

# Determining LED Load

## A Short Primer

Thomas Research Products strives to make it easy to find the most appropriate LED driver for your luminaire design. However, the process is more complex than picking a fluorescent or HID ballast in the past, because the possibilities are almost endless (for example: the number of LEDs, the drive current, whether the LEDs are in series or parallel). One of the most important considerations is determining the LED load that the driver will need to support. This brief overview will help you visualize a general description of the driver you need.

### LED Fixtures/ Light Engines

How much power do you need? Most luminaires require multiple LEDs. First, how many LEDs are being used in the fixture? You must also know the specifications of the Light Engine (the set of LED chips on a board), including the forward voltage and drive current. LED drive currents range from 200 mA to 8000 mA. Choose a driver that is rated at or just slightly higher than your maximum load.

There are two basic electrical arrangements for LED engines, Series or Parallel. The descriptions below show how the number and arrangement of the LEDs determine the load. A third arrangement, Matrix, combines these two to improve fault tolerance.

### Simple Series

Typically, LEDs are connected in a series. All of the LEDs will see the same current. However, the voltage requirement increases as LEDs are added to the string.

#### Advantages:

- No current sharing

#### Disadvantages:

- Voltage requirement can escalate

#### Failure modes:

- Short – balance of LEDs remain lit
- Open – fixture goes dark

#### SERIES EXAMPLE

##### Quantity:

- Assume **8** Cree X-PG LEDs
- 350mA per LED
  - 3.3VDC per LED
  - 1.2W per LED

##### Power required:

- $8 \times 1.2W = 9.6W$

##### Current required:

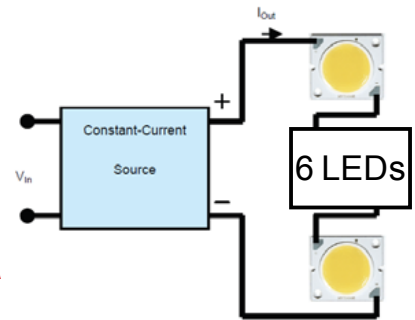
- $350mA \times 1 \text{ string} = 350mA$

##### Voltage required:

- $8 \times 3.3V = 26.4V$

##### Recommended TRP Driver:

- LED12W-36-C0350 (12W / 18-36V)



### Parallel

Parallel arrangements include sets of series. The LEDs will see the same current within each string, but you need to increase the current to adequately supply all the strings.

#### Advantages:

- If one LED opens, the other string stays lit
- Reduces required voltage

#### Disadvantages:

- Current is shared, which can lead to "current hogging"

#### Failure modes:

- Short
  - Balance of LEDs remain lit
  - String with short draws more current
- Open
  - Half of fixture goes dark
  - Remaining string see more current

#### PARALLEL EXAMPLE

##### Quantity:

- Assume **two** strings of **8** Cree X-PG LEDs
- 350mA per LED
  - 3.3VDC per LED
  - 1.2W per LED

##### Power required:

- $16 \times 1.2W = 19.2W$

##### Current required:

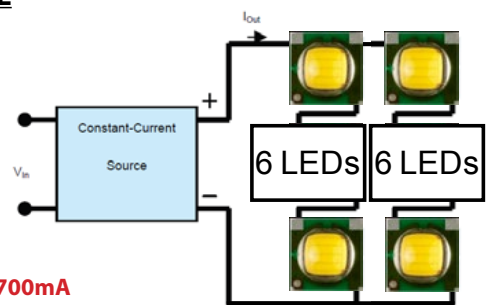
- $350mA \times 2 \text{ strings} = 700mA$

##### Voltage required:

- $8 \times 3.3V = 26.4V$

##### Recommended TRP Driver:

- LED25W-36-C0700 (25W / 12-36V, note that this model provides twice the current)



### Additional factors in selecting the best driver for your application:

- Input line voltage (120V, 277V, 480V?)
- Is Dimming required?
- Physical properties, such as size
- Power Factor (affects current draw)
- Is UL Class 2 required?
- Life rating
- Is Constant-Current or Constant-Voltage required?
- Efficiency (affects power consumption)
- Protections, such as Short Circuit, Lightning, IP rating