What type of LED driver or power supply do I need?

Mel Berman, TDK-Lambda Americas

Conventional AC-DC power supplies and DC-DC converters provide an output that is regulated to provide a “constant-voltage.” However, LEDs work most efficiently and safest with a “constant-current” drive. As a result, many new devices have been developed to provide this type of LED drive. LED power sources that provide a “constant-current” output have typically been referred to as LED drivers. In the past, AC-DC power supplies that provided a regulated “constant-voltage” to LEDs were referred to as LED power supplies. Today, the terms “LED driver” and “LED Power Supply” are used interchangeably. The important thing to keep in mind is whether the output of the power device provides a “constant-voltage” or a “constant-current” as is required by the LED device that is receiving the power.

When do I need a “constant-voltage” LED driver?

Most commercially available LED “light modules” are constructed by connecting a number of LEDs in series or parallel to form cluster or string configurations. In cases where these light modules include a “constant-current” driver as part of the assembly, an external “constant-voltage” driver or power supply is required. Low cost LED circuits control the current flowing through the LED with a simple resistor. This is another case where a constant-voltage power source is required. Other examples where “constant-voltage” supplies have been employed include backlit ad signs, traffic information signs and large screen high definition LED displays, such as those described in this article: http://www.ledsmagazine.com/products/20877 [1]. Constant-voltage drivers come in many different forms. They can look like a conventional power supply or they can be enclosed for moisture and environmental

protection.

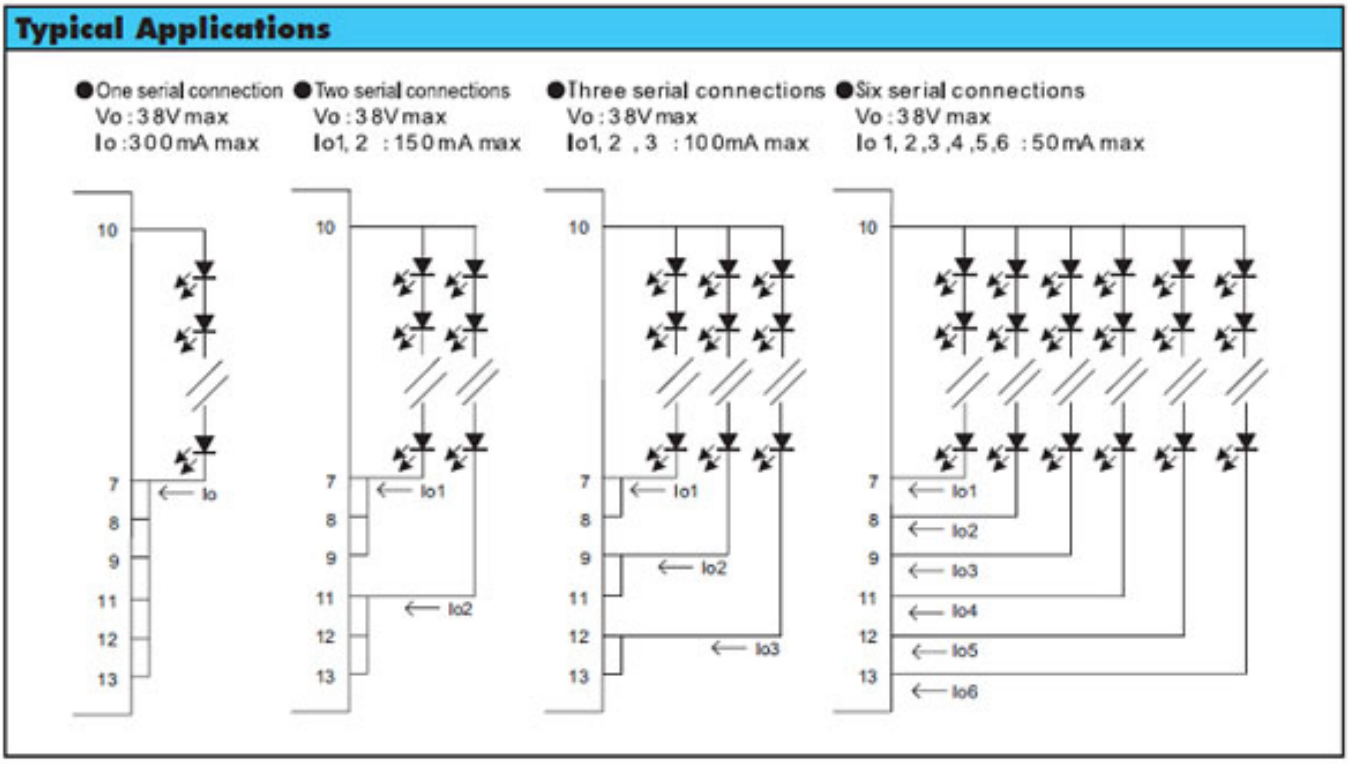
When do I need a “constant-current” LED driver?

In cases where a manufactured cluster or string of LEDs does not include an internal “constant-current” driver, an external LED driver or power supply that provides a “constant-current” is required. Constant-current LED drivers are available in many different package configurations, ranging from integrated circuits to enclosed moisture-proof packages, depending on the application and the required output power.

Series and Parallel LED Configurations

Depending on the application, LEDs can be connected in series and/or parallel configurations. Obviously, when LEDs are connected in series the forward voltage drop of each LED in the string are additive. For example, if you put 15 LEDs in series and each one has a voltage drop of 3V (at its nominal current), you need to provide a voltage source of 45V (15 x 3V = 45V) to drive the required current. This is why “constant-current” drivers always include in their specs the output voltage range that it is capable of providing to overcome the LED voltage drops. In order to limit the drive voltage to reasonable levels, multiple strings of series-connected LEDs can be placed in parallel and driven by multi-output constant-current drivers.

Below is an excerpt from the datasheet for TDK-Lambda’s ALD6 series of LED drivers. As you can see from the schematic diagrams, this driver contains up to 6 independent “constant-current” LED drivers. The 38V output corresponds to the combined forward voltage drop of 10 typical white LEDs connected in series. For high-current applications, up to 300mA is available to power one series-string of high brightness LEDs. For lower power applications where the LED strings each require up to 50mA, this device can power up to 6 strings of LEDs via its multi-output drivers. This type of driver is ideal for LCD display backlighting and general LED lighting applications.



How is LED dimming accomplished?
The light output of LEDs can be controlled by varying the amount of current flowing through the LED (within defined limits) or by turning the LED on and off via pulse-width-modulation (PWM). LED drivers like the ALD6 series have the capability of providing “dimming” by both of these popular methods.

The drawing above shows the two methods of light dimming that are included in the ALD6 LED driver. It is permitted to use a combination of both of these methods simultaneously. The “Rbr” is an external variable 10k ohm resistor input. By varying this potentiometer from 1k to 10k ohms, an analog dimming control is achieved. In this case, the maximum LED brightness occurs when the pot is set to 10k ohms. This same input can operate with variable analog voltage ranging from 1.6 to 3.8-volts. In some applications, this input can be connected to a temperature sensing device that could reduce the current flow through the LEDs as the temperature rises, thus providing a means for temperature compensation. The “Vpwm” is a Pulse-Width-Modulation input that controls the LED brightness by varying the duty-cycle of the input signal from 1% to 100%. Typical PWM frequencies can range from 180 to 270 Hz.

More information about LED drivers, LED power supplies, and applications can be found at the following web link: http://www.us.tdk-lambda.com/lp/products/ledsigns.htm [2]

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