Features

- Ultra High Efficiency (Up to 96%)
- Compact Metal Case with Excellent Thermal Performance
- 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 Standby Power ≤ 0.5W
- Always-on Auxiliary Power: 12Vdc, 250mA
- Output Lumen Compensation
- End-of-Life Indicator
- Input Surge Protection: DM 6kV, CM 10kV
- All-Around Protection: IUVP, IOVP, OVP, SCP, OTP
- Low Inrush Current
- IP66/IP67
- 5 Years Warranty

Description

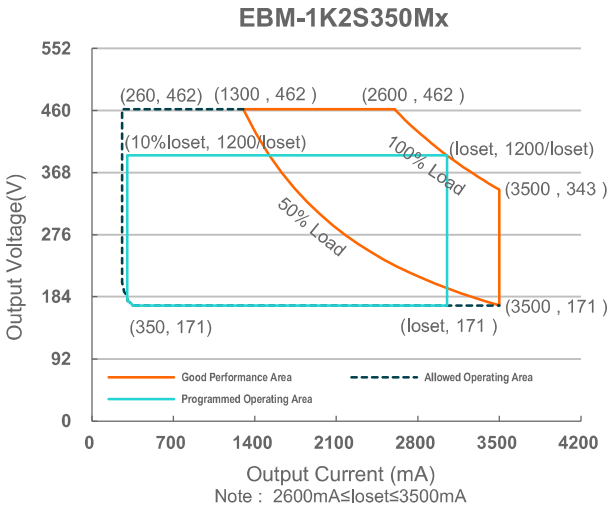
The *EBM-1K2SxxxMx* series is a 1200W, constant-current, programmable and IP66/IP67 rated LED driver that operates from 176-305 Vac input with excellent power factor. Created for many lighting applications including high mast, sports, UV-LED, aquaculture and horticulture etc., this family provides an 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.

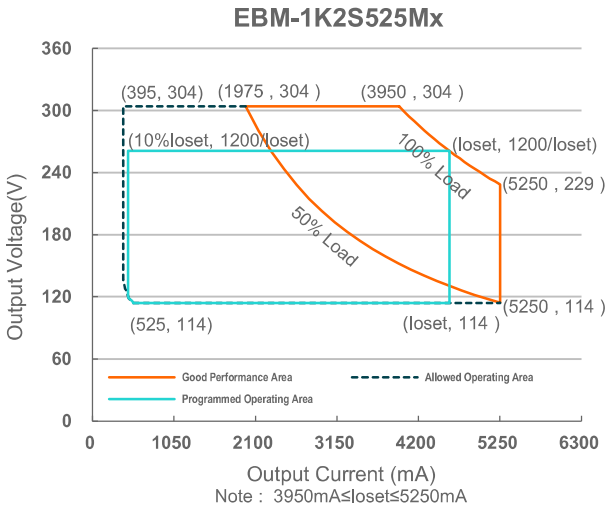
Models

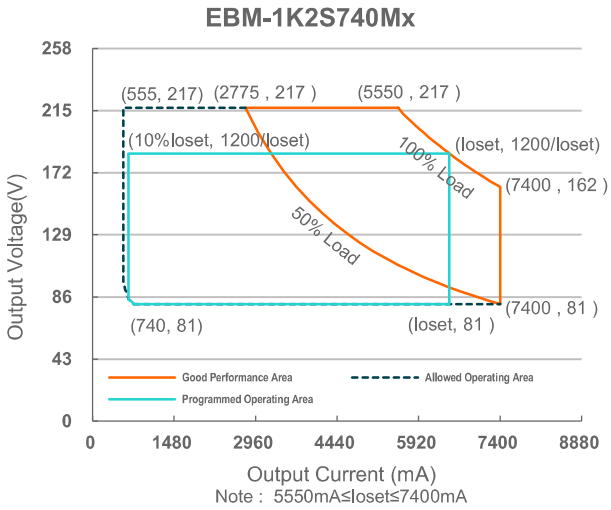
Adjustable Output Current Range (mA)	Full-Power Current Range (mA)(1)	Default Output Current (mA)	Output Voltage Range (Vdc)	Max. Output Power (W)	Typical Efficiency(2)	Typical Power Factor		Model Number(3) (4)
						220Vac	277Vac	
260-3500	2600-3500	3500	171-462	1200	95.5%	0.99	0.96	EBM-1K2S350Mx
395-5250	3950-5250	5250	114-304	1200	95.0%	0.99	0.96	EBM-1K2S525Mx
555-7400	5550-7400	7400	81-217	1200	95.0%	0.99	0.96	EBM-1K2S740Mx

Notes: (1) Output current range with constant power at 1200W.
(2) Measured at 100% load and 220Vac input (see below "General Specifications" for details).
(3) Certified input voltage range: 200-240Vac.
(4) x = G are UL Recognized, ENEC and CCC, etc. models; x = B are BIS models.

I-V Operation Area







Input Specifications

Parameter	Min.	Typ.	Max.	Notes
Input AC Voltage	176 Vac	-	305 Vac	
Input DC Voltage	190 Vdc	-	250 Vdc	
Input Frequency	47 Hz	-	63 Hz	
Leakage Current	-	-	0.70 mA	IEC 60598-1; 240Vac/ 60Hz, grounding effectively
Input AC Current	-	-	6.40 A	Measured at 100% load and 220 Vac input.
Inrush Current(I^2t)	-	-	2.70 A^2s	At 220Vac input, 25°C cold start, duration=19.8 ms, 10%Ipk-10%Ipk.

Input Specifications (Continued)

Parameter	Min.	Typ.	Max.	Notes
PF	0.90	-	-	At 200-277Vac, 50-60Hz, 50%-100% Load (600 - 1200W)
THD	-	-	20%	
THD	-	-	10%	At 220-240Vac, 50-60Hz, 75%-100% Load (900 - 1200W)

Output Specifications

Parameter	Min.	Typ.	Max.	Notes
Output Current Tolerance	-5%Ioset	-	5%Ioset	100% load
Output Current Setting(Ioset) Range EBM-1K2S350Mx EBM-1K2S525Mx EBM-1K2S740Mx	 260 mA 395 mA 555 mA	 - - -	 3500 mA 5250 mA 7400 mA	
Output Current Setting Range with Constant Power EBM-1K2S350Mx EBM-1K2S525Mx EBM-1K2S740Mx	 2600 mA 3950 mA 5550 mA	 - - -	 3500 mA 5250 mA 7400 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	100% load
Startup Overshoot Current	-	-	10%Iomax	100% load
No Load Output Voltage EBM-1K2S350Mx EBM-1K2S525Mx EBM-1K2S740Mx	 - - -	 - - -	 500 V 340 V 240 V	
Line Regulation	-	-	±0.5%	100% load
Load Regulation	-	-	±1.5%	
Turn-on Delay Time	-	-	0.5 s	Measured at 200-277Vac input, 50%-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 2.2ms 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 1.3ms in a 5.2ms period during which time the average should not exceed 250mA.

General Specifications

Parameter	Min.	Typ.	Max.	Notes
Efficiency at 220 Vac input: EBM-1K2S350Mx Io= 2600 mA Io= 3500 mA EBM-1K2S525Mx Io= 3950 mA Io= 5250 mA EBM-1K2S740Mx Io= 5550 mA Io= 7400 mA	 93.0% 93.5% 93.0% 93.0% 93.0% 93.0%	 95.0% 95.5% 95.0% 95.0% 95.0% 95.0%	 - - - - - -	Measured at 100% load and steady-state temperature in 25°C ambient; (Efficiency will be about 2.0% lower if measured immediately after startup.)
Efficiency at 277 Vac input: EBM-1K2S350Mx Io= 2600 mA Io= 3500 mA EBM-1K2S525Mx Io= 3950 mA Io= 5250 mA EBM-1K2S740Mx Io= 5550 mA Io= 7400 mA	 94.0% 94.0% 93.5% 93.5% 93.5% 93.5%	 96.0% 96.0% 95.5% 95.5% 95.5% 95.5%	 - - - - - -	Measured at 100% load and steady-state temperature in 25°C ambient; (Efficiency will be about 2.0% lower if measured immediately after startup.)
Standby Power	-	-	0.5 W	Measured at 230Vac/50Hz; Dimming off
MTBF	-	203,000 Hours	-	Measured at 220Vac input, 80%Load and 25°C ambient temperature (MIL-HDBK-217F)
Lifetime	-	100,000 Hours	-	Measured at 220Vac input, 80%Load and 70°C case temperature; See lifetime vs. Tc curve for the details
	-	54,000 Hours	-	Measured at 220Vac 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)	11.22 × 5.55 × 1.91 285 × 141 × 48.5			With mounting ear 12.21 × 5.55 × 1.91 310 × 141 × 48.5
Net Weight	-	3800 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	EBM-1K2S350Mx EBM-1K2S525Mx EBM-1K2S740Mx	10%Ioset	-	Ioset	2600 mA ⩽ Ioset ⩽ 3500 mA 3950 mA ⩽ Ioset ⩽ 5250 mA 5550 mA ⩽ Ioset ⩽ 7400 mA
	EBM-1K2S350Mx EBM-1K2S525Mx EBM-1K2S740Mx	260 mA 395 mA 555 mA	-	Ioset	260 mA ⩽ Ioset < 2600 mA 395 mA ⩽ Ioset < 3950 mA 555 mA ⩽ Ioset < 5550 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

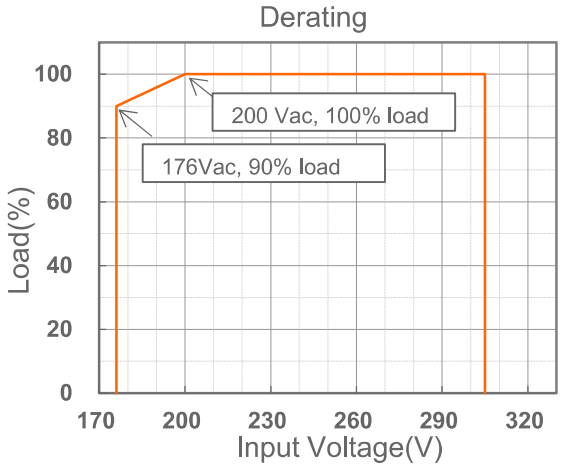
Safety Category	Standard
UL/CUL	UL 8750, CAN/CSA-C22.2 No. 250.13
ENEC & CE	EN 61347-1, EN 61347-2-13
CB	IEC 61347-1, IEC 61347-2-13
CCC	GB 19510.1, GB 19510.14
KC	KC 61347-1, KC 61347-2-13
BIS	IS 15885(Part2/Sec13)

Safety & EMC Compliance (Continued)

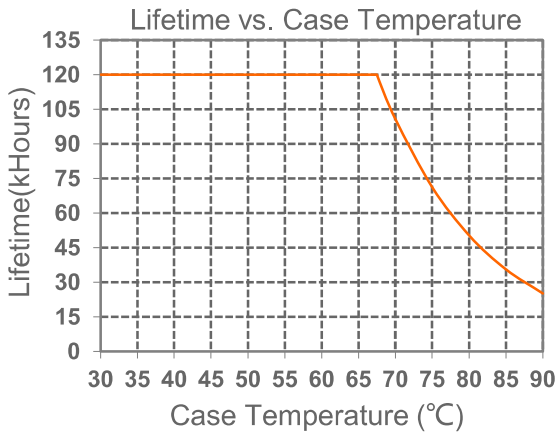
Performance	Standard
ENEC	EN IEC 62384
EMI Standards	**Notes**
EN IEC 55015/GB/T 17743/ KS C 9815(1)	Conducted emission Test &Radiated emission Test
EN IEC 61000-3-2/GB 17625.1	Harmonic current emissions
EN 61000-3-3	Voltage fluctuations & flicker
FCC Part 15(1)	ANSI C63.4 Class B
	This device complies 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/KS C 9547	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.

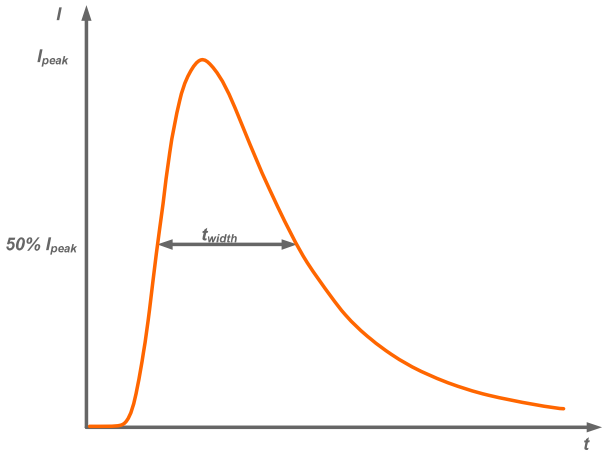
Derating



Lifetime vs. Case Temperature



Inrush Current Waveform



Input AC Voltage	I_{peak}	t_{width} (@ 50% Ipeak)
220Vac	13.4 A	5.84 ms
277Vac	16.8 A	5.60 ms

MCB	Tripping Curves	B	B	B	B	C	C	C	C
	Rated Current	10A	16A	20A	25A	10A	16A	20A	25A
The Number of LED Driver can be Configured	220Vac	1	1	2	2	1	1	2	3
	277Vac	1	2	2	3	1	2	3	3

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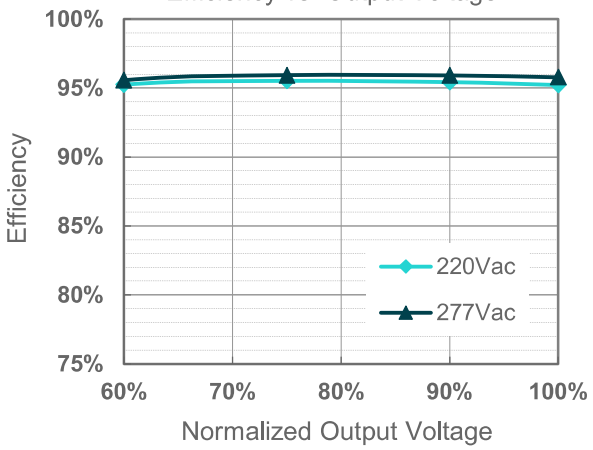
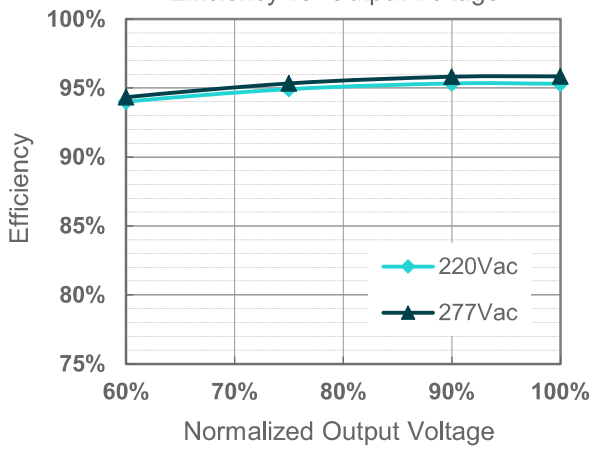
Efficiency vs. Load

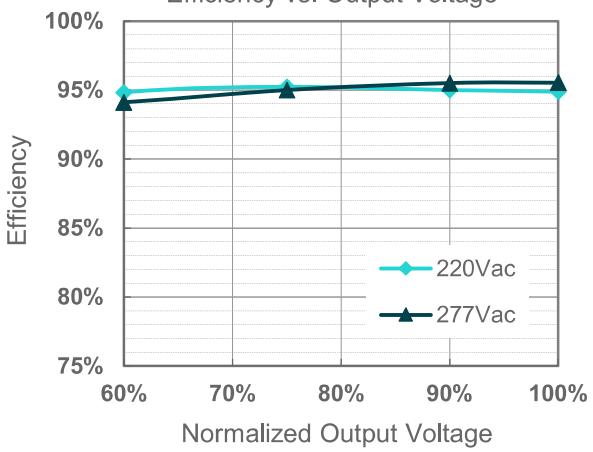
EBM-1K2S350Mx(Io=2600mA)



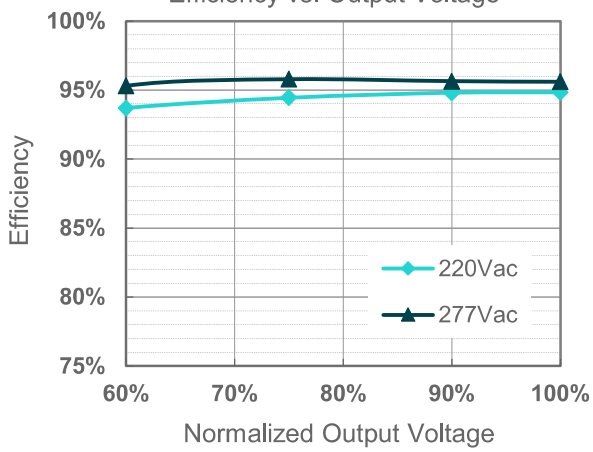
EBM-1K2S350Mx(Io=3500mA)



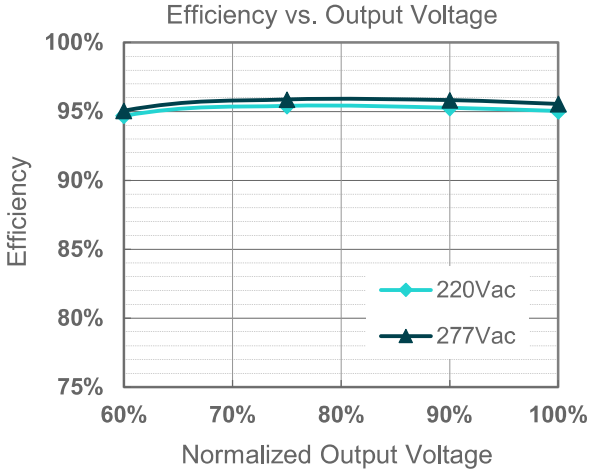
EBM-1K2S525Mx(Io=3950mA)



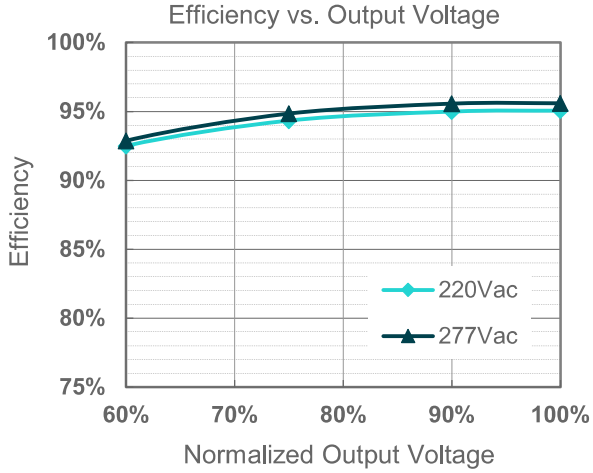
EBM-1K2S525Mx(Io=5250mA)



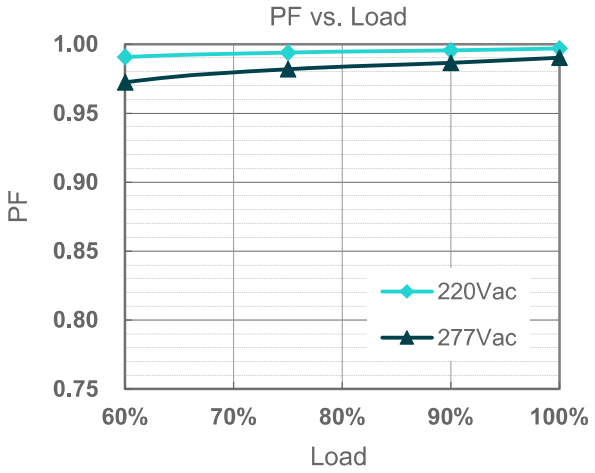
EBM-1K2S740Mx(Io=5550mA)



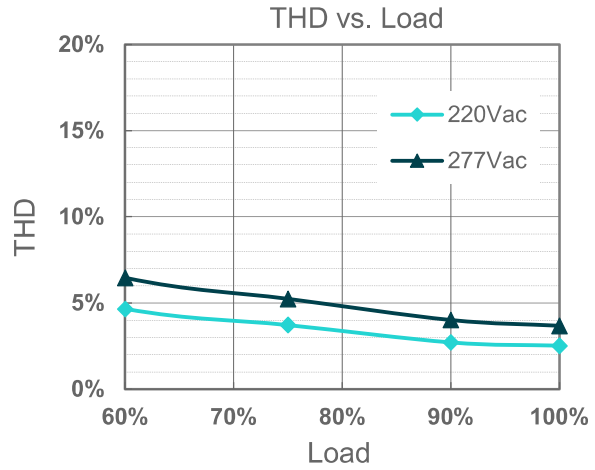
EBM-1K2S740Mx(Io=7400mA)



Power Factor



Total Harmonic Distortion



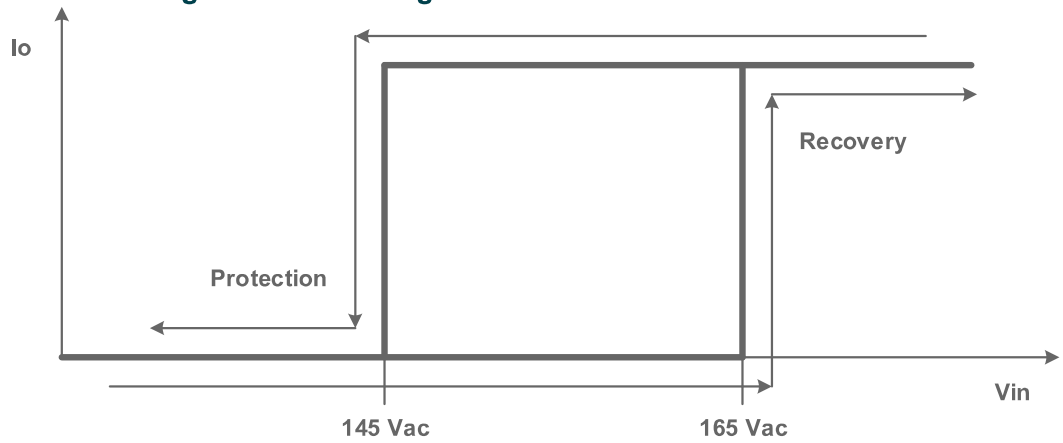
Protection Functions

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 Protection Voltage	135 Vac	145 Vac	155 Vac	Turn off the output when the input voltage falls below protection voltage.
	Input Recovery Voltage	155 Vac	165 Vac	175 Vac	Auto Recovery. The driver will restart when the input voltage exceeds recovery voltage.

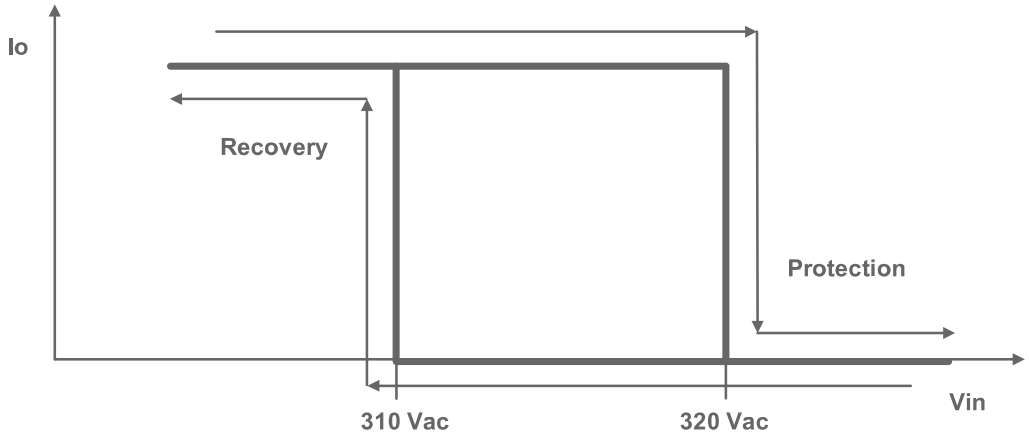
Protection Functions (Continued)

Parameter		Min.	Typ.	Max.	Notes
Input Over Voltage Protection (IOVP)	Input Over Voltage Protection	310 Vac	320 Vac	330 Vac	Turn off the output when the input voltage exceeds protection voltage.
	Input Over Voltage Recovery	300 Vac	310 Vac	320 Vac	Auto Recovery. The driver will restart when the input voltage falls below recovery voltage.
	Max. of Input Over Voltage	-	-	350 Vac	The driver can survive for 48 hours with input voltage stress of 350Vac.

- **Input Under Voltage Protection Diagram**



- **Input Over Voltage Protection Diagram**



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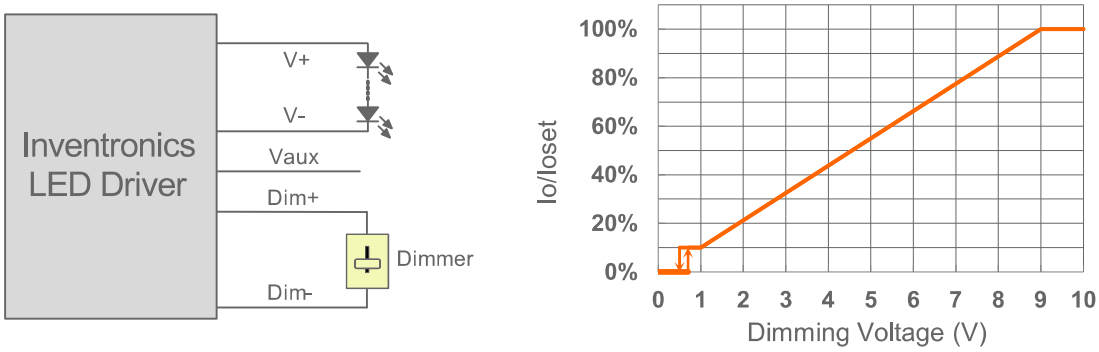
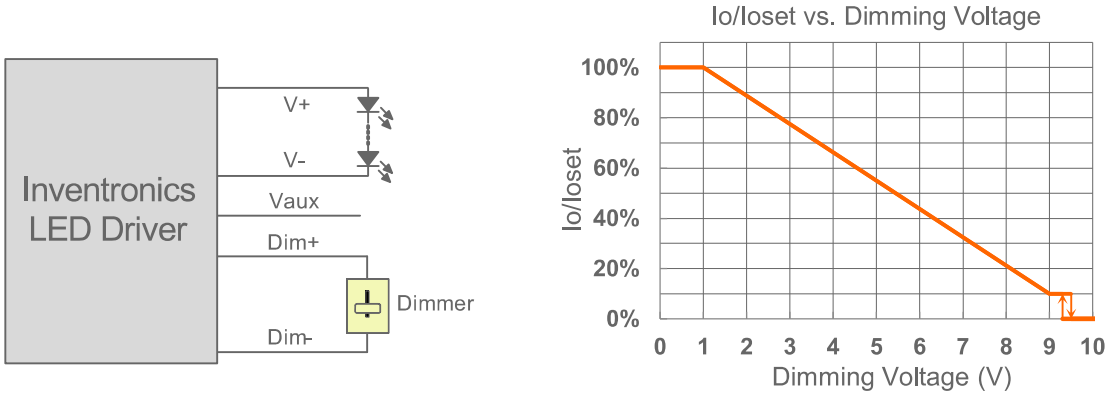
Dimming

0-10V 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.

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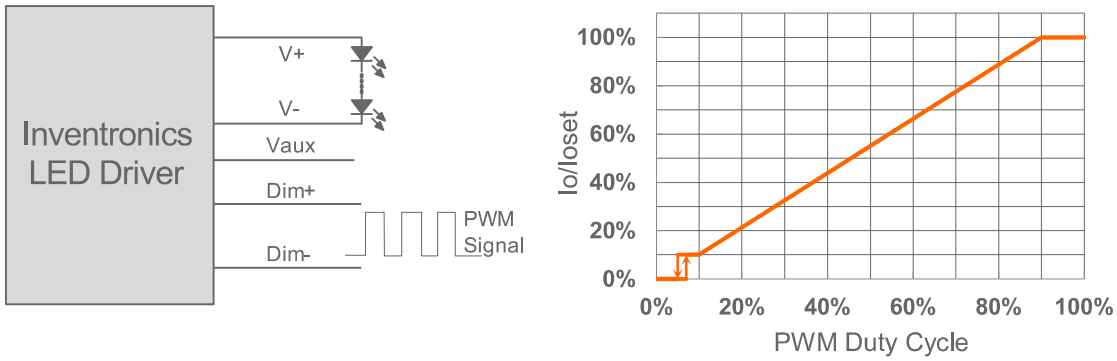
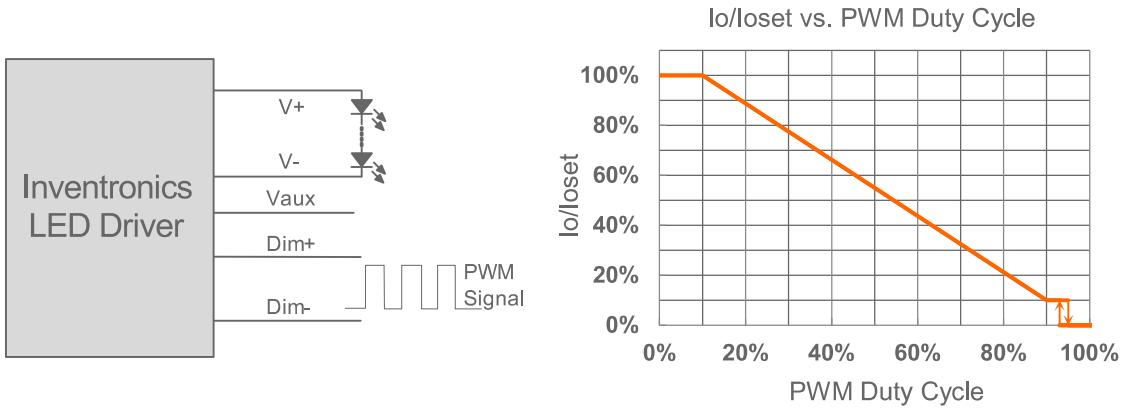
PWM Dimming

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.

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.

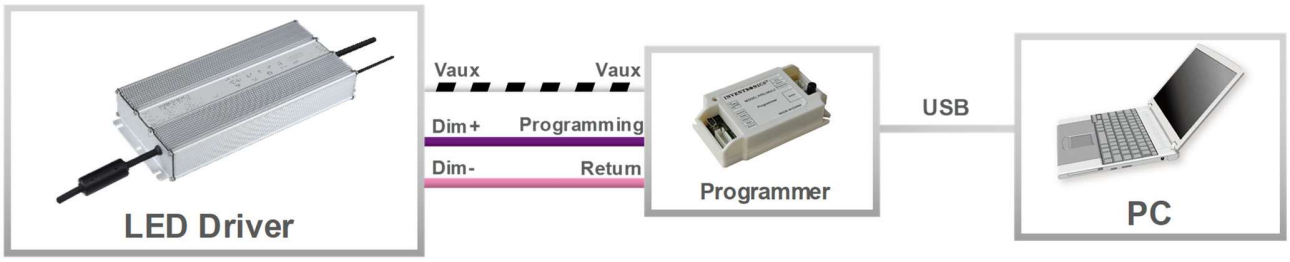
- **End Of Life**

  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.
  file for details.

- **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

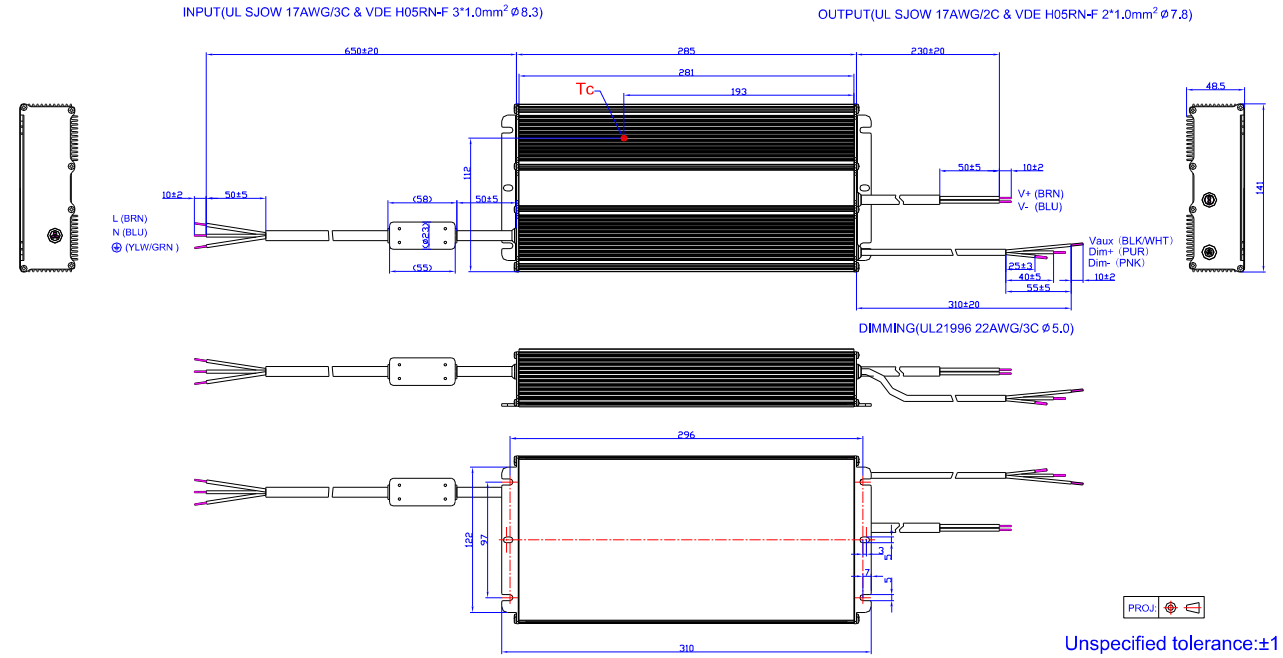


Note: The driver does not need to be powered on during the programming process.

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

Mechanical Outline

EBM-1K2SxxxMG



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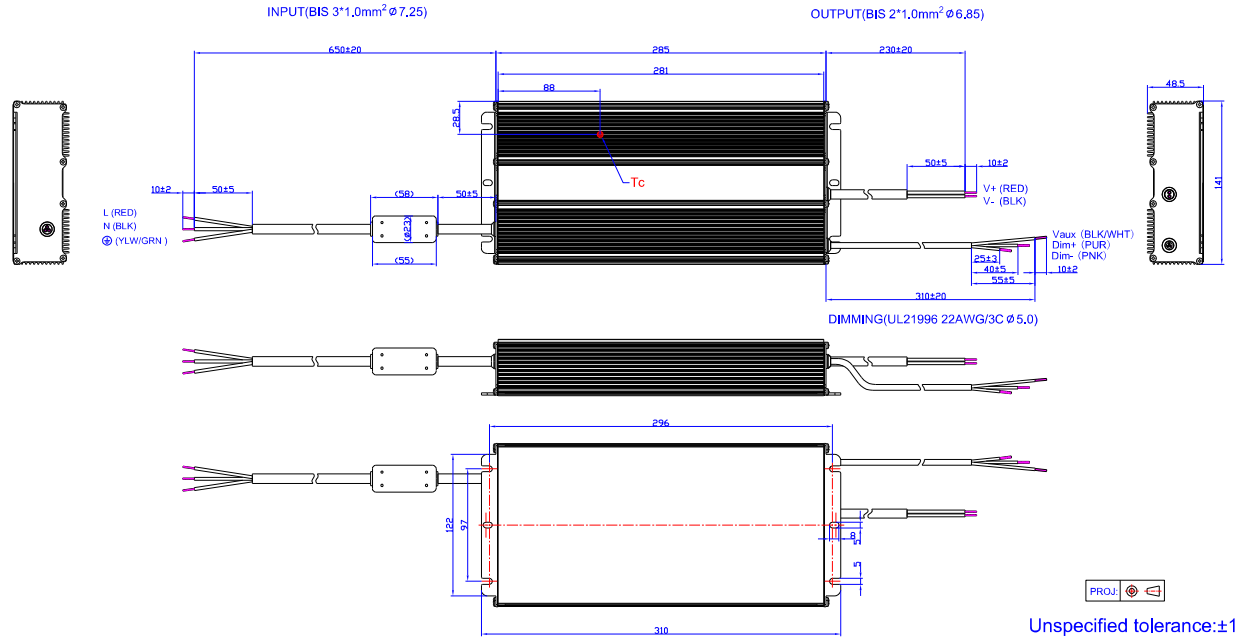
EBM-1K2SxxxMB



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.

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Revision History

Change Date	Rev.	Description of Change		
		Item	From	To
2020-12-25	A	Datasheet Release	/	/
2020-12-30	B	Features	/	updated
		Safety &EMC Compliance	/	updated
2021-02-05	C	Features	/	updated
		Input Specifications	Leakage Current	updated
2021-12-02	D	ENEC logo	/	Updated
		UKCA logo	/	Updated
		Safety &EMC Compliance	ENEC	Updated
		Safety &EMC Compliance	UKCA	Updated
2021-12-17	E	Product Photograph	/	Updated
		EAC logo	/	Added
		Safety &EMC Compliance	EAC	Added
2023-05-25	F	Product Photograph	/	Updated
		Safety &EMC Compliance	/	Updated
		Dimming	/	Updated
		Programming Connection Diagram	/	Updated
		Mechanical Outline	/	Updated
2024-07-30	G	Format	/	Updated
		Product Photograph	/	Updated
		UKCA logo	/	Deleted
		UL/FCC/BIS logo	/	Added
		Models	Note (4)	Added
		Safety &EMC Compliance	/	Updated
		Inrush Current Waveform	/	Updated
		Mechanical Outline	/	Updated
2025-01-09	H	EAC logo	/	Deleted
		Safety &EMC Compliance	/	Updated

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