BostonElectronics

violumas
High Power UV LED Solutions

Application Note

LED Driver Selection Guideline

This application note is intended to provide high-level, generic guidelines regarding the selection of LED drivers suitable for use with Violumas UV LED products. Furthermore, applicable LED parameters, LED driver concepts, and safety regulations for the North American market are briefly explained.

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Overview

This application note is intended to provide high-level, generic guidelines regarding the selection of LED drivers suitable for use with Violumas UV LED products. Furthermore, applicable LED parameters, LED driver concepts, and safety regulations for the North American market are briefly explained.

Intended Audience

- Hardware designers, product developers, and engineers using Violumas UV LED products
- Violumas Technical Sales Engineers providing support to potential customers

Scope

While this application note provides the basics for selecting a suitable power supply for use with Violumas UV LED products, it is not meant to replace fundamental engineering knowledge and is rather intended to be used as a first guide for selection of a suitable power supply. The documentation is not geared towards providing detailed information on regulations and safety certifications for different countries and does not provide information on application-specific requirements. Please contact the Violumas team for resources on thermal management solutions.

Disclaimer

This resource is intended for product developers using Violumas UV LED products. Product designers are solely responsible for (1) selecting the appropriate Violumas products, (2) validating and testing the power supplies depending on the application, and (3) ensuring that the applicable standards and safety requirements are met. Violumas cannot be held responsible for any damages caused by following these guidelines since this document provides generic, high-level guidelines for driver selection (independent of the application).

Part 1: Introduction

The power supply, also known as a driver, is one of the most important components of an LED system. LEDs are DC devices and so cannot be operated using AC wall-power. The LED power supply converts the AC wall-power to a DC signal and in most cases steps down the voltage/current to meet specific LED device and system requirements.

The selection of an optimal power supply is vital to obtain the desired optical output, suitable lifetimes, and the desired reliability from the LEDs. Using the incorrect power supply can not only damage your LED product but can also be a source of dangerous hazards. Hence, the power supply should be chosen with utmost caution, keeping in mind the specific characteristics, which closely match the requirements of the application and the LEDs being used.

In this document, we provide a general guideline to select power supplies for Violumas products. A standard PSU by Meanwell has been chosen as a reference to study the required parameters.

Part 2: Before the Selection Process

In order to select a suitable driver(s) for your LEDs, you need to obtain the datasheet(s) of the LED product(s) of interest. In the case of a custom product, please check in with the Violumas technical support team to obtain information regarding a suitable driver.

2.1: Electro-Optical Parameters

A. Forward Voltage: This parameter is specified in the electro-optical characteristics of the LED product and is defined as the voltage required to turn on the LED. While the parameter may be represented as a single value and not a range, it is important to also know about the binning differences and the range of forward voltages available for a particular bin. In addition, the operating voltage may vary slightly depending on the drive current. The forward voltage in the datasheet should match the output voltage required from the power supply.

Electro-Optical Characteristics at T=25°C and I_F =700mA

Parameter	Symbol	Unit	Min	Typical	Max
Peak Wavelength	λ_p	nm	260	265	270
Forward Voltage	V_F	V	-	6.4	-
Radiant Flux	P_O	mW	70	82	86
Full Width of Half Magnitude	$\Delta\lambda$	nm	-	13	-
Radiant Angle	$2\Phi_{1/2}$	Degree	-	30	-
Thermal Resistance, Junction to Solder Joint	R_{th}(J-S)	°C/W	-	0.9	-

Figure 1: Electro-optical characteristics of a Violumas LED

B. Driving Current: The optical output of an LED is directly proportional to the driving current chosen (as shown in Figure 2 below). This would be the minimum output current required from the power supply (in the case of a single LED product) and would determine the intensity of the light. Hence, this may be varied on the basis of the application.

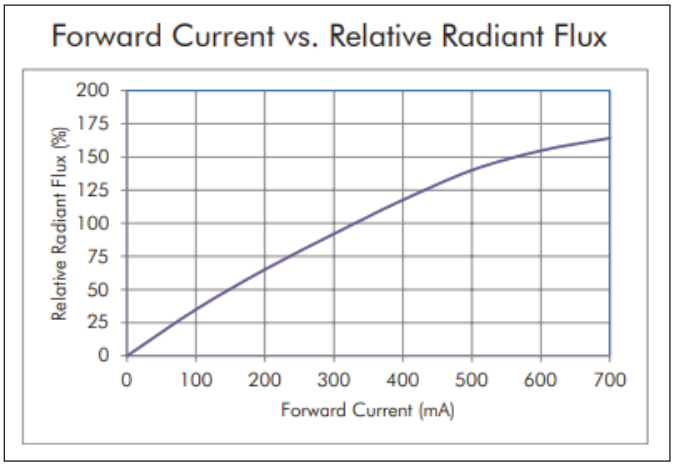

Figure 2: Relative radiant flux as a function of the driving current for a UV LED

C. LED Arrays: In many cases LEDs may be configured in series or parallel arrays to meet application requirements. Information on the series/parallel combinations of LED products is important if a combination of products is required to be driven by the same PSU. Voltages are to be added in series and currents should be added when LEDs are connected in parallel. The total voltage and current requirements for a module need to be known to power up the module.

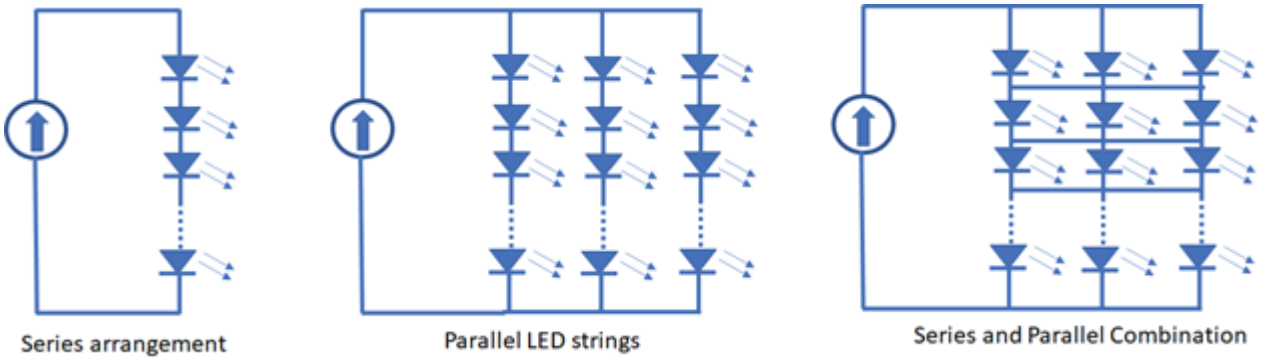

Figure 3: Different LED array formats define the voltage/current requirements

D. Power Requirements: Once the forward voltage and current are known, the output power requirements for the power supply can be calculated.

2.2: Environmental/Operational Parameters

- Wall Voltage: It is important to know the input AC Voltage value available to power-up the power supply. North American products are mostly designed for 120/240 VAC but 277 VAC may also be used in some facilities.
- Ambient Temperature: Depending on the application requirements, the ambient temperature needs to be determined. Outdoor products may have harsher ambient temperature requirements than products used indoors.
- Water and Dust Ingress Protection: Many applications may require water-proofing and so the IP or the ingress protection requirements for the application need to be known.

Part 3: Power Supply Selection Procedure

3.1: Constant Voltage or Constant Current Driver

As the majority of our products are designed for specific illumination requirements, **Violumas recommends the use of constant current drivers with LED products**. Constant current drivers support limited voltage ranges and proper driver selection should be ensured for a given COB. If a constant voltage driver is used instead and the current is not regulated, as the LED temperature increases when powered ON, the LED forward voltage would decrease accordingly. This would mean that the LED would draw more current, implying a further increase in temperature. This continual increase in the driving current would result in additional heat generation leading to a thermal runaway fault resulting in premature failures and lower lifetimes. Hence, the preferred method of driving Violumas LEDs is by using a constant current LED driver. A constant current driver controls and maintains the set current without over driving the LEDs and preventing thermal runaway, even if there is a change in temperature.

3.2: Driver Specifications

The driver specifications provided here assume that a **constant current driver** is being used.

1. Input Voltage and Frequency Range: The AC input voltage range for the driver must comply with the AC wall-voltage of the facility. Voltage variations should also be taken into account. For example, a 90-305 VAC PSU would work both for 120 and 220 VAC grid systems. For European voltages, the requirement would be 230 VAC @ 50 Hz, which the power-supply (specifications in Figure 4) below would satisfy.

INPUT	VOLTAGE RANGE Note.5	90 ~ 305VAC 127 ~ 431VDC (Please refer to "STATIC CHARACTERISTIC" section)							
	FREQUENCY RANGE	47 ~ 63Hz							
	POWER FACTOR (Typ.)	PF≧0.98/115VAC, PF≧0.95/230VAC, PF≧0.94/277VAC @ full load (Please refer to "POWER FACTOR (PF) CHARACTERISTIC" section)							
	TOTAL HARMONIC DISTORTION	THD< 20% (@ load≧50% / 115VAC,230VAC; @ load≧75% / 277VAC) (Please refer to "TOTAL HARMONIC DISTORTION (THD)" section)							
	EFFICIENCY (Typ.) (230Vac)	91%	92.5%	93.5%	94%	94%	94.5%	95%	95%	95%
	EFFICIENCY (Typ.) (277Vac)	91.5%	93%	94%	94.5%	94.5%	95%	95%	95%	95%
	AC CURRENT (Typ.)	3.5A / 115VAC 1.65A / 230VAC 1.45A / 277VAC							
	INRUSH CURRENT(Typ.)	COLD START 70A(twidth=1010μs measured at 50% Ipeak) at 230VAC; Per NEMA 410							
	MAX. No. of PSUs on 16A CIRCUIT BREAKER	1 unit (circuit breaker of type B) / 2 units (circuit breaker of type C) at 230VAC							
	LEAKAGE CURRENT	<0.75mA / 277VAC							

Figure 4: Input parameters from a Meanwell power supply

It should also be noted that the PSU may be derated below certain input voltages as shown in the static characteristics in Figure 5. This should be kept in mind if input AC voltage fluctuations are anticipated.

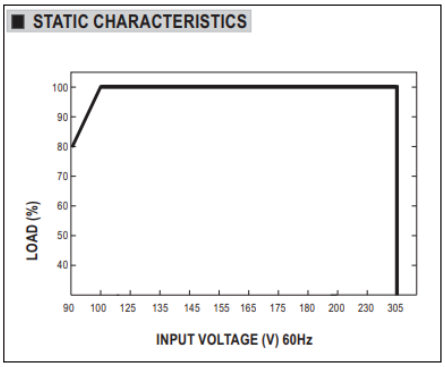

Figure 5: Load characteristics over the input voltage range from a Meanwell power supply

2. Output Current Range: To select a constant current driver you will need to determine the proper driving current for your LED array and ensure the "Output Current" matches the driving current you require. Figure 6 below shows several models (of the Meanwell power supply referred to earlier) which have different voltage and current ranges.

MODEL		HLG-320H-12	HLG-320H-15	HLG-320H-20	HLG-320H-24	HLG-320H-30	HLG-320H-36	HLG-320H-42	HLG-320H-48	HLG-320H-54
OUTPUT	DC VOLTAGE	12V	15V	20V	24V	30V	36V	42V	48V	54V
	CONSTANT CURRENT REGION Note.4	6 ~12V	7.5 ~ 15V	10 ~ 20V	12 ~ 24V	15 ~ 30V	18 ~ 36V	21 ~ 42V	24 ~ 48V	27 ~ 54V
	RATED CURRENT	22A	19A	15A	13.34A	10.7A	8.9A	7.65A	6.7A	5.95A
	RATED POWER	264W	285W	300W	320.16W	321W	320.4W	321.3W	321.6W	321.3W
	RIPPLE & NOISE (max.) Note.2	150mVp-p	150mVp-p	150mVp-p	150mVp-p	200mVp-p	250mVp-p	250mVp-p	250mVp-p	350mVp-p
	VOLTAGE ADJ. RANGE	Adjustable for A/C-Type only (via built-in potentiometer)								
		10.8 ~ 13.5V	13.5 ~ 17V	17 ~ 22V	21 ~ 26V	26 ~ 32V	32 ~ 39V	38 ~ 45V	43 ~ 52V	49 ~ 58V
	CURRENT ADJ. RANGE	Adjustable for A/AB/C-Type only (via built-in potentiometer)								
		11 ~ 22A	9.5 ~ 19A	7.5 ~ 15A	6.67 ~ 13.34A	5.35 ~ 10.7A	4.45 ~ 8.9A	3.8 ~ 7.65A	3.35 ~ 6.7A	2.97 ~ 5.95A
	VOLTAGE TOLERANCE Note.3	±3.0%	±2.0%	±1.5%	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%
	LINE REGULATION	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%
	LOAD REGULATION	±2.0%	±1.5%	±1.0%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%
	SETUP, RISE TIME Note.6	2500ms,80ms/115VAC 500ms,80ms/230VAC								
	HOLD UP TIME (Typ.)	15ms / 115VAC, 230VAC								

Figure 6: Output characteristics of a constant current driver

3. Output Voltage Range: This range should cover the forward voltage of the LED or LED array. The voltage supplied by the driver automatically adjusts to meet the required LED forward voltage. In some power supplies, the output voltage can be adjusted using a potentiometer option (voltage adjustable range) as shown in Figure 6.
4. Output Power: The output power from the PSU should be equal to or greater than the LED power requirement. In many cases, a 20% additional margin is used to ensure the power supply lifetime and reliability.
5. Other Parameters
   a. Ingress Protection: Depending on the ambient environment where the power supply needs to be used, an ingress protection (IP) rating may be required. The IP rating determines how resistant the PSU would be to dust and water. The table in Figure 7 shows how to determine the IP rating for an application. For example, a dust-tight supply protected against jets of water would be rated IP65. This rating should be checked when selecting the PSU.

Figure 7: Ingress protection rating chart

   b. Ambient and Case Temperature: It is important to note the temperature ratings if the PSU is going to be used in extreme temperature conditions as the load % as well as the driver lifetime can vary depending on temperature. For example, in Figure 8, the performance characteristics for a Meanwell driver vary depending on the input wall voltage. The lifetime drops to 50% of the value when case temperature is increased to 80 deg. C.

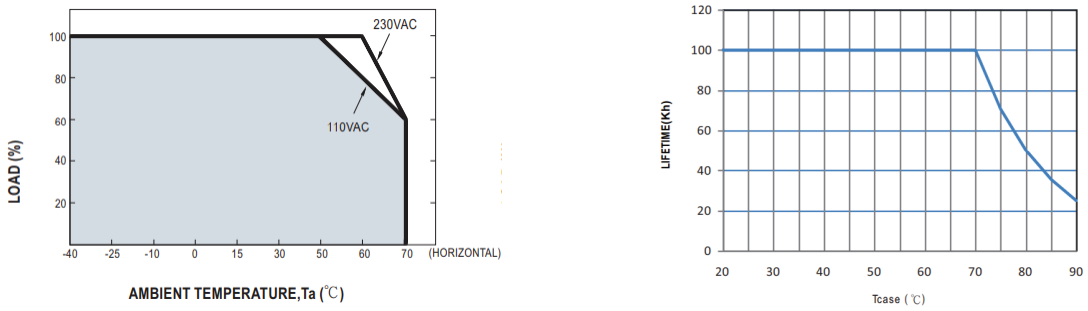

Figure 8: Performance and lifetime dependence of drivers at different temperatures

   c. Certifications: All LED drivers require basic agency safety certifications from UL and/or CSA, as well as FCC or equivalent EMI/RFI certification. In Japan, devices are required to meet PSE, and in Europe the certification requirement is TUV.

3.3: Dimming Requirements

If the application requires intensity control, a power supply with a dimming control would be needed. Many PSU manufacturers such as Meanwell offer several options for dimming control as shown. Depending on the driver type (Type A, Type B, or Type AB), various dimming options are available.

Meanwell's Type A PSU provides an in-built potentiometer option for controlling current as well as the voltage (within the specified adjustable range).

Type B PSU requires external controlling devices to control the current. Three different ways are possible as shown in Figure 9.

Type AB provides both the in-built potentiometer as well as an external control option.

Please check with the Violumas team on what can be offered for dimming control for your application.

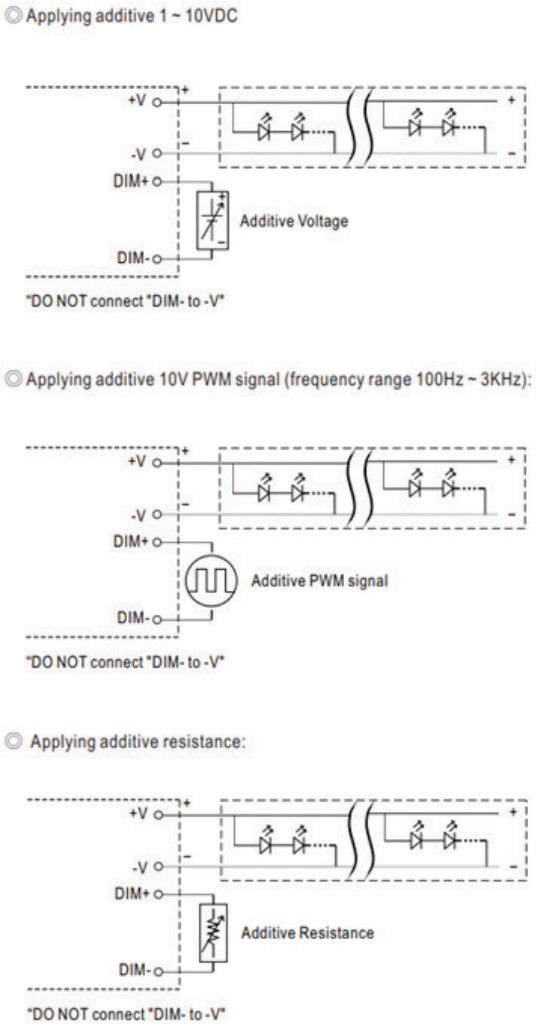

Figure 9: Different ways to dim a Type B Meanwell PSU

Have more questions?

If you have questions that are not answered in this document, please contact:

E : uv@boselec.com
P : 617.566.3821