

## Product Overview

The 4015 "BoostPuck" line of LED Power Modules are true constant-current regulated drivers for LEDs. Unlike standard power supplies, which deliver a fixed voltage to the output, the BoostPuck LED driver is designed to vary the output voltage as required to deliver a constant current to the LED(s), reliably and with stability.

The 4015 BoostPuck driver exhibits very high efficiency and requires no external current limiting resistors or additional heat sinking. A fast response current-sensing circuit makes the 4015 ideal for applications where flashing or strobe operation of the LED(s) is desired.

A wide range of options are available including external DC analog voltage intensity control, TTL/CMOS logic level on/off control, and set-and-forget internal current limiting.

The standard units are fully potted in an extremely small form factor\* and are provided with a simple 7 pin SIP connection for through-hole PCB mounting or use with the optional wiring harness.

The 4015's built-in regulated 5V reference can provide output to power logical circuitry or microprocessor, eliminating the need for an additional power supply on the circuit board.

*4015 BoostPuck LED Driver Module powering (9) LEDs in series at 350mA ( $V_{in}=12V$ )*

## Features

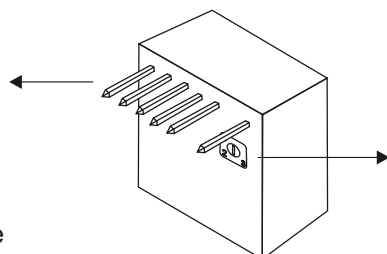
- DC input power up to 28V
- 350mA constant current output
- Extremely small form factor\* (0.83"x0.83"x0.43")
- Simple 7-pin SIP connection for through-hole PCB mounting or use with optional wiring harness
- External analog/digital intensity control (TTL compatible)
- Optional external potentiometer intensity control (0-100%)
- Optional on-board trim adjustment (75-120%)
- Output open circuit protection
- Pulse and strobe capable (control input)
- Built-in 5V reference/output to power logic circuitry or micro-controller

## Typical Applications

- Solar & Landscape Lighting
- Architectural Lighting
- Track Lighting
- Automotive & Marine Lighting
- Portable Lighting & Flashlights
- Point of Purchase Lighting
- Desk & Reading Lamps
- Signal & marker Lighting
- Flashing & Strobe Lighting
- Cabinet & Display Case Lighting
- Sign & Channel Letters
- Much More...



7-Pin SIP through-hole PCB mounting



Optional on-board trim adjustment (75-120%)



4015 BoostPuck with optional wiring harness (3021HEP)

\* - Units can be designed for OEM applications - Contact LuxDrive for more information

**Part Number Identification Table**

Part Number	DC Input	AC Input	On-Board Trim	Control/Dimming	Connection Type
04015-D-E-350	5-28V	no	no	yes	7-Pin SIP
04015-D-I-350	5-28V	no	yes	yes	7-Pin SIP

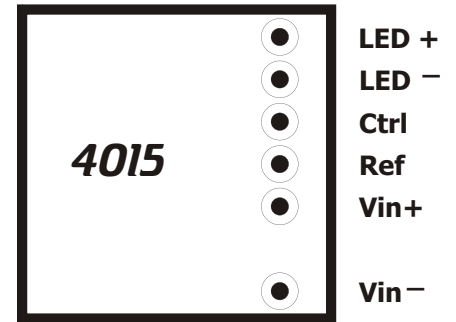
**Absolute Maximum Ratings**

Input Voltage, DC Model. . . . . 28V  
 Input Current, DC Model . . . . . 1.5A  
 Output Voltage . . . . . 48V  
 Control Pin Voltage . . . . . 10V  
 Reference regulator current (5V<sub>DC</sub>) . . . . . 20mA

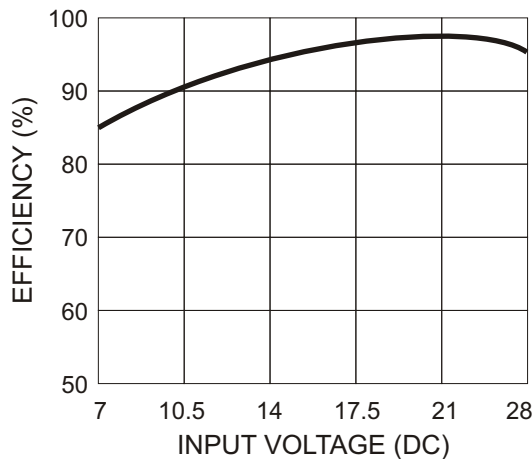
**Typical Characteristics**

Output tolerance (within specified temp. range) . . . . . ±5%  
 Efficiency . . . . . 95%  
 Input Voltage Minimum . . . . . 5V<sub>DC</sub>  
 Input Margin (350mA unit<sup>1</sup>, add to LED Vf MAX) . . . . . -3.0V<sub>DC</sub>

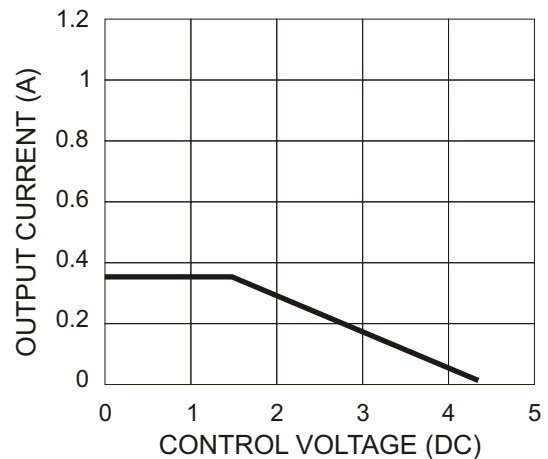
**PINOUT**



*Bottom View*



**Figure 1.**  
Efficiency vs. Vin



**Figure 2.**  
Output current vs. control voltage

<sup>1</sup> - Margin increases with higher current units.

## Specifications

Output current, 4015-D-x-350 .....	350mA
Control Pin, adjustment threshold .....	1.5 V ±5%
Control Pin, shutoff threshold .....	4.3 V ±5%
Control Pin, input impedance .....	1.8 k ohm
Reference voltage .....	5 V <sub>DC</sub> ±5% <sup>2</sup>
Optional trim pot adjustment range .....	75-120% <sup>2</sup>
External pot adjustment range .....	0-100% <sup>2</sup>
Maximum flash frequency .....	1 kHz
Minimum strobe pulse width .....	500 μs
Strobe turn-on / turn-off time .....	<50 μs
Quiescent current (no load or control pin high) .....	<12 mA
Operating temperature .....	-40+85°C
Storage temperature .....	-40+125°C

## Application Information

### Description

The 4015 Wide Range LED Power Module is a high efficiency dc to dc converter which delivers a fixed output current by varying the output voltage as required to maintain the specified current . A fast response current-sensing circuit permits the unit to be used in applications where flashing or pulsing of the LEDs is required. Several options are available allowing for use with many types of LEDs and in a variety of operating modes.

### Fixed Current Drive

The fixed output of the 4015 is designed to supply rated current to four to twelve LED junctions connected in series. A single 4015 will drive up to twelve LUXEON I®\* LEDs connected in series. Due to the nature of the boost regulator, the input voltage must always be less ( $V_{IN} < V_f$ ) than the total forward voltage drop of the LED junctions connected in series. For example, to drive a string of six junctions having an average forward drop of 3.5V, the forward voltage required for the string is 21V (6x3.5V=21V). The input voltage should be kept at least 3 volts lower than the total forward LED voltage, therefore 18V can be considered the practical maximum. A standard 12V power supply is a good choice for this application.

### Adjustable Current - On-Board Control - "I" Model

Where the ability to adjust the output current to an intermediate value is desired, models are available with an on-board potentiometer. This permits the output current to be varied from approximately 75-120% of the rated value while maintaining full external dimming capability. When measuring the output current in order to determine a particular set point, the following method is recommended:

- Temporarily place a 0.1 ohm, 1% resistor in series with the LED+ output.
- Read the voltage across the 0.1 ohm resistor.
- The voltage, in millivolts X 10, will equal the output current in mA.

\* - LUXEON® is a registered trademark of Lumileds Lighting LLC

2 - When  $V_{IN} > 5.25V_{DC}$

**NOTE:** Because there is a small, high-frequency component in the 4015 output, many multi-meters will give an incorrect reading when used in the current mode. It has been found that the method previously described yields a far more accurate measurement.

The potentiometers used for the on-board adjustable "I" units are rated for a limited number of rotations (typically 100) and are intended for "set it and forget it" applications. Where frequent adjustments of output current are needed, the use of units with external adjustment capabilities is recommended.

### **Adjustable Current - External Control - "E" Model**

Both the "E" and "I" models feature externally adjustable output current. Figures 6 and 7 show external adjustment configurations. Both use a 5Kohm, linear taper potentiometer. In Figure 6, the potentiometer is connected between the internal  $5V_{DC}$  reference (Ref) output and the control (Ctrl) input. When using this configuration, it is important that  $V_{in}$  be  $5.25V_{DC}$  or higher. Figure 7 shows the control potentiometer being powered by an external  $5V_{DC}$  source. In either configuration, connect the potentiometer such that clockwise rotation increases the resistance. Note that because the current through the potentiometer is less than 5mA, a low power potentiometer may be used.

### **External On/Off Control**

Where a manual on/off control is desired, the potentiometer in Figures 6 and 7 may be replaced by a pushbutton or toggle switch. The output current will be zero when the switch is closed. Figures 8 and 9 show external dimming control combined with on/off control. The circuit in Figure 9 uses a 2N4403 or equivalent PNP switching transistor.

### **External Pulse/Strobe Control**

Figures 10 and 11 show two methods for low speed pulsing or high speed flashing operation. In Figure 10, a TTL/CMOS logic signal is applied directly to the control (Ctrl) input of the 4015. The output current will be zero when the control signal is high. Note that the input needs to source a minimum of  $4.75V_{DC}$  into a 1Kohm input impedance. Also, as is the case with a dc control signal, the logic input ground should be common to the LED-output terminal.

Figure 11 shows an inverted input configuration using a 2N4401 or other NPN switching transistor. In this case, a logic high will cause the output to be "on". In either configuration, the rise and fall times of the output will be  $15\mu\text{sec}$  or less. A pulse frequency up to 1kHz may be used.

### **Microprocessor Control**

Figure 12 shows a typical interface for a microchip PIC or similar micro-controller. The reference output provides the operating voltage for the processor (up to 20mA current).

### **Other Control Applications**

In addition to the configurations described above, the 4015 may also be driven by a D to A converter. Figure 2 shows the effective control range of the analog input signal.

### **Connections**

In all cases, the LEDs being driven should be located as close to the 4015 LED output as possible. When the use

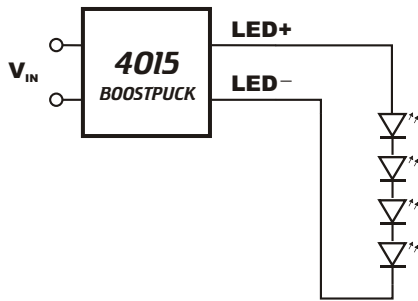
of long leads is required, use heavier gauge wire. For strobe or pulse applications, a wire length not exceeding 6" should be used to maintain accurate timing. All control wires should also be less than 6" in length.

Due to the high current draw of the 4015, power input wires/traces should also be kept short. Where DC input units are located more than 6" from the power source, a 220µF, 35V capacitor should be placed across the input terminals as shown in Figure 13.

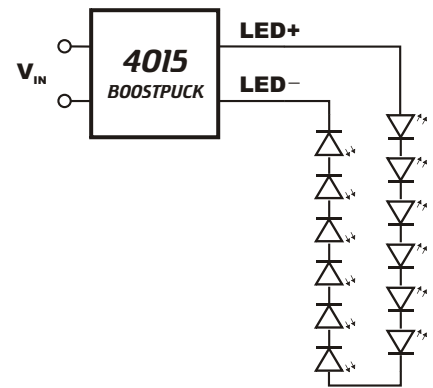
For applications where the use of header pins is inconvenient, a mating connector with 6" leads is available as an accessory or the BoostPuck may be ordered with 6" colored leads (minimum order required).

- 03021HN** - Harness for "N" type (4-wire)
- 03021HE** - Harness for "E" & "I" type (6-wire)
- 03021HEP** - Harness for "E" & "I" w/pot (6-wire w/pot)

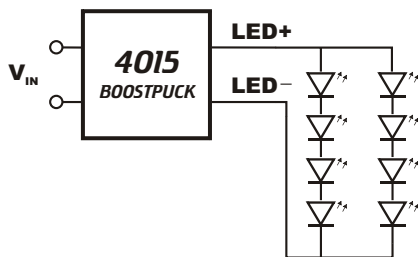
## Application Figures



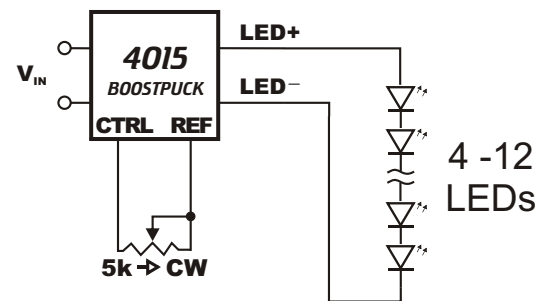
**Figure 3.**  
4015 unit driving four LUXEON® I LEDs  
(VIN ≤ 9VDC)



**Figure 4.**  
4015 driving 12 LUXEON® I LEDs @350mA  
(VIN ≤ 28VDC)

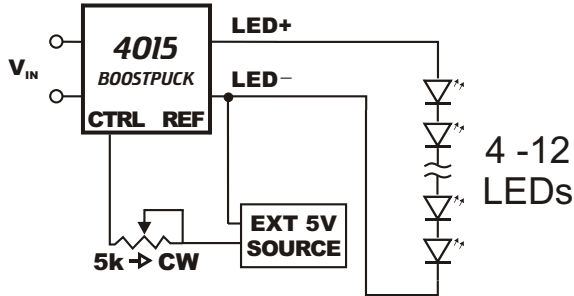


**Figure 5.**  
4015 driving 8 Nichia Rigel LEDs @175mA  
(VIN ≤ 9VDC)

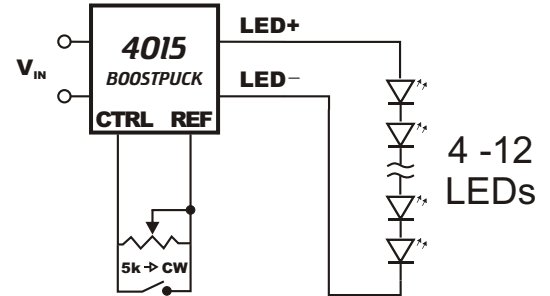


**Figure 6.**  
External potentiometer using internal  
reference

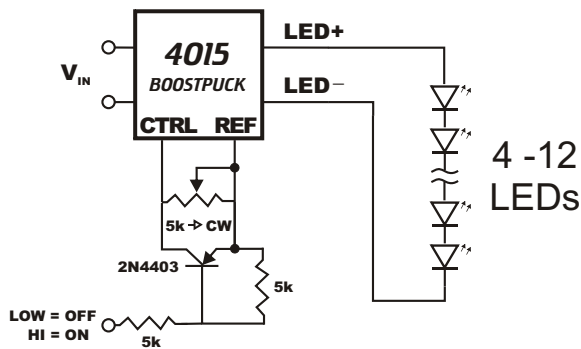
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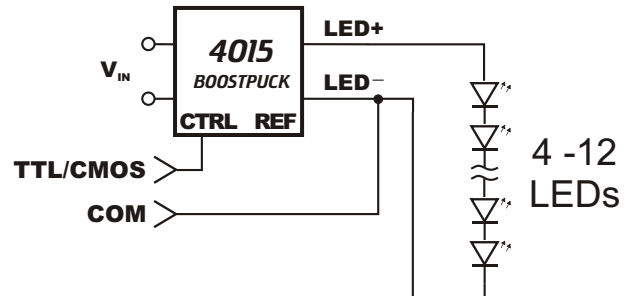
**Figure 7.**  
External potentiometer using external voltage source



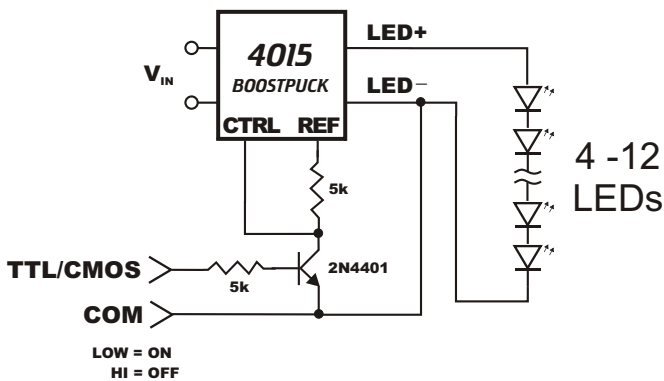
**Figure 8.**  
External dimming plus ON/OFF control with switch closure



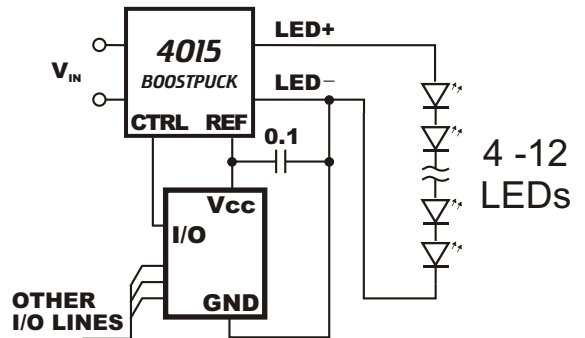
**Figure 9.**  
External dimming plus ON/OFF control with logic level input



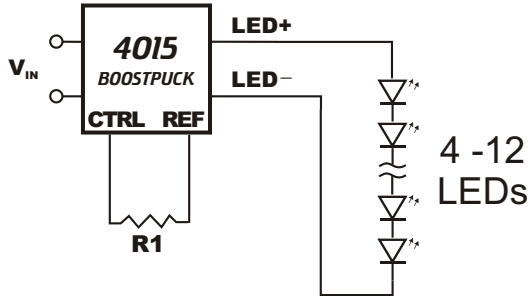
**Figure 10.**  
Pulse/Strobe input 5V=OFF



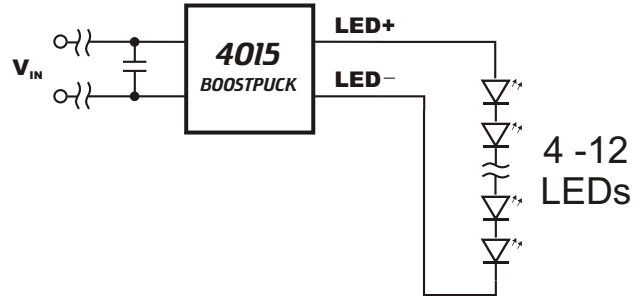
**Figure 11.**  
Pulse/Strobe input 5V=ON



**Figure 12.**  
Interface to PIC or other microcontroller

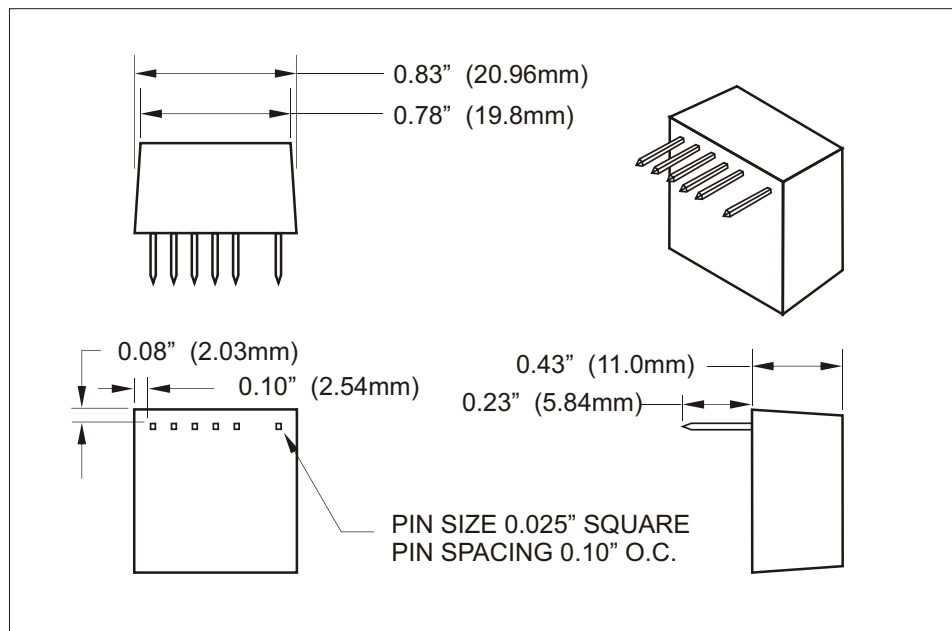


**Figure 13.**  
Using resistor for fixed current reduction  
Output is approximately:  $\%IOUT = R1/50$



**Figure 14.**  
Using a capacitor across the input terminals  
to increase performance when long leads are used

## Physical Dimensions



Shown approximately actual size