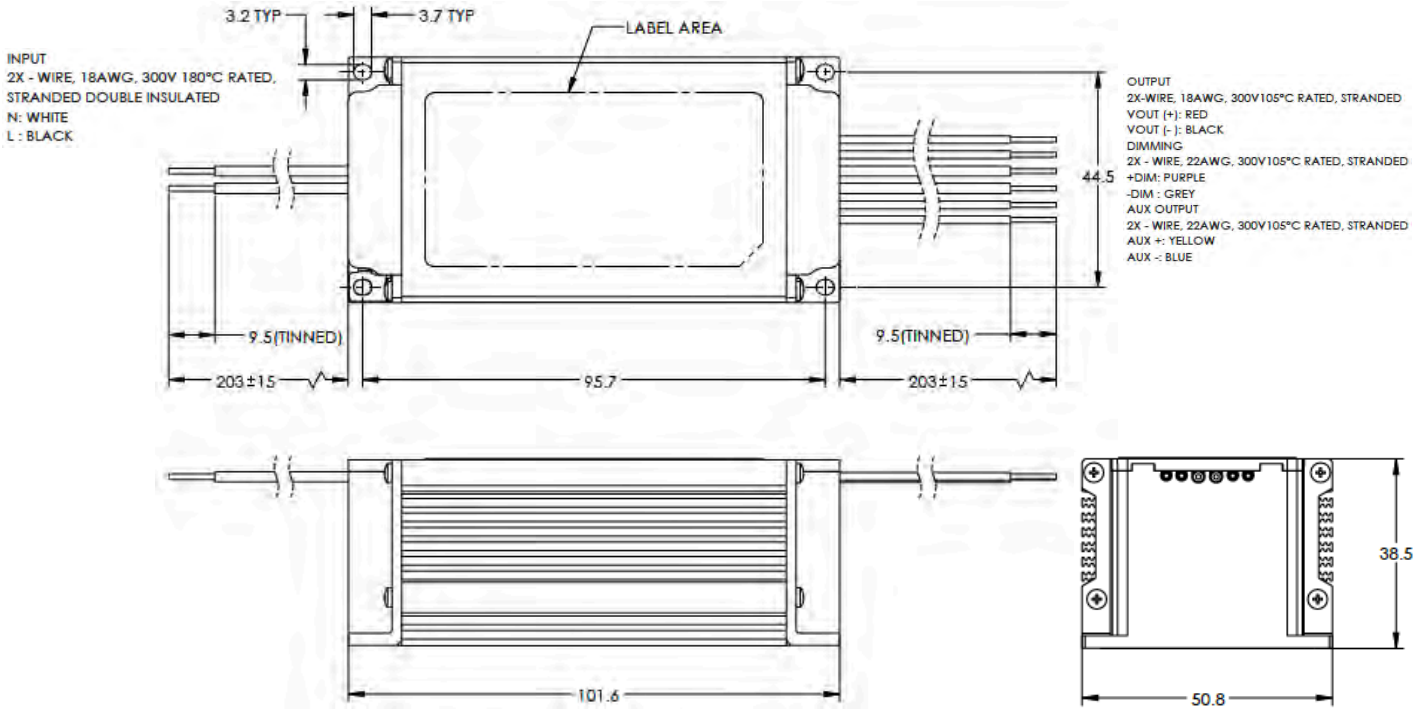

Figure 4

Tri-Mode Dimming™ (TRIAC, ELV & 0-10 V) High Power CC LED Drivers with 0.01-100% Dimming Range and with 12 V / 100 mA Auxiliary Output

14 - LABELING

The TLM090W-2.1-42 is used in figure 5 as an example to illustrate a typical label.

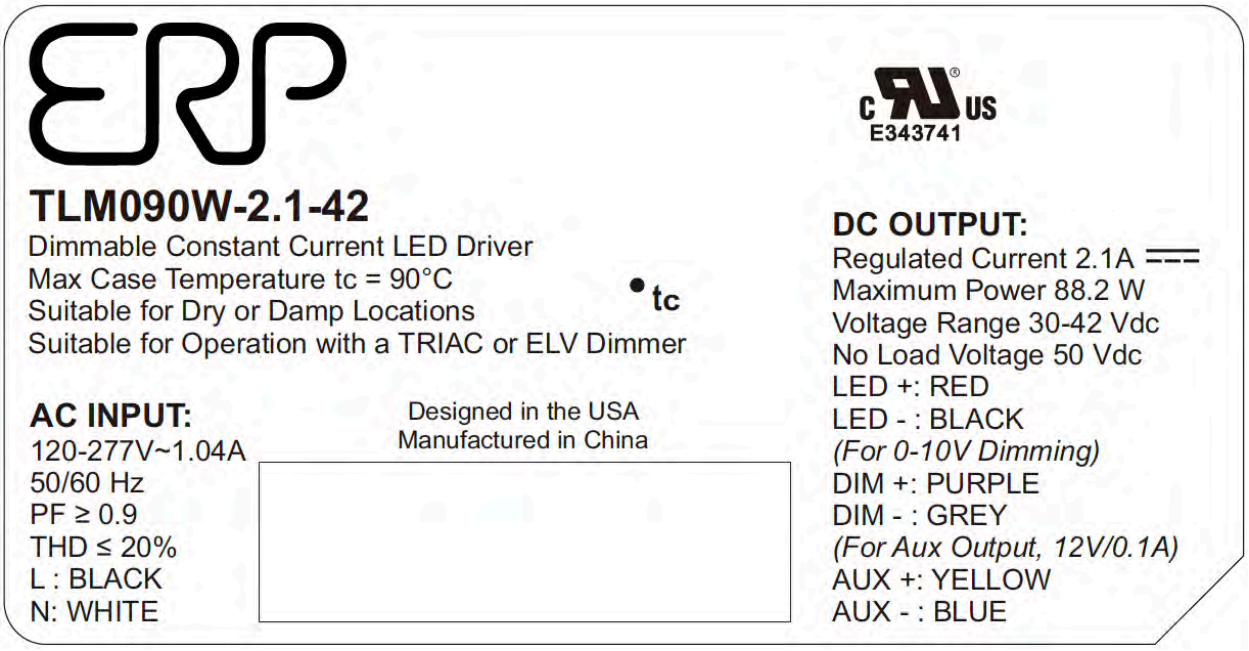

Figure 5

USA Headquarters
Tel: +1-805-517-1300
Fax: +1-805-517-1411
893 Patriot Drive, Suite E,
Moorpark, CA 93021, USA

CHINA Operations
Tel: +86-756-6266298
Fax: +86-756-6266299
No. 8 Pingdong Road 2
Zhuhai, Guangdong, China 519060

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