inventronics ESM-880S280MGS 880W Programmable Driver with INV Digital Dimming

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Contents

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Specifications:

- Model: ESM-880SxxxMGS
- Power: 880W
- Output Current Range: 0.195-20.0 A
- Output Voltage Range: Varies per model
- Max. Output Power: 880W
- Typical Efficiency: 95.0% – 96.0%
- Typical Power Factor: 0.96 – 0.99
- Input Voltage Range: 277Vac – 480Vac

Product Usage Instructions:

Installation:
Follow these steps to install the programmable driver:

1. Ensure power is switched off before installation.
2. Connect the driver to the power source within the input voltage range.
3. Connect the output to the load following the specified current and voltage ranges.

Programming:
To program the driver:

1. Refer to the model number and adjust the output current within the specified range.
2. Ensure the output voltage is within the allowed operating area for optimal performance.

Dimming:
Utilize the INV Digital Dimming feature for dimming control:

1. Follow the dimming instructions provided in the manual for proper dimming operation.

Frequently Asked Questions (FAQ):

- **Q: Can I use this driver with input voltage below 277Vac?**
  A: The certified voltage range is UL, FCC 277-480Vac; however, it can also work within 277-400Vac.
- **Q: What is the warranty period for this product?**
  A: The product comes with a 5-year warranty for added assurance.
- **Q: How do I determine the correct output current for my application?**
  A: Refer to the model number and adjust the output current within the specified range based on your requirements.

Features

- Panel Mount Connectors Facilitates Installation
- Brackets Accommodates Variety of Hanging Applications
- Ultra High Efficiency (Up to 96%)
- Full Power at Wide Output Current Range (Constant Power)
- Adjustable Output Current (AOC) with Programmability
- Isolated 0-10V/PWM/3-Timer-Modes Dimmable
- Adjustable Dimming Curve
- INV Digital Dimming, UART Based Communication Protocol
- Dim-to-Off with Standby Power
- Minimum Dimming Level with 5% or 10% Selectable
- Hold Time Adjustable
- Fade Time Adjustable
- Always-on Auxiliary Power: 12Vdc, 250mA
- Low Inrush Current
- Output Lumen Compensation
- End-of-Life Indicator
- Input Surge Protection: DM 6kV, CM 10kV
- All-Around Protection: IUVP, IOVP, OVP, SCP, OTP
- IP66/IP67 and UL Dry/Damp/Wet Location
- TYPE HL, for Use in a Class I, Division 2 Hazardous (Classified) Location
- 5 Years Warranty

Description
The ESM-880SxxxMGS series is an 880W, constant-current, programmable and IP66/IP67 rated LED driver that operates from 249-528Vac input with excellent power factor. Created for many lighting applications including high mast, sports, UV-LED, aquaculture and horticulture, etc. It provides an auxiliary voltage and dim-to-off functionality for powering low voltage, wireless controls. The dimming control supports 0-10V dimming as well as two-way communication via Digital Dimming, a UART based communication protocol. The high efficiency of these drivers and compact metal case enables them to run cooler, significantly improving reliability and extending product life. To ensure trouble-free operation, protection is provided against input surge, input under voltage, input over voltage, output over voltage, short circuit, and over temperature.

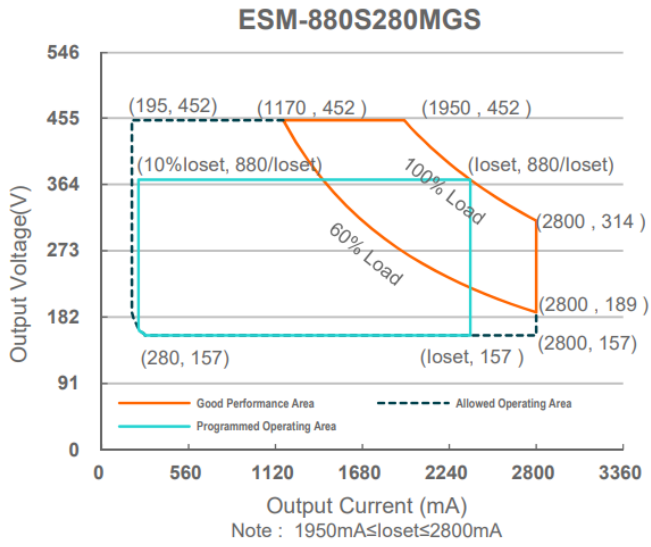
Models

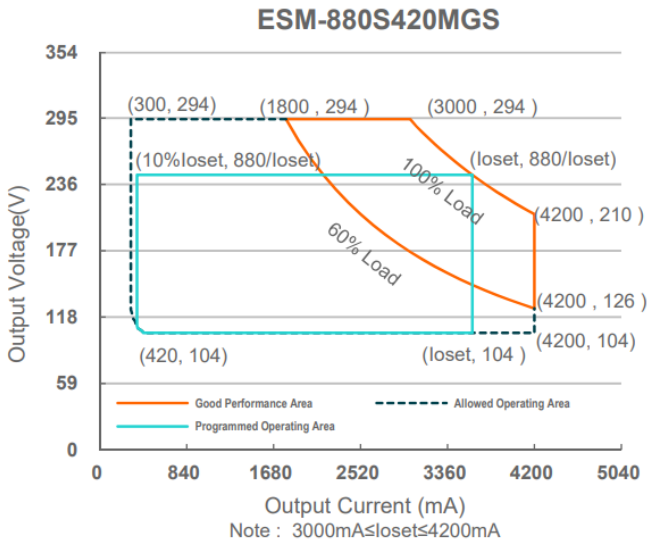
Adjustable Output Current Range(A)	Full-Power Current Range (A)(1)	Default Output Current(A)	Output Voltage Range(Vdc)	Max. Output Power(W)	Typical Efficiency(2)	Typical Power Factor		Model Number(3)
						277Vac	480Vac	
0.195-2.8	1.95-2.8	2.1	157-452	880	96.0%	0.99	0.96	ESM-880S280MGS
0.300-4.2	3.0-4.2	4.2	104-294	880	95.5%	0.99	0.96	ESM-880S420MGS
0.490-7.0	4.9-7.0	5.6	63.0-180	880	96.0%	0.99	0.96	ESM-880S700MGS
0.800-11.5	8.0-11.5	8.4	38.0-110	880	95.0%	0.99	0.96	ESM-880S11AMGS(4)
1.630-20.0	16.3-20.0	20.0	22.0-54	880	95.5%	0.99	0.96	ESM-880S20AMGS(4)

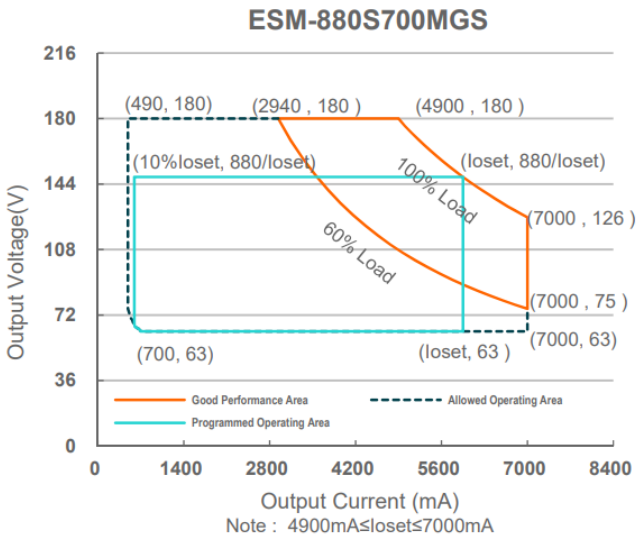
Notes:

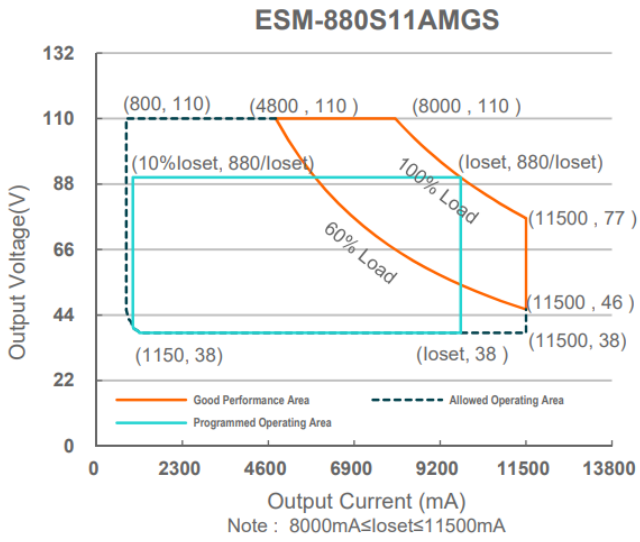
1. Output current range with constant power at 880W.
2. Measured at 100% load and 480Vac input (see below “General Specifications” for details).
3. Certified voltage range: UL, FCC 277-480Vac; otherwise 277-400Vac.
4. SELV output

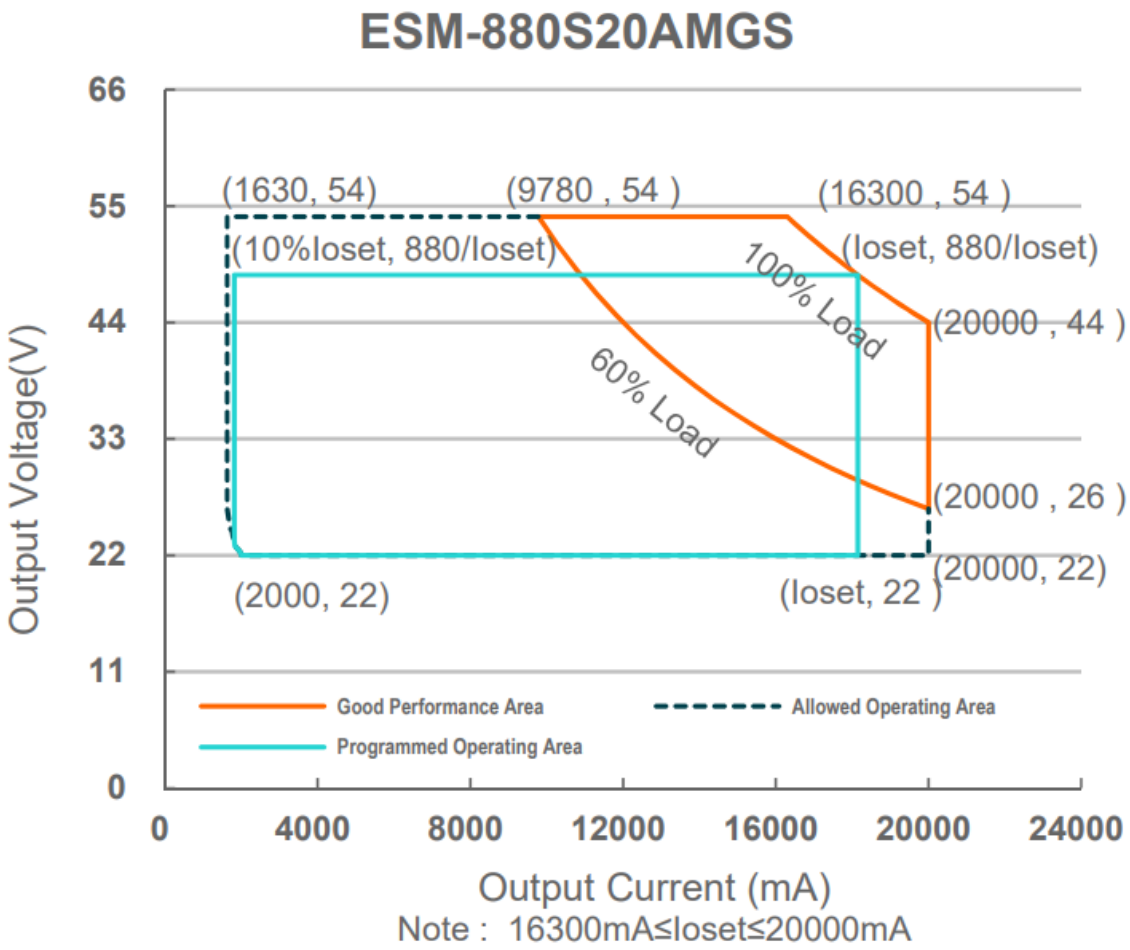
Operating Area











Input Specifications

Parameter	Min.	Typ.	Max.	Notes
Input AC Voltage	249 Vac	–	528 Vac	
Input DC Voltage	352 Vdc	–	500 Vdc	
Input Frequency	47 Hz	–	63 Hz	
Leakage Current	–	–	0.75 MIU	UL 8750; 480Vac/60Hz
	–	–	0.70 mA	IEC 60598-1; 480Vac/60Hz
Input AC Current	–	–	3.79 A	Measured at 100% load and 277 Vac input.
	–	–	2.16 A	Measured at 100% load and 480 Vac input.
Inrush Current(I2t)	–	–	1.98 A2s	At 480Vac input, 25°C cold start, duration=6.6 ms, 10%Ipk-10%Ipk.
PF	0.90	–	–	At 277-480Vac, 50-60Hz, 60%-100% Load (528-880W)
THD	–	–	20%	

Output Specifications

Parameter	Min.	Typ.	Max.	Notes
Output Current Tolerance	-5%Ioset	–	5%Ioset	100% load
Output Current Setting(Ioset) Range ESM-880S280MGS ESM-880S420MGS ESM-880S700MGS ESM-880S11AMGS ESM-880S20AMGS	195 mA 300 mA 490 mA 800 mA 1630 mA	– – – – –	2800 mA 4200 mA 7000 mA 11500 mA 20000 mA	
Output Current Setting Range with Constant Power ESM-880S280MGS ESM-880S420MGS ESM-880S700MGS ESM-880S11AMGS ESM-880S20AMGS	1950 mA 3000 mA 4900 mA 8000 mA 16300 mA	– – – – –	2800 mA 4200 mA 7000 mA 11500 mA 20000 mA	
Total Output Current Ripple (pk-pk)	–	5%Iomax	10%Iomax	100% load, 20 MHz BW
Output Current Ripple at < 200 Hz (pk-pk)	–	–	2%Iomax	70%-100% load
Startup Overshoot Current	–	–	10%Iomax	100% load
No Load Output Voltage ESM-880S280MGS ESM-880S420MGS ESM-880S700MGS ESM-880S11AMGS ESM-880S20AMGS	– – – – –	– – – – –	500 V 350 V 200 V 120 V 60 V	
Line Regulation	–	–	±0.5%	100% load
Load Regulation	–	–	±1.5%	
Turn-on Delay Time	–	–	0.5 s	Measured at 277-480Vac input, 60%-100% Load

Parameter	Min.	Typ.	Max.	Notes
Temperature Coefficient of Iose t	–	0.03%/°C	–	Case temperature = 0°C ~Tc max
12V Auxiliary Output Voltage	10.8 V	12 V	13.2 V	
12V Auxiliary Output Source C urrent	0 mA	–	250 mA	Return terminal is “Dim–“
12V Auxiliary Output Transient Peak Current@6W	–	–	500 mA	500mA peak for a maximum duration of 2.2ms in a 6.0ms period during which t ime the average should not exceed 25 0mA.
12V Auxiliary Output Transient Peak Current@10W	–	–	850 mA	850mA peak for a maximum duration of 1.3ms in a 5.2ms period during which time the average should not exc eed 250mA.

General Specifications

Parameter	Min.	Typ.	Max.	Notes
Efficiency at 277 Vac input:				
ESM-880S280MGS				
Io= 1950 mA	93.0%	95.0%	–	
Io= 2800 mA	93.0%	95.0%	–	
ESM-880S420MGS				
Io= 3000 mA Io= 4200 mA	92.0% 92.5%	94.0% 94.5%	– –	Measured at 100% load and steady-st ate
ESM-880S700MGS				temperature in 25°C ambient;
Io= 4900 mA	93.0%	95.0%	–	(Efficiency will be about 2.0% lower if
Io= 7000 mA ESM-880S11AMGS	92.5%	94.5%	–	measured immediately after startup.)
Io= 8000 mA	92.0%	94.0%	–	
Io= 11500 mA	92.0%	94.0%	–	

ESM-880S20AMGS				
Io= 16300 mA	93.0%	95.0%	–	
Io= 20000 mA	92.5%	94.5%	–	
Efficiency at 400 Vac input:				
ESM-880S280MGS				
Io= 1950 mA	94.0%	96.0%	–	
Io= 2800 mA	94.0%	96.0%	–	
ESM-880S420MGS				
Io= 3000 mA Io= 4200 mA	93.0% 93.5%	95.0% 95.5%	– –	Measured at 100% load and steady-st ate
ESM-880S700MGS				temperature in 25°C ambient;
Io= 4900 mA	94.0%	96.0%	–	(Efficiency will be about 2.0% lower if
Io= 7000 mA ESM-880S11AMGS	93.5%	95.5%	–	measured immediately after startup.)
Io= 8000 mA	93.0%	95.0%	–	
Io= 11500 mA	93.0%	95.0%	–	
ESM-880S20AMGS				
Io= 16300 mA	93.5%	95.5%	–	
Io= 20000 mA	93.0%	95.0%	–	

Parameter	**Min.**	**Typ.**	**Max.**	**Notes**
Efficiency at 480 Vac input:				
ESM-880S280MGS				
Io= 1950 mA	94.0%	96.0%	–	
Io= 2800 mA	94.0%	96.0%	–	

ESM-880S420MGS				
Io= 3000 mA Io= 4200 mA	93.0% 93.5%	95.0% 95.5%	– –	Measured at 100% load and steady-state
ESM-880S700MGS				temperature in 25°C ambient;
Io= 4900 mA	94.0%	96.0%	–	(Efficiency will be about 2.0% lower if
Io= 7000 mA ESM-880S11AMGS	94.0%	96.0%	–	measured immediately after startup.)
Io= 8000 mA	93.0%	95.0%	–	
Io= 11500 mA	93.0%	95.0%	–	
ESM-880S20AMGS				
Io= 16300 mA	93.5%	95.5%	–	
Io= 20000 mA	93.0%	95.0%	–	
Standby Power	–	1.5 W	–	Measured at 480Vac/50Hz; Dimming off
MTBF	–	217,000 Hours	–	Measured at 480Vac input, 80%Load and 25°C ambient temperature (MIL-HDBK-217F)
Lifetime	–	100,000 Hours	–	Measured at 480Vac input, 80%Load and 70°C case temperature; See lifetime vs. Tc curve for the details
	–	50,000 Hours	–	Measured at 277Vac input, 100%Load and 40°C ambient temperature
Operating Case Temperature for Safety Tc_s	-40°C	–	+90°C	
Operating Case Temperature for Warranty Tc_w	-40°C	–	+80°C	Case temperature for 5 years warranty Humidity: 10%RH to 95%RH

Storage Temperature	-40°C	–	+85°C	Humidity: 5%RH to 95%RH
Dimensions Inches (L × W × H) Millimeters (L × W × H)				With mounting ear
	10.83 × 6.30 × 1.91			11.81 × 6.30 × 1.91
	275 × 160 x 48.5			300 ×160 x 48.5
Net Weight	–	3650 g	–	

Dimming Specifications

Parameter		**Min.**	**Typ.**	**Max.**	**Notes**
Absolute Maximum Voltage on the Vdim (+) Pin		-20 V	–	20 V	
Source Current on Vdim (+)Pin		200 uA	300 uA	450 uA	Vdim(+) = 0 V
Dimming Output Range with 10%-100% (Default)	ESM-880S280MGS ESM-880S420MGS ESM-880S700MGS ESM-880S11AMGS ESM-880S20AMGS	10%Ioset	–	Ioset	1950 mA ≤ Ioset ≤ 2800 mA 3000 mA ≤ Ioset ≤ 4200 mA 4900 mA ≤ Ioset ≤ 7000 mA 8000 mA ≤ Ioset ≤ 11500 mA 16300 mA ≤ Ioset ≤ 20000 mA
	ESM-880S280MGS ESM-880S420MGS ESM-880S700MGS ESM-880S11AMGS ESM-880S20AMGS	195 mA 300 mA 490 mA 800 mA 1630 mA	–	Ioset	195 mA ≤ Ioset 1950 mA 300 mA ≤ Ioset 3000 mA 490 mA ≤ Ioset 4900 mA 800 mA ≤ Ioset 8000 mA 1630 mA ≤ Ioset 16300 mA

Parameter		**Min.**	**Typ.**	**Max.**	**Notes**
Dimming Output Range with 5	ESM-880S280MGS ESM-880S420MGS ESM-880S700MGS ESM-880S11AMGS ESM-880S20AMGS	5%Ioset	–	Ioset	1950 mA ≤ Ioset ≤ 2800 mA 3000 mA ≤ Ioset ≤ 4200 mA 4900 mA ≤ Ioset ≤ 7000 mA 8000 mA ≤ Ioset ≤ 11500 mA 16300 mA ≤ Ioset ≤ 20000 mA

%-100% (Settable)	ESM-880S280MGS ESM-880S420MGS ESM-880S700MGS ESM-880S11AMGS ESM-880S20AMGS	98 mA 150 mA 245 mA 400 mA 815 mA	–	Ioset	195 mA ≤ Ioset 1950 mA 300 mA ≤ Ioset 3000 mA 490 mA ≤ Ioset 4900 mA 800 mA ≤ Ioset 8000 mA 1630 mA ≤ Ioset 16300 mA
Recommended Dimming Input Range		0 V	–	10 V	Default 0-10V dimming mode.
Dim off Voltage		0.35 V	0.5 V	0.65 V	
Dim on Voltage		0.55 V	0.7 V	0.85 V	
Hysteresis		–	0.2 V	–	
PWM_in High Level		3 V	–	10 V	Dimming mode set to PWM in Inventronics Programing Software.
PWM_in Low Level		-0.3 V	–	0.6 V	
PWM_in Frequency Range		200 Hz	–	3 KHz	
PWM_in Duty Cycle		1%	–	99%	
PWM Dimming off (Positive Logic)		3%	5%	8%	
PWM Dimming on (Positive Logic)		5%	7%	10%	
PWM Dimming off (Negative Logic)		92%	95%	97%	
PWM Dimming on (Negative Logic)		90%	93%	95%	
Hysteresis		–	2%	–	

Safety &EMC Compliance

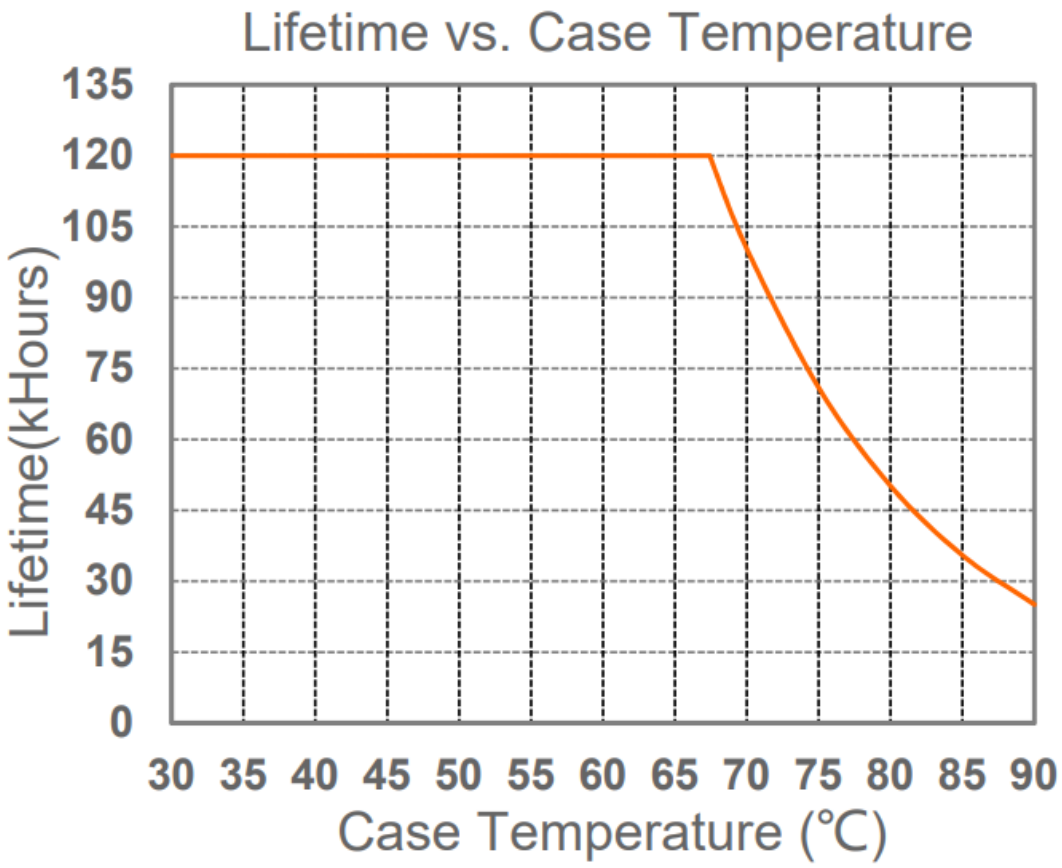
Safety Category	**Standard**
UL/CUL	UL 8750,CAN/CSA-C22.2 No. 250.13
ENEC & CE	EN 61347-1, EN 61347-2-13
UKCA	BS EN 61347-1, BS EN 61347-2-13
CB	IEC 61347-1, IEC 61347-2-13
Performance	**Standard**
ENEC	EN 62384
EMI Standards	**Notes**
BS EN/EN IEC 55015(1)	Conducted emission Test &Radiated emission Test
BS EN/EN IEC 61000-3-2	Harmonic current emissions

EMI Standards	**Notes**
BS EN/EN 61000-3-3	Voltage fluctuations & flicker
FCC Part 15(1)	ANSI C63.4 Class B
	This device complies with Part 15 of the FCC Rules. Operation is subject to th e following two conditions: [1] this device may not cause harmful interference, and [2] this device must accept any interference received, including interference that may cause undesired Operation.
EMS Standards	**Notes**
BS EN/EN 61000-4-2	Electrostatic Discharge (ESD): 8 kV air discharge, 4 kV contact discharge
BS EN/EN 61000-4-3	Radio-Frequency Electromagnetic Field Susceptibility Test-RS
BS EN/EN 61000-4-4	Electrical Fast Transient / Burst-EFT
BS EN/EN 61000-4-5	Surge Immunity Test: AC Power Line: Differential Mode 6 kV, Common Mode 10 kV
BS EN/EN 61000-4-6	Conducted Radio Frequency Disturbances Test-CS
BS EN/EN 61000-4-8	Power Frequency Magnetic Field Test
BS EN/EN 61000-4-11	Voltage Dips
BS EN/EN 61547	Electromagnetic Immunity Requirements Applies To Lighting Equipment

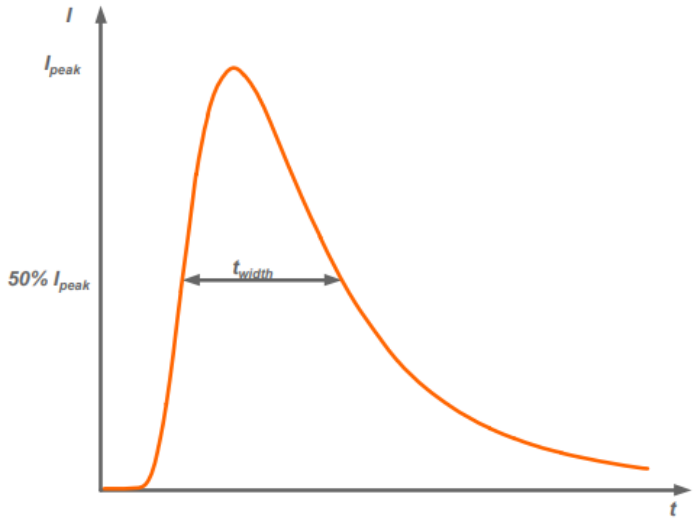
Note:

1. This LED driver meets the EMI specifications above, but EMI performance of a luminaire that contains it depends also on the other devices connected to the driver and on the fixture itself.

Lifetime vs. Case Temperature



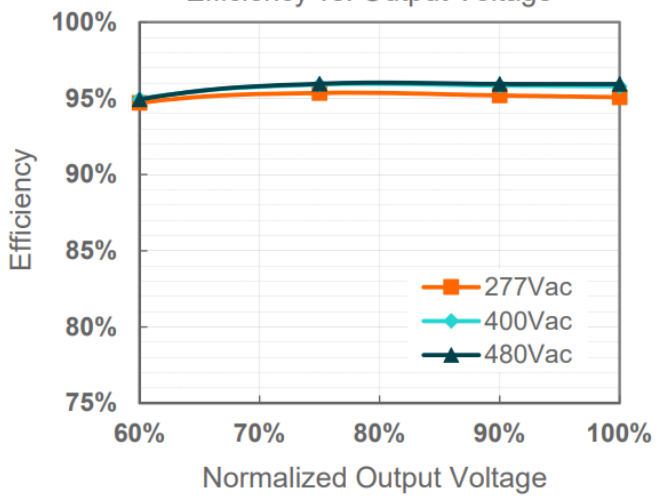
Inrush Current Waveform



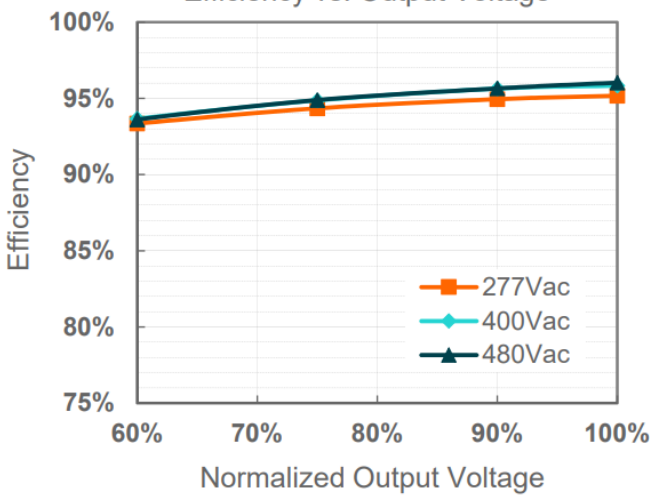
Input AC Voltage	I_{peak}	t_{width} (@ 50% Ipeak)
480V	20.0A	2.0ms

Efficiency vs. Load

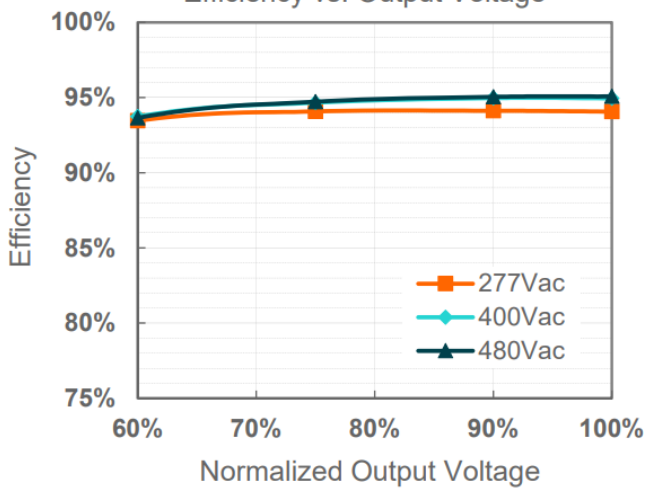
ESM-880S280MGS(Io=1950mA)



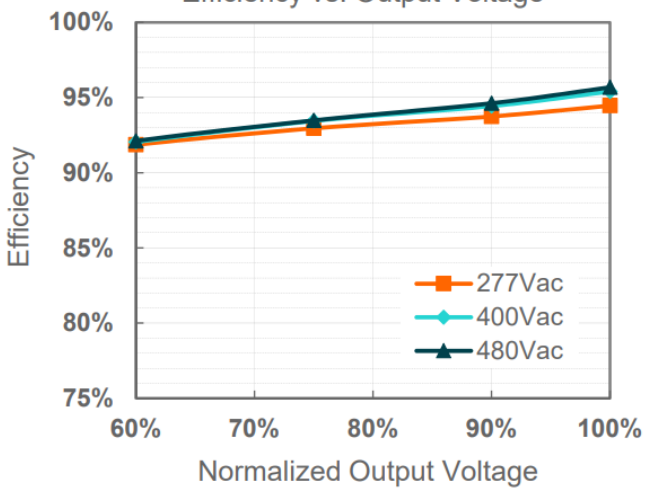
ESM-880S280MGS(Io=2800mA)



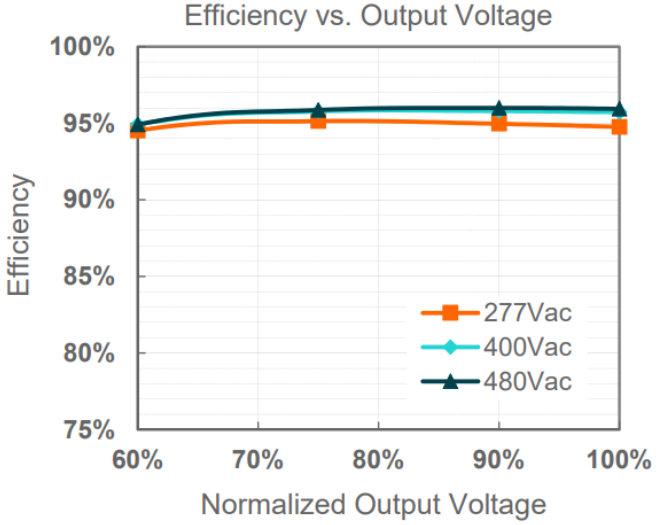
ESM-880S420MGS(Io=3000mA)



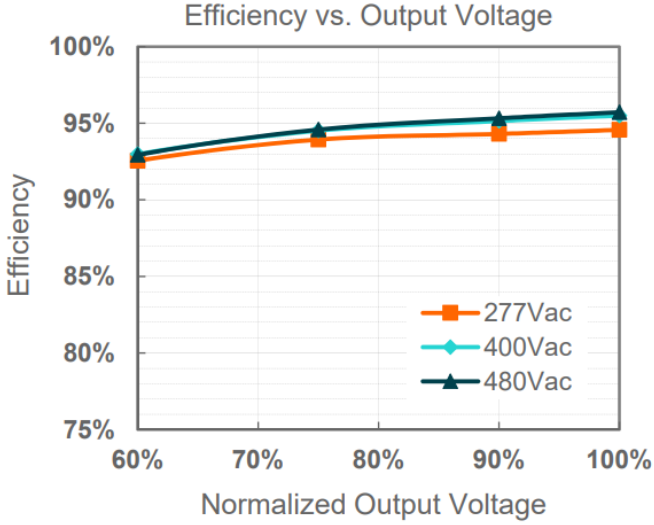
ESM-880S420MGS(Io=4200mA)

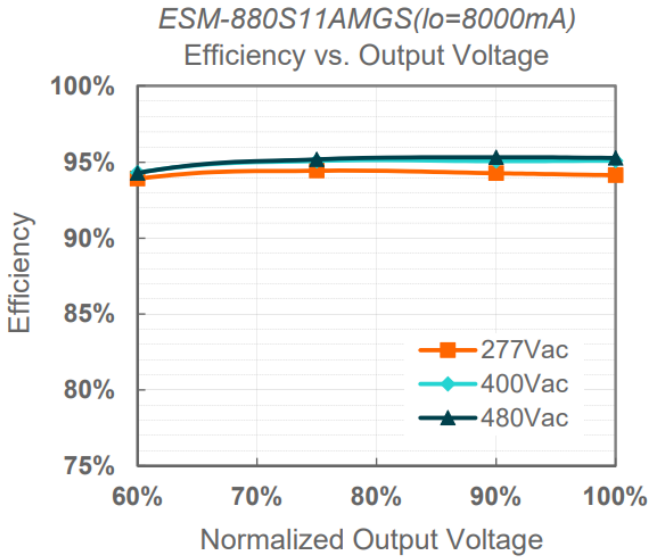


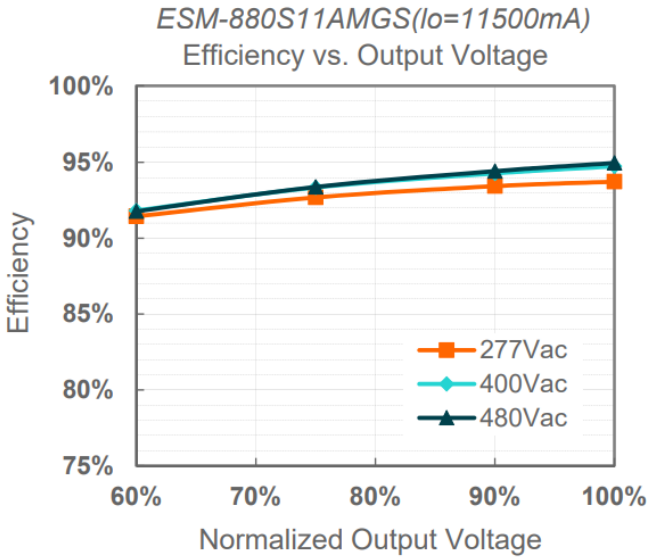
ESM-880S700MGS(Io=4900mA)

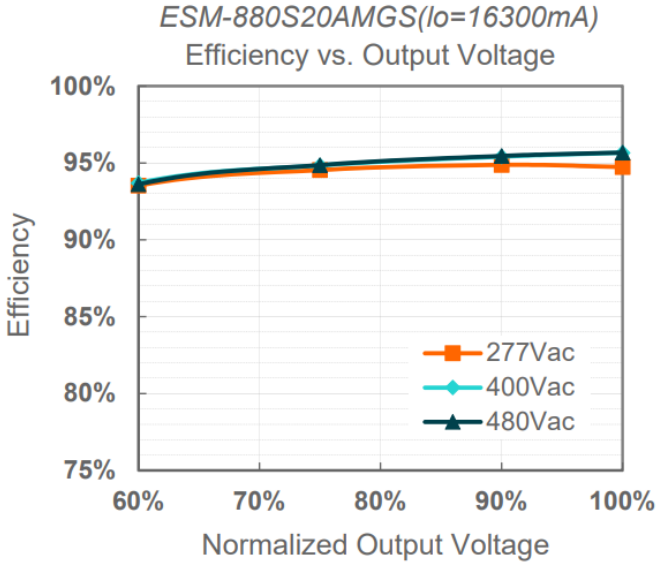


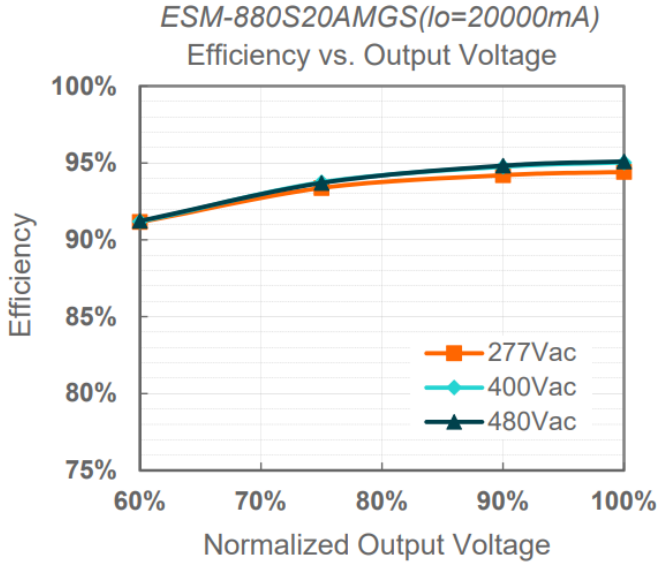
ESM-880S700MGS(Io=7000mA)



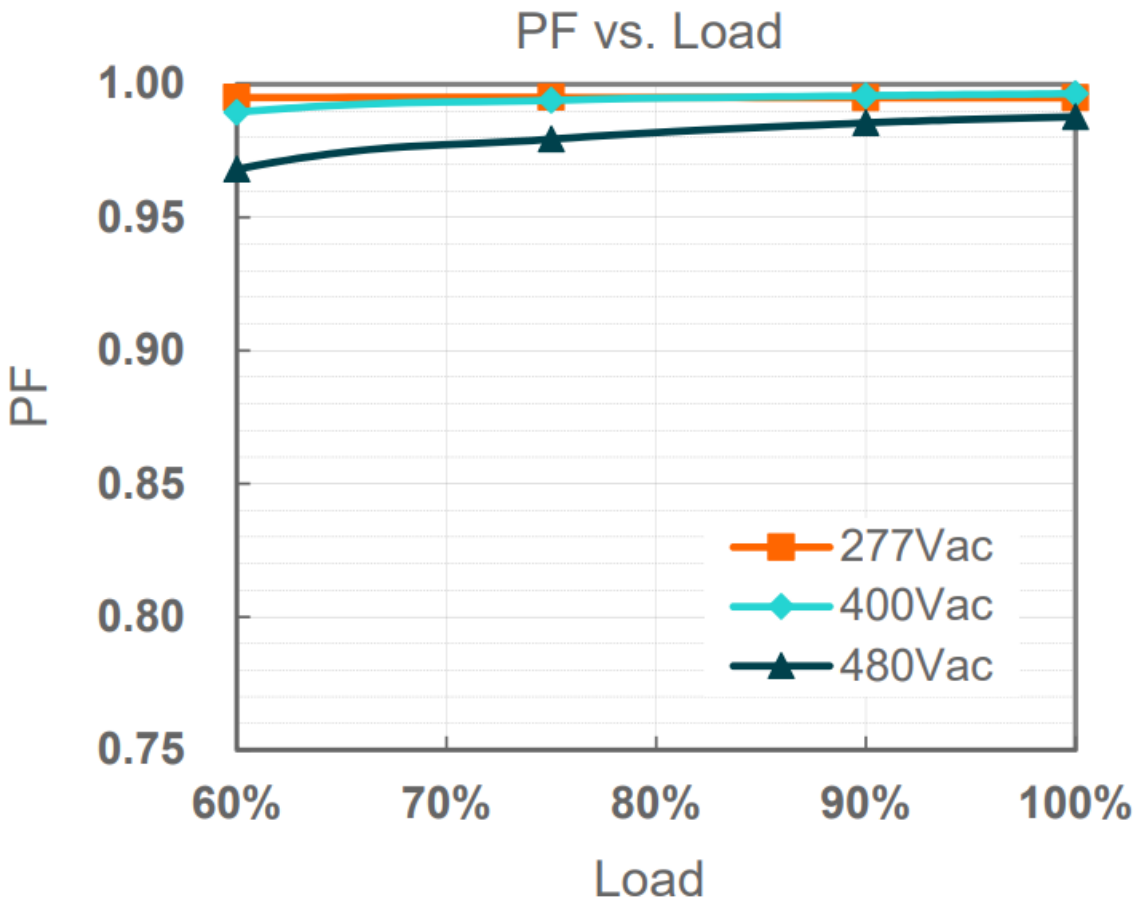




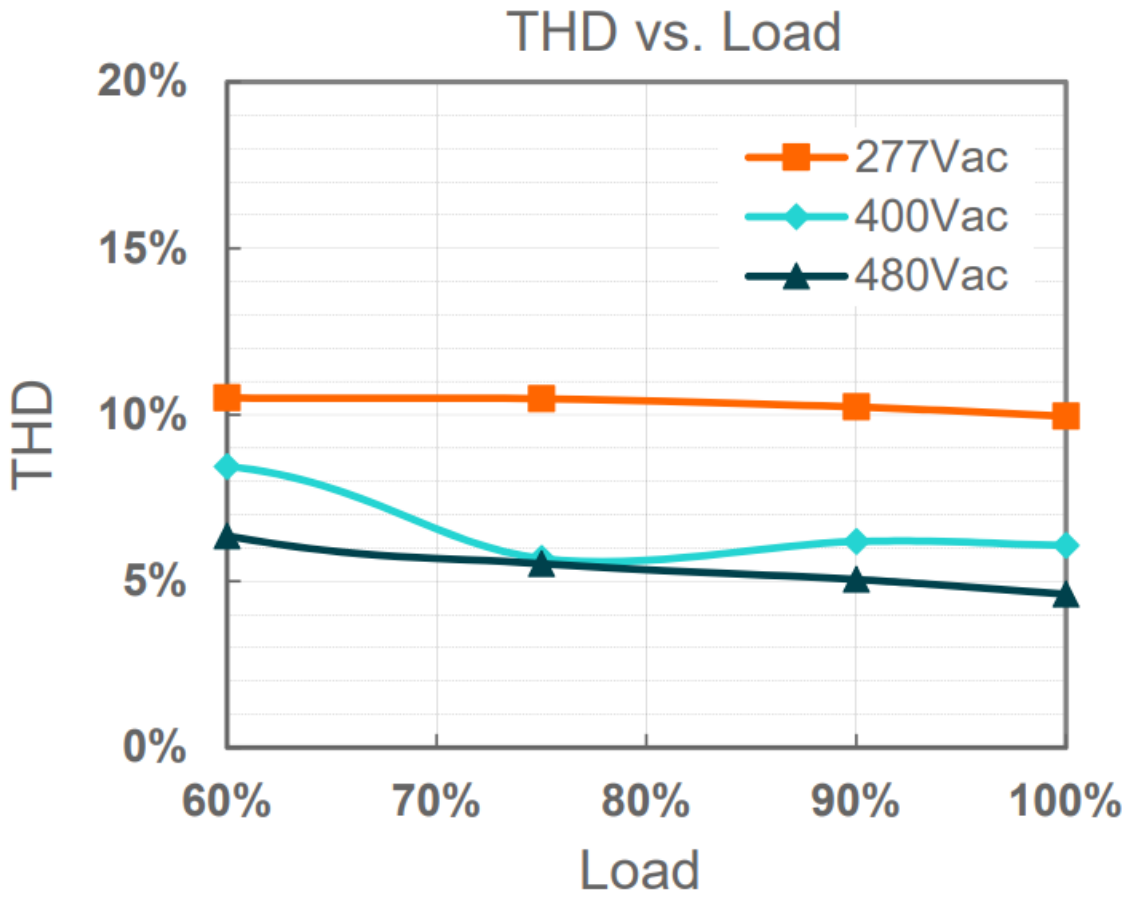




Power Factor



Total Harmonic Distortion



Protection Functions

Parameter		Min.	Typ.	Max.	Notes
Over Temperature Protection		Decreases output current, returning to normal after over temperature is removed.			
Short Circuit Protection		Auto Recovery. No damage will occur when any output is short circuited. The output shall return to normal when the fault condition is removed.			
Over Voltage Protection		Limits output voltage at no load and in case the normal voltage limit fails.			
Input Under Voltage Protection (IUVP)	Input Protection Voltage	220 Vac	230 Vac	240 Vac	Turn off the output when the input voltage falls below protection voltage.
	Input Recovery Voltage	230 Vac	240 Vac	250 Vac	Auto Recovery. The driver will restart when the input voltage exceeds recovery voltage.
Input Over Voltage Protection (IOVP)	Input Over Voltage Protection	550 Vac	570 Vac	590 Vac	Turn off the output when the input voltage exceeds protection voltage.
	Input Over Voltage Recovery	530 Vac	550 Vac	570 Vac	Auto Recovery. The driver will restart when the input voltage falls below recovery voltage.
	Max. of Input Over Voltage	–	–	590 Vac	The driver can survive for 8 hours with input voltage stress of 590Vac.

- **Input Under Voltage Protection Diagram**
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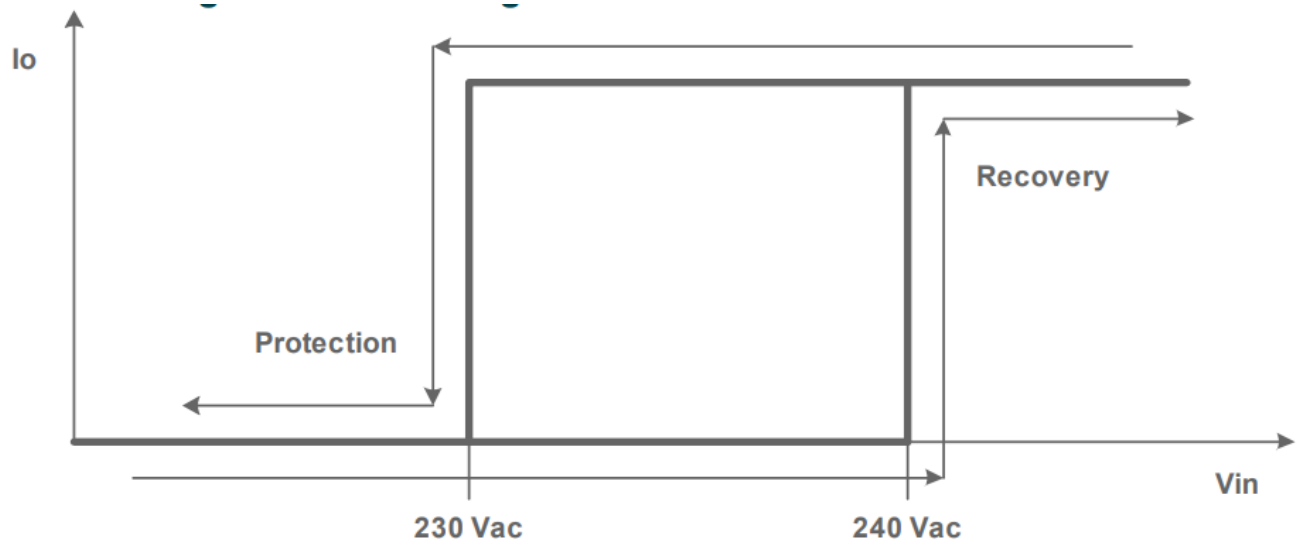
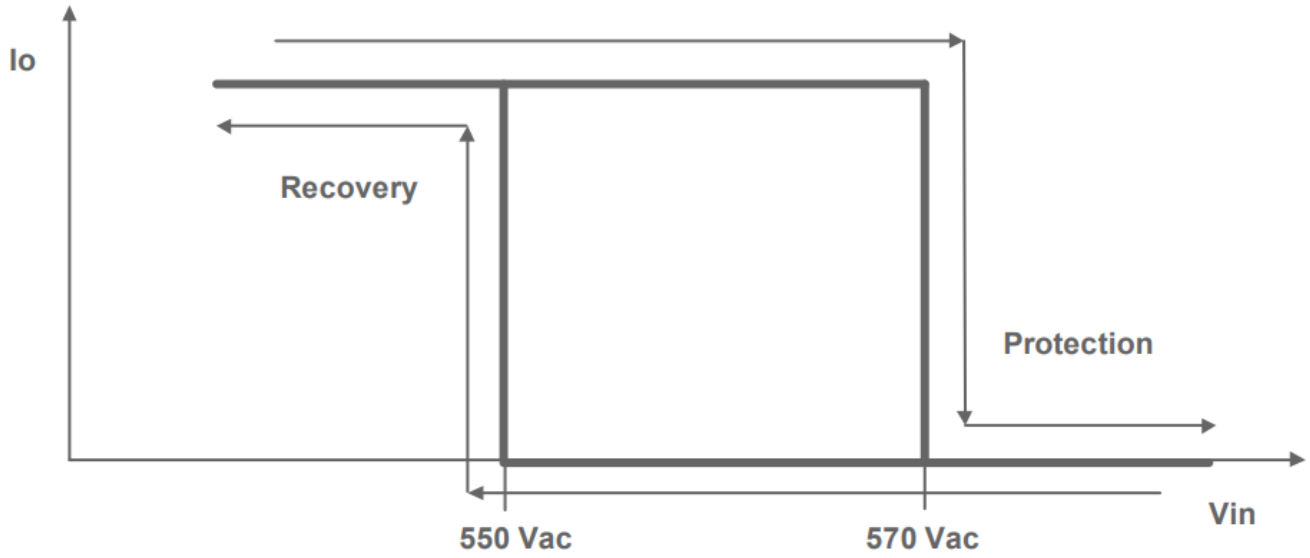


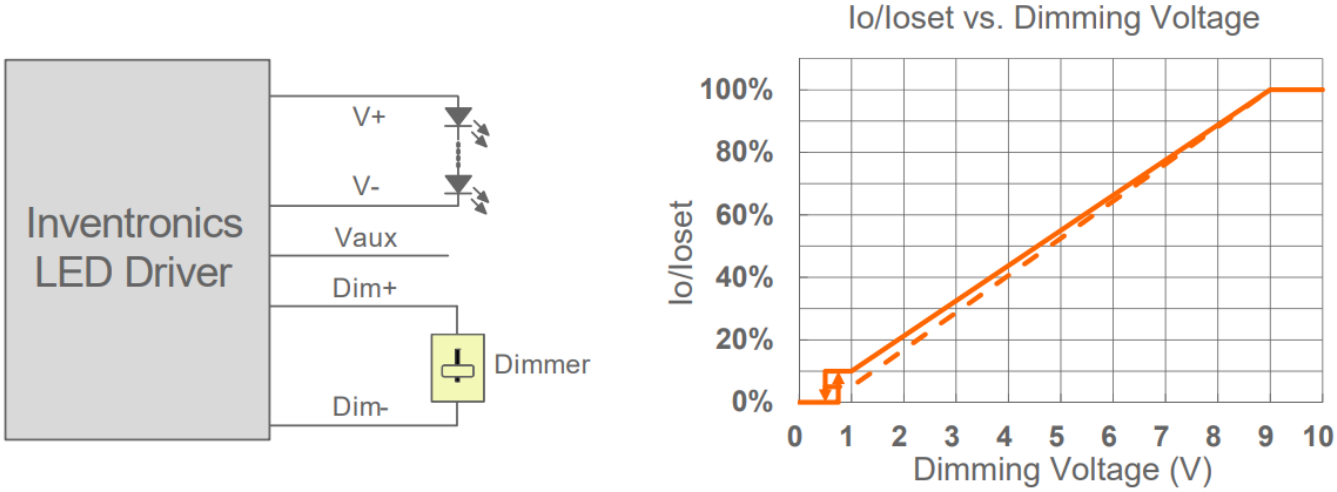
Input Over Voltage Protection Diagram



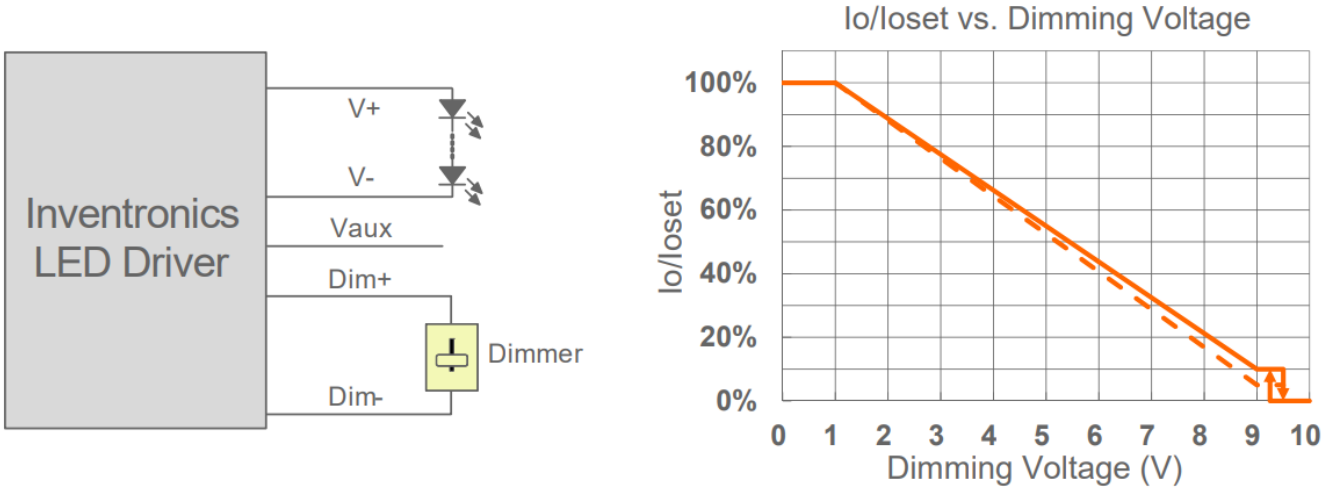
Dimming

10V Dimming

The recommended implementation of the dimming control is provided below.



Implementation 1: Positive logic



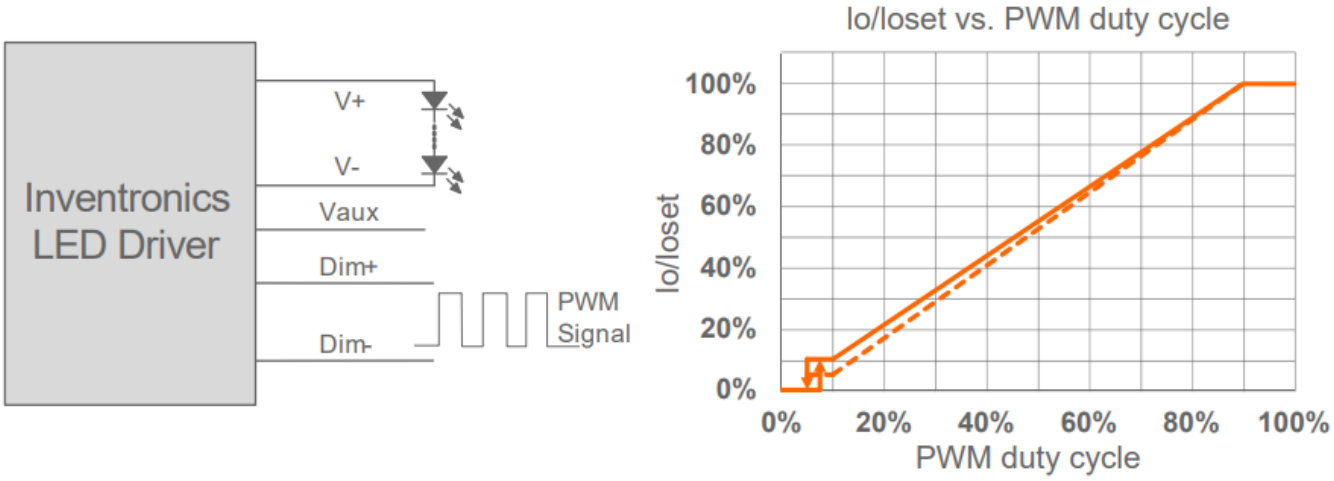
Implementation 2: Negative logic

Notes:

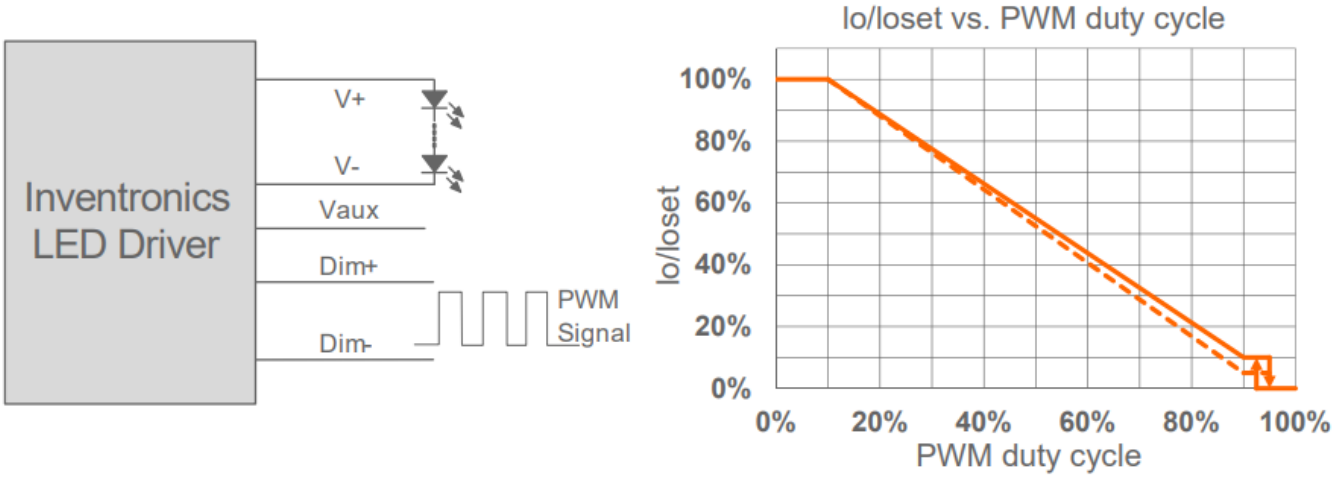
1. Do NOT connect Dim– to the output V– or V+, otherwise the driver will not work properly.
2. The dimmer can also be replaced by an active 0-10V voltage source signal or passive components like zener.
3. When 0-10V negative logic dimming mode and Dim+ is open, the driver will dim to off and be standby.

PWM Dimming

The recommended implementation of the dimming control is provided below.



Implementation 3: Positive logic



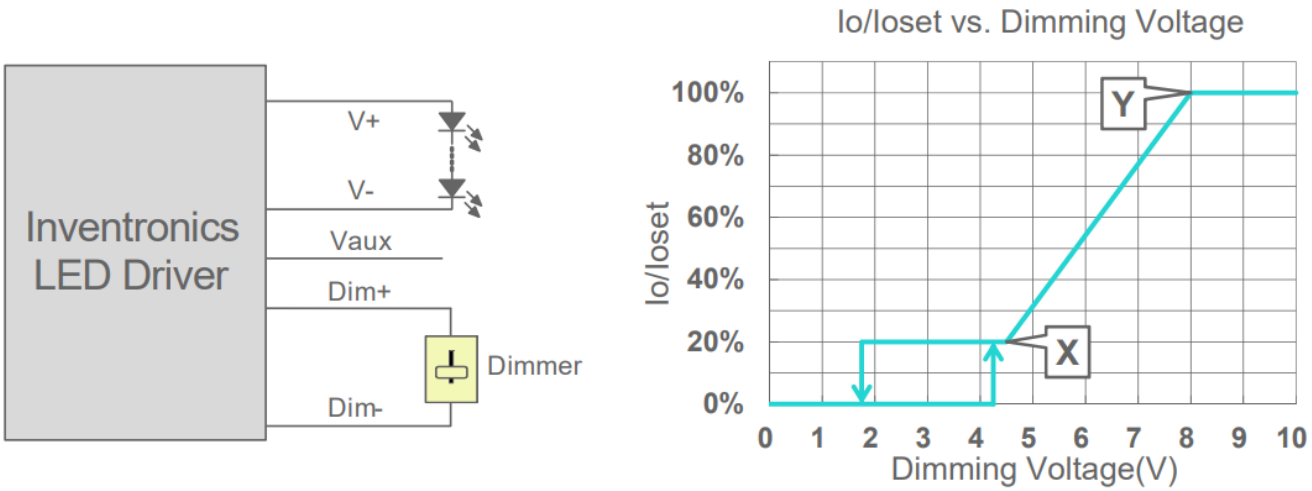
Implementation 4: Negative logic

Notes:

1. Do NOT connect Dim– to the output V– or V+, otherwise the driver will not work properly.
2. When PWM negative logic dimming mode and Dim+ is open, the driver will dim to off and be standby.

Adjustable Dimming Curve

0-10V dimming curve can be set as corresponding dimming voltage by Inventronics Multi Programmer. Take the positive logic dimming as an example, the recommended implementation of the dimming control is provided below.



Implementation 5: Positive logic

Notes:

1. Do NOT connect Dim– to the output V– or V+, otherwise the driver will not work properly.
2. The dimmer can also be replaced by an active 0-10V voltage source signal or passive components like zener.
3. When dimming voltage X point is set to be smaller than Y point, the dimming curve is positive logic; conversely, when X point is set to be bigger than Y point, the dimming curve is negative logic.
4. For best dimming accuracy, the difference between X point and Y point is advised more than 4V.
5. Dimming off voltage adjustable.

- **Time Dimming**
  Time dimming control includes 3 kinds of modes, they are Self Adapting-Midnight, Self Adapting-Percentage and Traditional Timer.
  - Self Adapting-Midnight: Automatically adjusts the dimming curve based on the on-time of past two days (if difference <15 minutes), assuming that the center point of the dimming curve is midnight local time.
  - Self Adapting-Percentage: Automatically adjusts the on-time of each step by a constant percentage = (actual on-time for the past 2 days if difference <15 min) / (programmed on-time from the dimming curve).
  - Traditional Timer: Follows the programmed timing curve after power on with no changes.
- **Output Lumen Compensation**
  Output Lumen Compensation (OLC) may be used to maintain constant light output over the life of the LEDs by driving them at a reduced current when new, then gradually increasing the drive current over time to counteract LED lumen degradation.
- **Minimum Dimming Level with 5% or 10% Selectable**
  The minimum dimming level can be set as 5% or 10% by Inventronics Multi Programmer,10% is default.
- **Hold Time Adjustable**
  When AC power is first applied to the LED driver, enabling a “Hold” period can allow devices powered by the Auxiliary voltage to stabilize before the driver fades up to the maximum dimming level. During this period, the driver will not respond to external dimming commands but will respond again after the hold time ends. Both the initial dimming percentage and the duration of this hold period can be adjusted by the Inventronics Multi Programmer. This function is disabled by default.
- **Fade Time Adjustable**
  There is a “Fade” period after the “Hold” period. The soft-start time and dimming slope applied to all dimming

transitions can be adjusted individually. It is adjusted by the Inventronics Multi Programmer. This function is disabled by default.

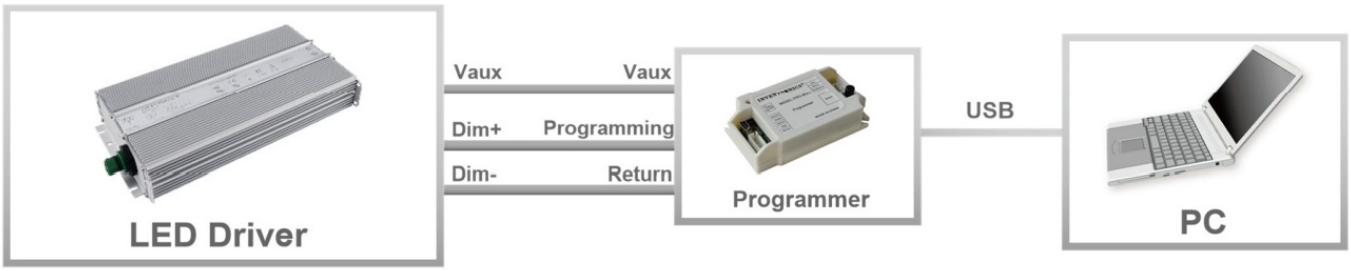
- **End Of Life**

  End-of-Life (EOL) is providing a visual notification to a user that the LED module has reached the end of manufacturer-specified life and that the replacement is recommended. Once active, an indication is given at each power-up of the driver, which the driver indicates this through a lower light output during the first 1 minute before normal operation is continued.

- **Digital Dimming**

  Inventronics Digital Dimming is a UART (Universal Asynchronous Receive Transmitter) based communication protocol. Please refer to Inventronics Digital Dimming file for details

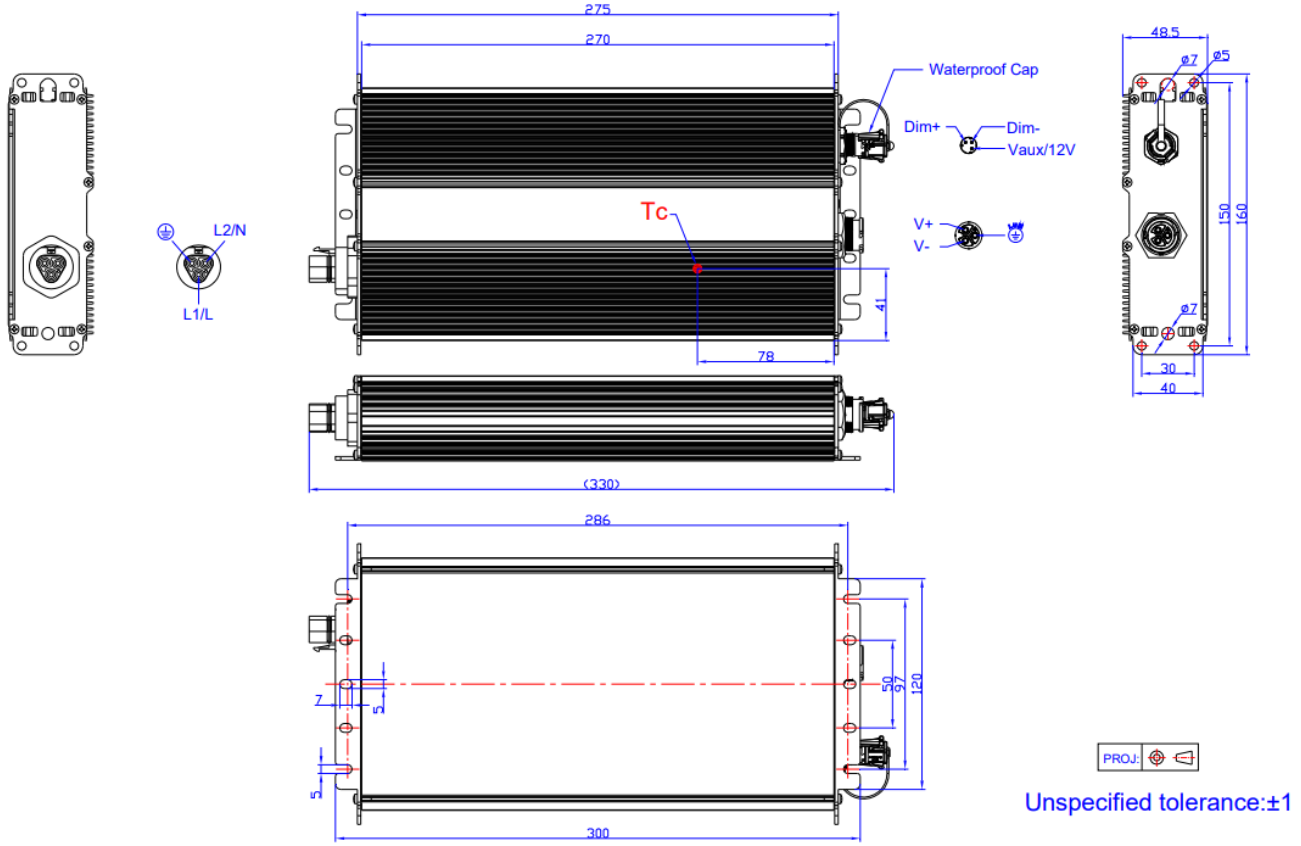
Programming Connection Diagram



Note: The driver does not need to be powered on during the programming process.

- Please refer to PRG-MUL2 (Programmer) datasheet for details.

Mechanical Outline



Note: This driver features UL Wet Location, IP67 panel mount connectors to streamline wiring in the field while still supporting stringent environmental conditions. The mating push-lock are not supplied by Inventronics. Please contact Wieland and Amphenol LTW or one of their suppliers for assistance sourcing the mating push-lock.

Location	Series	Rating voltage /current	PN of connector on drive r	PN of mating push-lock
Vin	Wieland RST20i3	600V/10A	96.032.1055.7	96.031.0055.7 (Spring) or 96.031.4055.7 (Screw)
Vo	ALTW X-Lok,C-Size	600V/10A	CC-03PMFS-QC801P	CC-03BFMB-QL8APA
		300V/20A	CC-03PMFS-QC800P	CC-03BFMB-QL8APP
Dim	ALTW X-Lok,A-Size	300V/5A	AD-03PMMS-QC8001	AD-03BFFB-QL8AP0
Dim	ALTW X-Lok,A-Size Waterproof Cap	/	CAP-WAAMQPC1	/

RoHS Compliance
Our products comply with reference to RoHS Directive (EU) 2015/863 amending 2011/65/EU, calling for the elimination of lead and other hazardous substances from electronic products.

Revision History

Change Date	Rev.	Description of Change		
		Item	From	To
2022-06-13	A	Datasheet Release	/	/
2024-01-09	B	Format	/	Updated
		Product Photograph	/	Updated
		Features	/	Updated
		Models	/	Updated
		Inrush Current Waveform	/	Updated
		Dimming	/	Updated
		Mechanical Outline	/	Updated

Specifications are subject to changes without notice.
All specifications are typical at 25 C unless otherwise stated.

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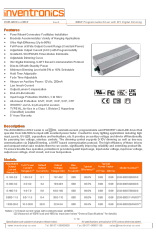
Documents / Resources

	inventronics ESM-880S280MGS 880W Programmable Driver with INV Digital Dimming [pdf] User Manual ESM-880S280MGS 880W Programmable Driver with INV Digital Dimming, ESM-880S280MGS, 880W Programmable Driver with INV Digital Dimming, Programmable Driver with INV Digital Dimming, Driver with INV Digital Dimming, INV Digital Dimming, Digital Dimming, Dimming

References

- User Manual