Features

- Full Power at Wide Output Current Range (Constant Power)
- Adjustable Output Current (AOC) with Programmability
- Isolated 0-10V/PWM/3-Timer-Modes Dimmable
- INV Digital Dimming, UART Based Communication Protocol
- Dim-to-Off with Low Standby Power
- Always-on Auxiliary Power:
  12Vdc, 250mA, 3W (Transient Peak Power up to 10W)
- 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-240SxxxMx* series is a 240W, constant-current, programmable and IP66/IP67 rated LED driver that operates from 249-528Vac input with excellent power factor. Created for smart lighting application, this family 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.

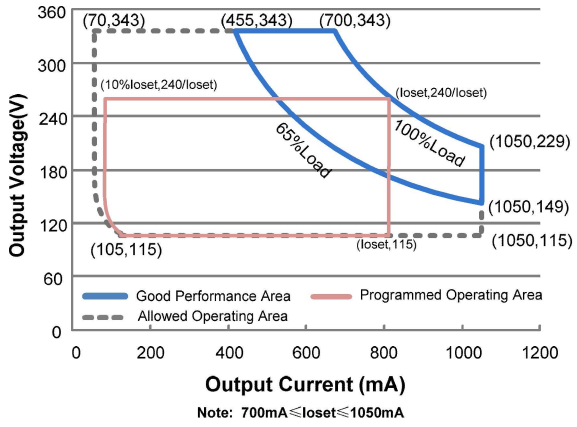
Models

Adjustable Output Current Range	Full-Power Current Range(1)	Default Output Current	Input Voltage Range(2)	Output Voltage Range	Max. Output Power	Typical Efficiency (3)	Typical Power Factor		Model Number (5)
							277Vac	480Vac	
70-1050mA	700-1050mA	700 mA	249~528 Vac/ 352~500 Vdc	115~343Vdc	240 W	94.0%	0.99	0.95	ESM-240S105Mx
105-1500mA	1050-1500mA	1050 mA	249~528 Vac/ 352~500 Vdc	80~229 Vdc	240 W	93.5%	0.99	0.95	ESM-240S150Mx
215-3500mA	2150-3500mA	2150 mA	249~528 Vac/ 352~500 Vdc	35~111 Vdc	240 W	93.0%	0.99	0.95	ESM-240S350Mx(4)
420-6700mA	4200-6700mA	4900 mA	249~528 Vac/ 352~500 Vdc	18 ~ 57 Vdc	240 W	92.5%	0.99	0.95	ESM-240S670Mx(4)

Notes: (1) Output current range with constant power at 240W
(2) Certified input voltage range: 277-480Vac.
(3) Measured at 100% load and 480Vac input (see below "General Specifications" for details).
(4) SELV output.
(5) x = G are UL Recognized and ENEC, etc. models; x = T are UL Class P models.

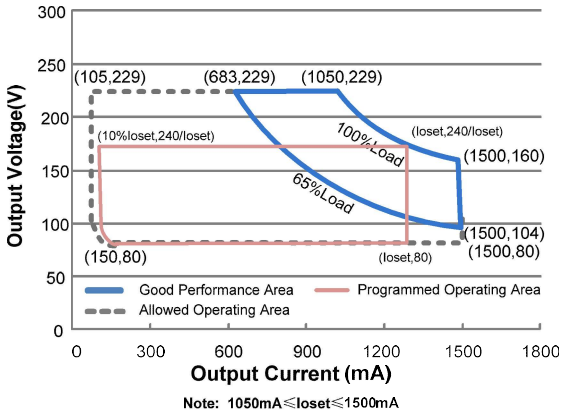
I-V Operation Area

ESM-240S105Mx



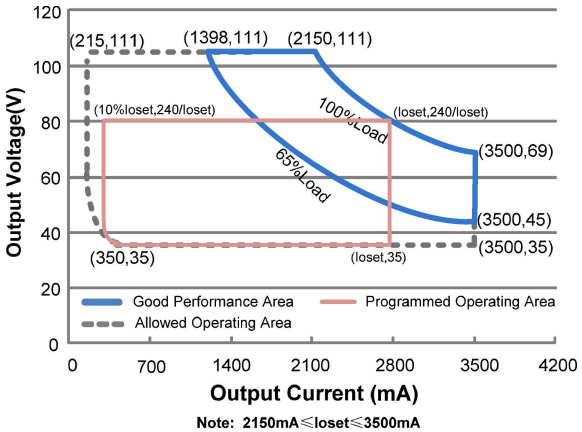
Note: 700mA≤Ioset≤1050mA

ESM-240S150Mx



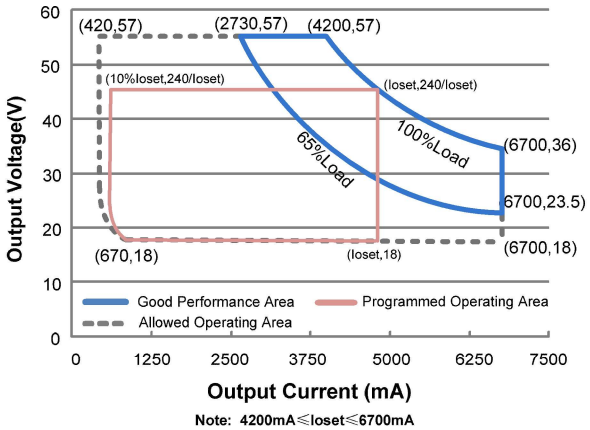
Note: 1050mA≤Ioset≤1500mA

ESM-240S350Mx



Note: 2150mA≤Ioset≤3500mA

ESM-240S670Mx



Note: 4200mA≤Ioset≤6700mA

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	UL8750; 480Vac/ 60Hz
	-	-	0.70 mA	IEC60598-1; 480Vac/ 60Hz,
Input AC Current	-	-	1.08 A	Measured at full load and 277 Vac input.
	-	-	0.64 A	Measured at full load and 480 Vac input.
Inrush Current(I^2t)	-	-	2.10 A^2s	At 480Vac input, 25°C cold start, duration=520 μs, 10%Ipk-10%Ipk. See Inrush Current Waveform for the details.

Input Specifications (Continued)

Parameter	Min.	Typ.	Max.	Notes
PF	0.9	-	-	At 277-480Vac, 50-60Hz, 60%-100% Load (144-240W)
THD	-	-	20%	

Output Specifications

Parameter	Min.	Typ.	Max.	Notes
Output Current Tolerance	-5%Ioset	-	5%Ioset	At 100% load condition
Output Current Setting(Ioset) Range ESM-240S105Mx ESM-240S150Mx ESM-240S350Mx ESM-240S670Mx	 70 mA 105 mA 215 mA 420 mA	 - - - -	 1050 mA 1500 mA 3500 mA 6700 mA	
Output Current Setting Range with Constant Power ESM-240S105Mx ESM-240S150Mx ESM-240S350Mx ESM-240S670Mx	 700 mA 1050 mA 2150 mA 4200 mA	 - - - -	 1050 mA 1500 mA 3500 mA 6700 mA	
Total Output Current Ripple (pk-pk)	-	5%Iomax	10%Iomax	At 100% load condition. 20 MHz BW
Output Current Ripple at < 200 Hz (pk-pk)	-	2%Iomax	-	At 100% load condition. Only this component of ripple is associated with visible flicker.
Startup Overshoot Current	-	-	10%Iomax	At 100% load condition
No Load Output Voltage ESM-240S105Mx ESM-240S150Mx ESM-240S350Mx ESM-240S670Mx	 - - - -	 - - - -	 400 V 290 V 120 V 75 V	
Line Regulation	-	-	±0.5%	Measured at 100% load
Load Regulation	-	-	±3.0%	
Turn-on Delay Time	-	-	0.5 s	Measured at 277-480Vac input, 60%-100% Load
Temperature Coefficient of Ioset	-	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 Current	0 mA	-	250 mA	Return terminal is "Dim−"
12V Auxiliary Output Transient Peak Current@6W	-	-	500 mA	500mA peak for a maximum duration of 2.2 ms in a 6.0ms period during which time the average should not exceed 250mA.
12V Auxiliary Output Transient Peak Current@10W	-	-	850 mA	850mA peak for a maximum duration of 1.3 ms in a 5.2ms period during which time the average should not exceed 250mA.

General Specifications

Parameter	Min.	Typ.	Max.	Notes
Efficiency at 277 Vac input: ESM-240S105Mx Io= 700 mA Io=1050 mA ESM-240S150Mx Io=1050 mA Io=1500 mA ESM-240S350Mx Io=2150 mA Io=3500 mA ESM-240S670Mx Io=4200 mA Io=6700 mA	 90.5% 91.0% 90.0% 90.0% 90.0% 88.5% 89.5% 87.5%	 92.5% 93.0% 92.0% 92.0% 92.0% 90.5% 91.5% 89.5%	 - - - - - - - -	Measured at 100% load and steady-state temperature in 25°C ambient; (Efficiency will be about 2.0% lower if measured immediately after startup.)
Efficiency at 400 Vac input: ESM-240S105Mx Io= 700 mA Io=1050 mA ESM-240S150Mx Io=1050 mA Io=1500 mA ESM-240S350Mx Io=2150 mA Io=3500 mA ESM-240S670Mx Io=4200 mA Io=6700 mA	 91.5% 91.5% 91.5% 91.0% 91.0% 89.5% 90.5% 88.5%	 93.5% 93.5% 93.5% 93.0% 93.0% 91.5% 92.5% 90.5%	 - - - - - - - -	Measured at 100% load and steady-state temperature in 25°C ambient; (Efficiency will be about 2.0% lower if measured immediately after startup.)
Efficiency at 480 Vac input: ESM-240S105Mx Io= 700 mA Io=1050 mA ESM-240S150Mx Io=1050 mA Io=1500 mA ESM-240S350Mx Io=2150 mA Io=3500 mA ESM-240S670Mx Io=4200 mA Io=6700 mA	 91.5% 92.0% 91.5% 91.0% 91.0% 89.5% 90.5% 89.0%	 93.5% 94.0% 93.5% 93.0% 93.0% 91.5% 92.5% 91.0%	 - - - - - - - -	Measured at 100% load and steady-state temperature in 25°C ambient; (Efficiency will be about 2.0% lower if measured immediately after startup.)
Standby Power	-	1.5 W	-	Measured at 480Vac/50Hz; Dimming off
MTBF	-	203,000 Hours	-	Measured at 480Vac input, 80%Load and 25°C ambient temperature (MIL-HDBK-217F)
Lifetime	-	106,000 Hours	-	Measured at 480Vac input, 80%Load and 70°C case temperature; See lifetime vs. Tc curve for the details
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)	7.91 × 3.01 × 1.52 201 × 76.5 × 38.5			With mounting ear 8.58 × 3.01 × 1.52 218 × 76.5 × 38.5
Net Weight	-	1200 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 μA	300 μA	450 μA	Vdim(+) = 0 V
Dimming Output Range	ESM-240S105Mx ESM-240S150Mx ESM-240S350Mx ESM-240S670Mx	10%Ioset	-	Ioset	700 mA ⩽ Ioset ⩽ 1050 mA 1050 mA ⩽ Ioset ⩽ 1500 mA 2150 mA ⩽ Ioset ⩽ 3500 mA 4200 mA ⩽ Ioset ⩽ 6700 mA
	ESM-240S105Mx ESM-240S150Mx ESM-240S350Mx ESM-240S670Mx	70 mA 105 mA 215 mA 420 mA	-	Ioset	70 mA ⩽ Ioset < 700 mA 105 mA ⩽ Ioset < 1050 mA 215 mA ⩽ Ioset < 2150 mA 420 mA ⩽ Ioset < 4200 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 PC interface.
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

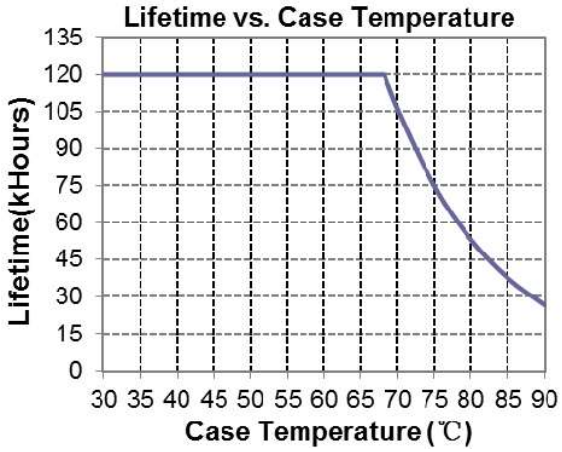
Safety Category	Standard
UL/CUL	UL8750,CAN/CSA-C22.2 No. 250.13
ENEC & CE	EN 61347-1, EN 61347-2-13
CB	IEC 61347-1, IEC 61347-2-13

Safety & EMC Compliance (Continued)

EMI Standards	Notes
EN 55015(1)	Conducted emission Test &Radiated emission Test
EN 61000-3-2	Harmonic current emissions
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 the 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**
EN 61000-4-2	Electrostatic Discharge (ESD): 8 kV air discharge, 4 kV contact discharge
EN 61000-4-3	Radio-Frequency Electromagnetic Field Susceptibility Test-RS
EN 61000-4-4	Electrical Fast Transient / Burst-EFT
EN 61000-4-5	Surge Immunity Test: AC Power Line: Differential Mode 6 kV, Common Mode 10 kV
EN 61000-4-6	Conducted Radio Frequency Disturbances Test-CS
EN 61000-4-8	Power Frequency Magnetic Field Test
EN 61000-4-11	Voltage Dips
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



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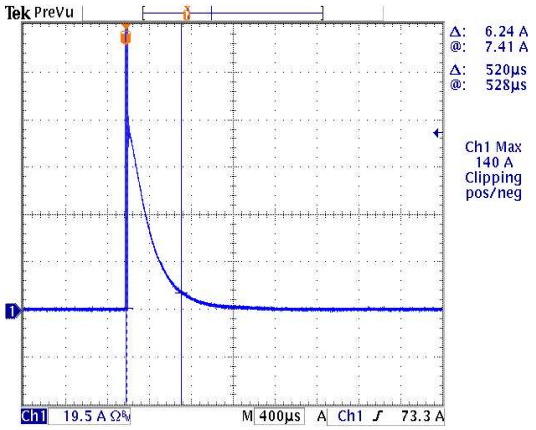
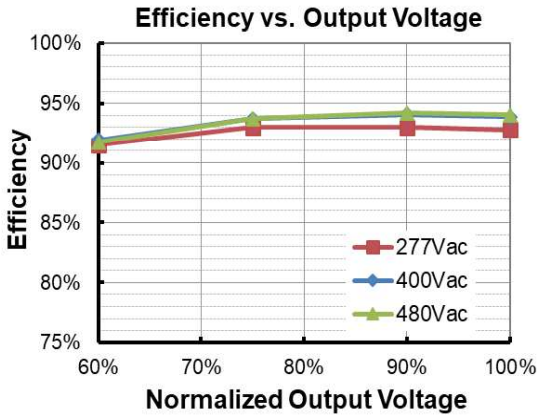
Inrush Current Waveform

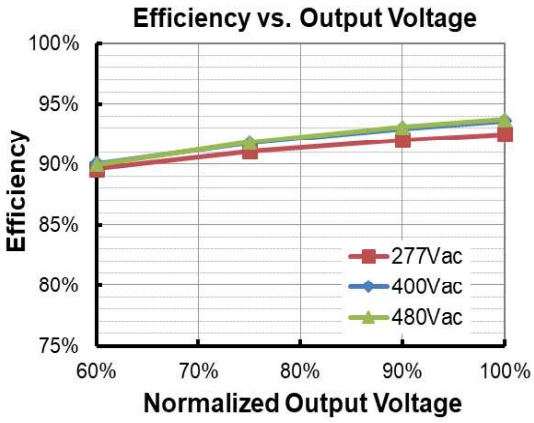


Efficiency vs. Load

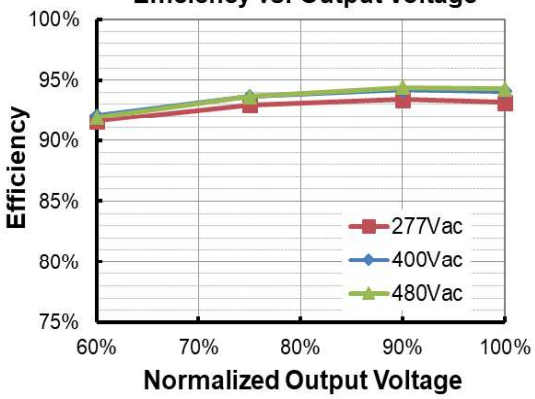
ESM-240S105Mx(Io=700mA)



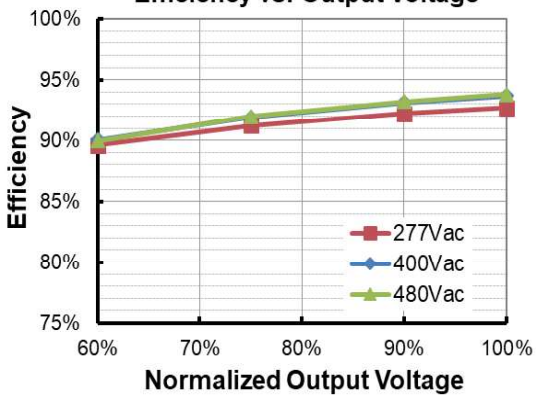
ESM-240S105Mx(Io=1050mA)



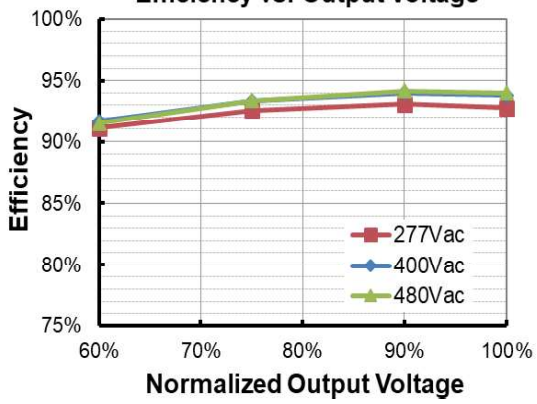
ESM-240S150Mx(Io=1050mA)



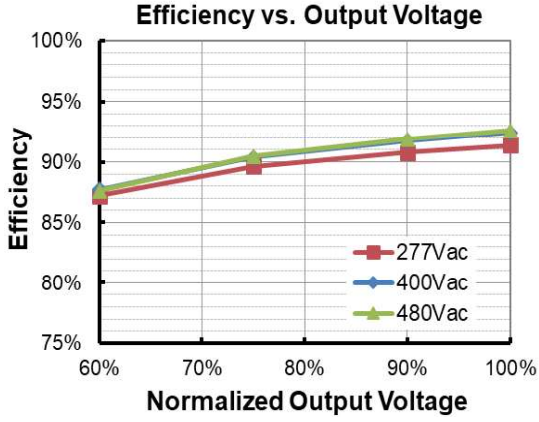
ESM-240S150Mx(Io=1500mA)



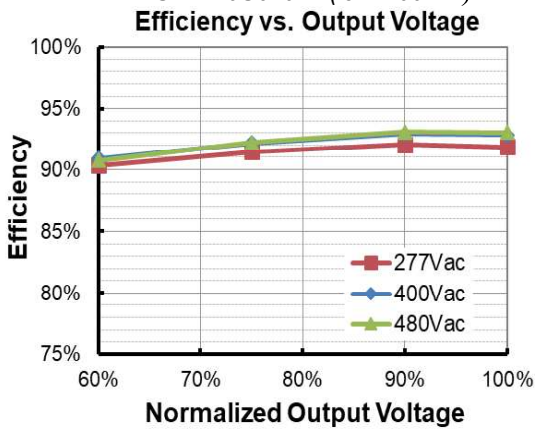
ESM-240S350Mx(Io=2150mA)



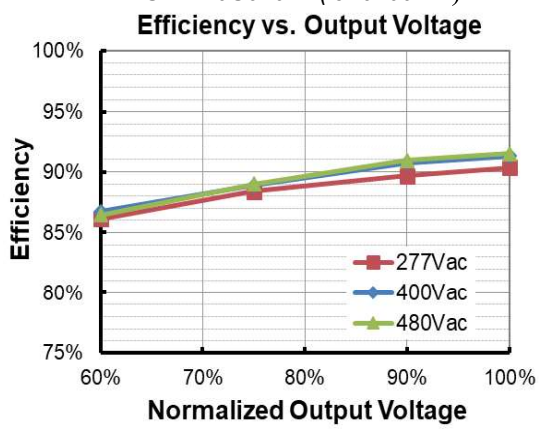
ESM-240S350Mx(Io=3500mA)



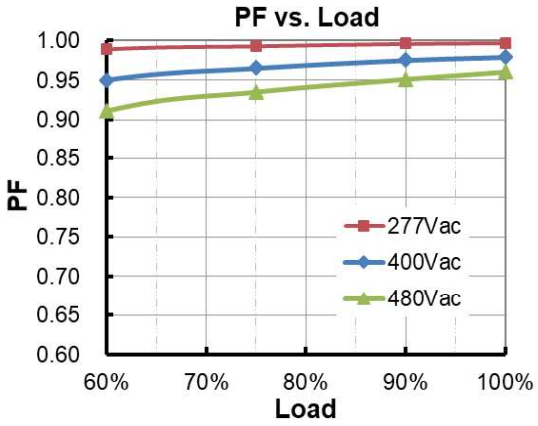
ESM-240S670Mx(Io=4200mA)



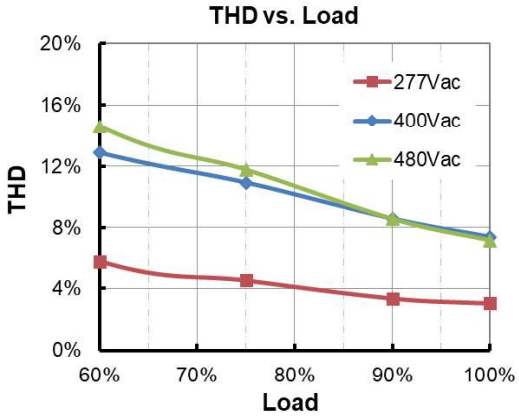
ESM-240S670Mx(Io=6700mA)



Power Factor



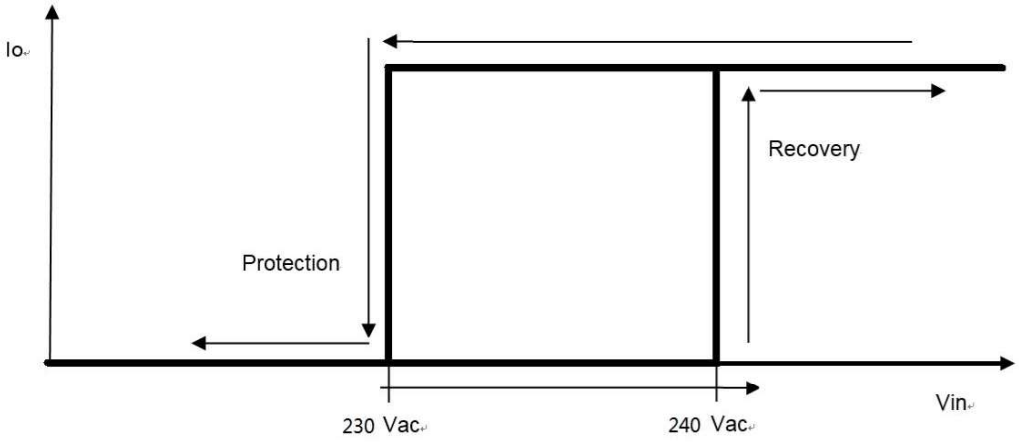
Total Harmonic Distortion



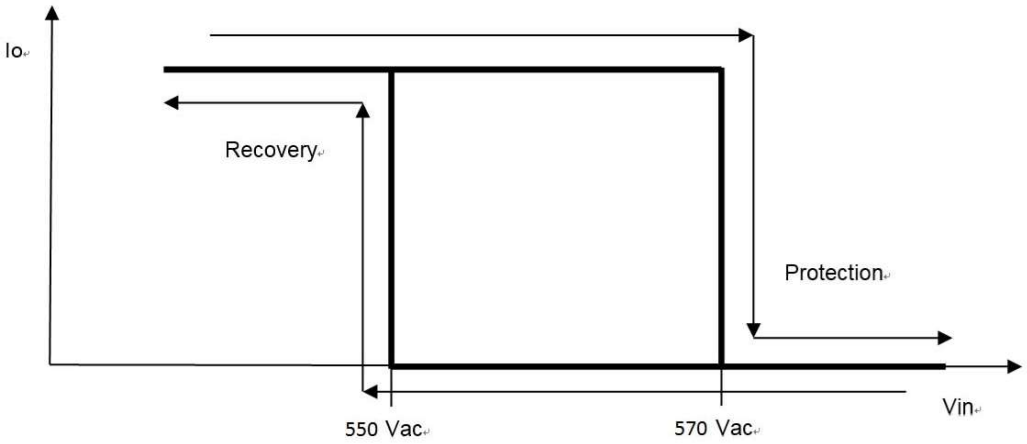
Protection Functions

Parameter		Min.	Typ.	Max.	Notes
Over Voltage Protection		Limits output voltage at no load and in case the normal voltage limit fails.			
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 Temperature Protection		Decreases output current, returning to normal after over temperature is removed.			
Input Under Voltage Protection (IUVP)	Input Under Voltage Protection	220 Vac	230 Vac	240 Vac	Turn off the output when the input voltage falls below protection voltage.
	Input Under Voltage Recovery	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**



- **Input Over Voltage Protection Diagram**



Dimming

- **0-10V Dimming**

The recommended implementation of the dimming control is provided below.

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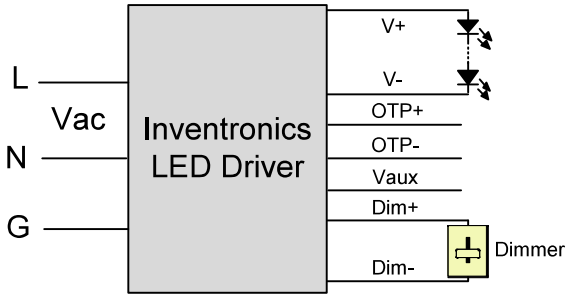
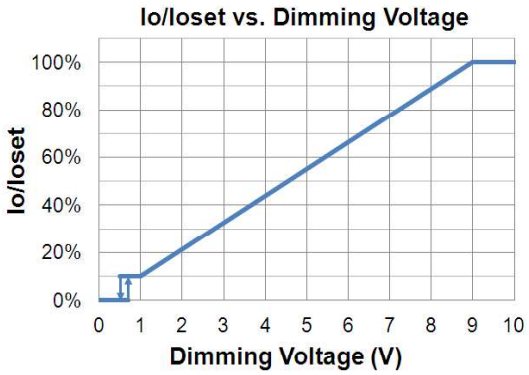
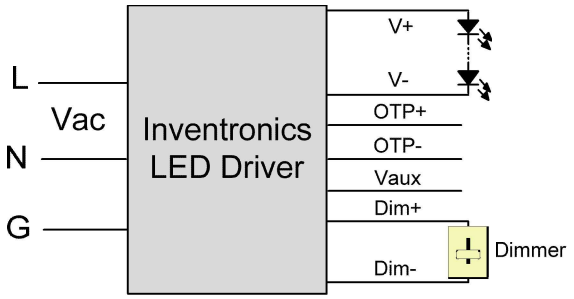
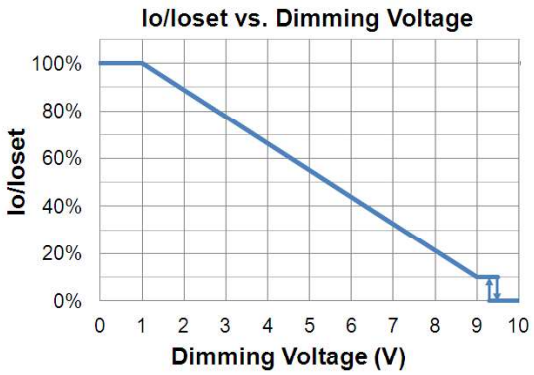




Implementation 1: Positive logic





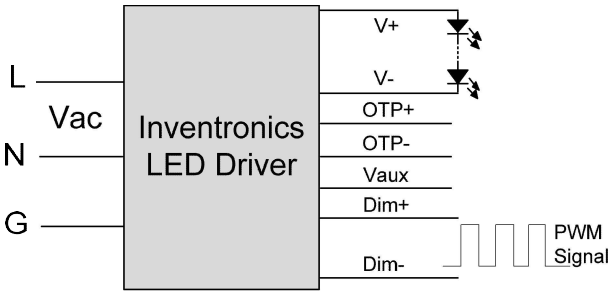
Implementation 2: Negative logic

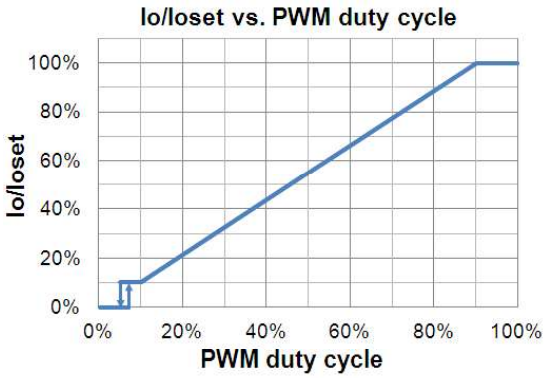
Notes:

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.

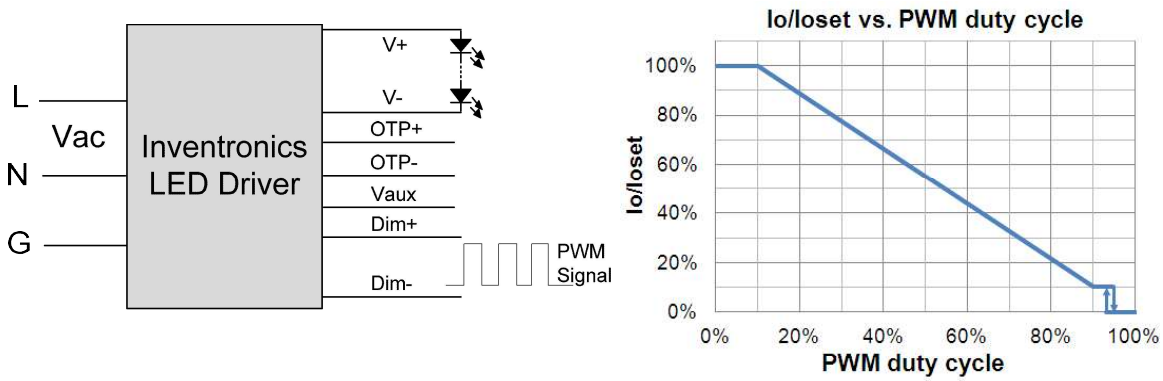
● PWM Dimming

The recommended implementation of the dimming control is provided below.





Implementation 3: Positive logic



Implementation 4: **Negative logic**

Note:

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.

- **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.

- **End Of Life**

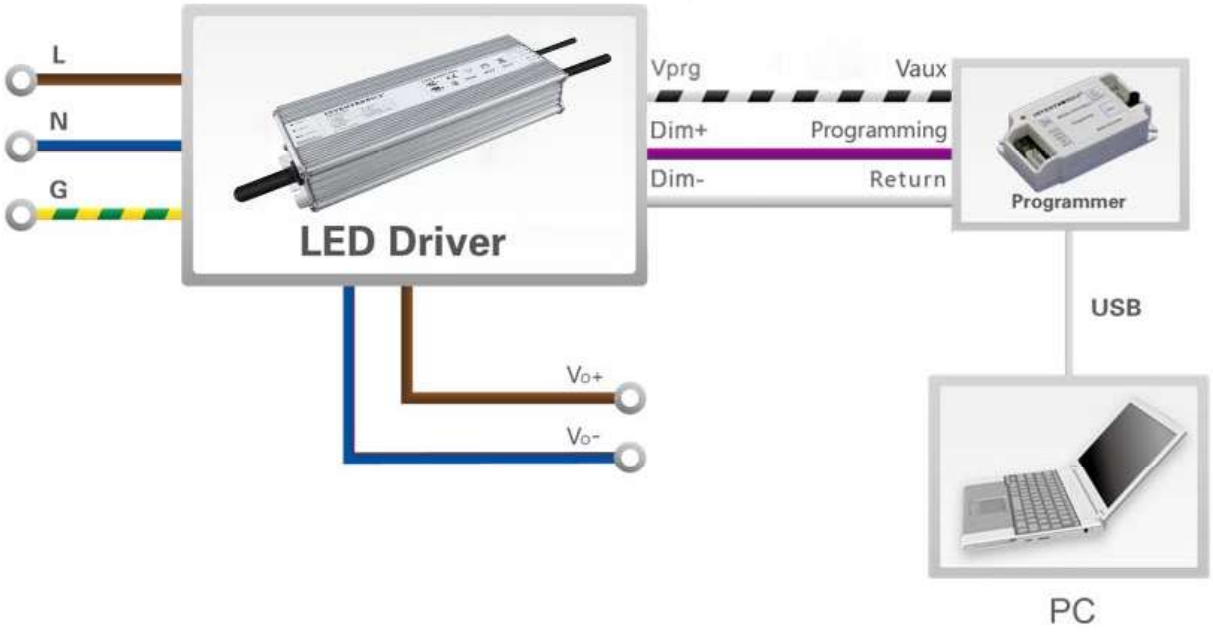
  End-of-Life (EOL) is providing a visual notification to a user that the LED module has reached the end of manufacturer-specified life and that the replacement is recommended. Once active, an indication is given at each power-up of the driver, which the driver indicates this through a lower light output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

- **Digital Dimming**

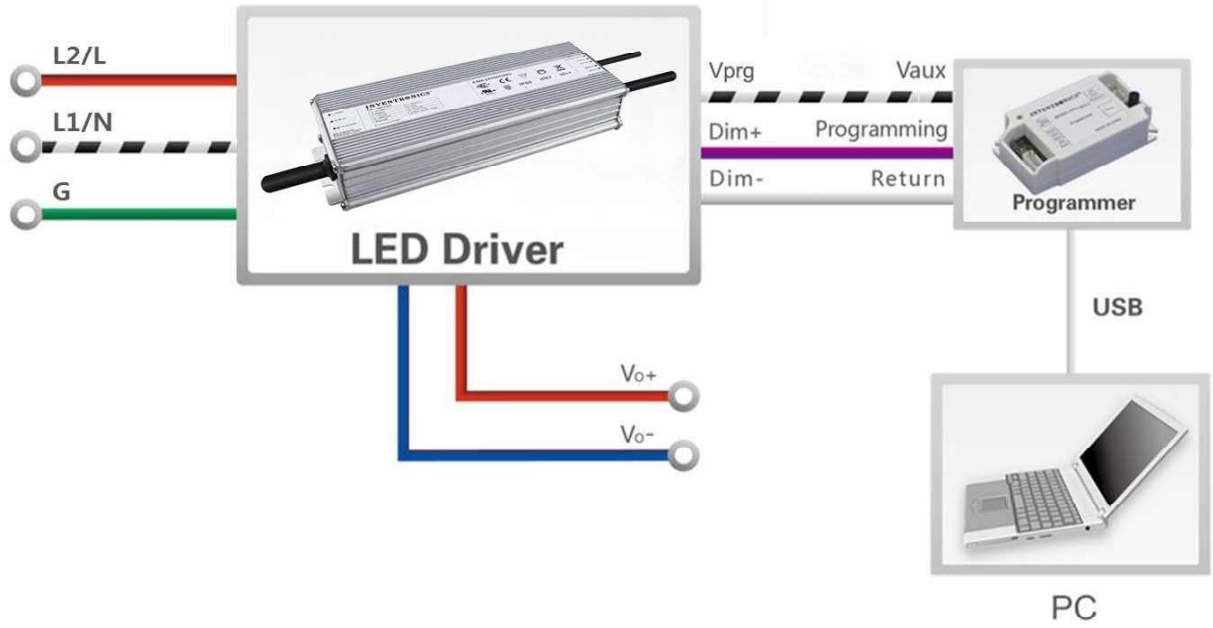
  Inventronics Digital Dimming is a UART (Universal Asynchronous Receive Transmitter) based communication protocol. Please refer to Inventronics Digital Dimming file for details.

Programming Connection Diagram

ESM-240SxxxMG



ESM-240SxxxMT

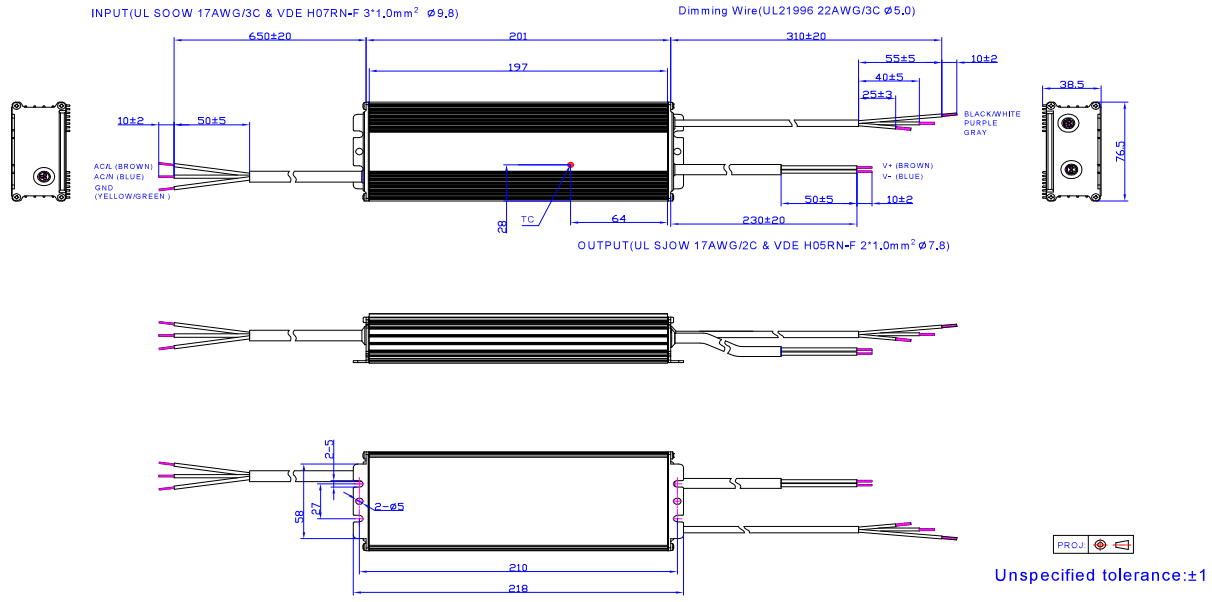


Note: The driver does not need to be powered on during the programming process.

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

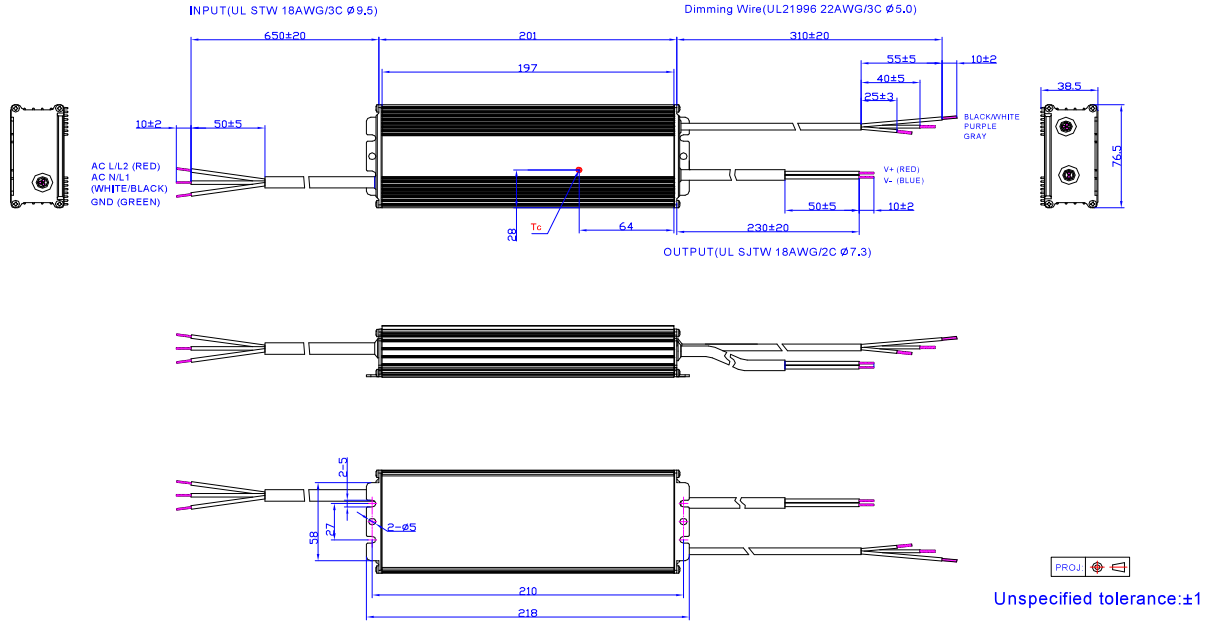
Mechanical Outline

ESM-240SxxxMG



Unspecified tolerance:±1

ESM-240SxxxMT



Unspecified tolerance:±1

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
2021-05-21	A	Datasheet Release	/	/
2021-06-11	B	Programming Connection Diagram	/	Updated
		Mechanical Outline	/	Updated