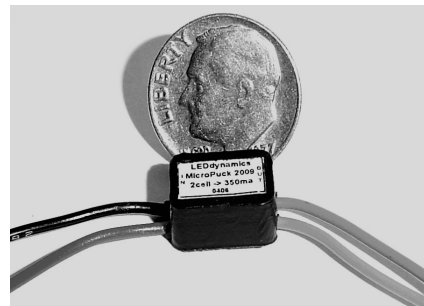# LuxDrive

LEDdynamics, Inc. 2009 Micro Puck
Application Note COM-DRV-2009-APP
"Additional Applications of the 2009"

Additional Applications of the 2009 "MicroPuck"

The LEDdynamics 2009 One Watt LED Driver Module is a inexpensive device originally designed to efficiently and safely drive a one Watt Luxeon[*1] emitter from one or two batteries. However, the 2009's elegantly simple design allows a great deal of flexibility in application. This document will illustrate a number of possible alternate configurations, including the ability to drive newly released high-power emitters such as Nichia's Jupiter* and the "Golden Dragon"* from Osram, in addition to a review of the standard one Watt Luxeon connection.

Inside this Application Note

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* Luxeon is a registered trademark of LumiLEDs Corp. Sirius and Jupiter are registered trademarks of Nichia Corp. "Golden Dragon" is a registered tradesymbol of OSRAM Opto Semiconductors GmbH.

2009 as a Boost Driver
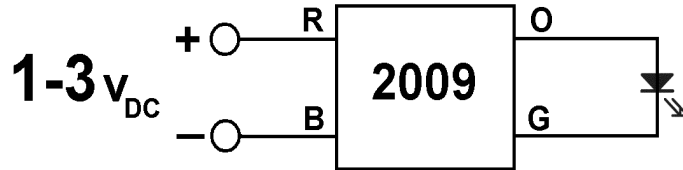
Figure 1. 2009 in its standard boost configuration driving a single junction InGaN(P) LED, one Watt or greater

NOTE:
LED(s) must *always* be connected whenever power is applied!

• **Applicable LED configurations**

15	Parallel 5mm LEDs @ 20mA ea.
1	1W Luxeon^{TM} LED
1	1W ISP High-Power LED

• **Suggested battery configurations**

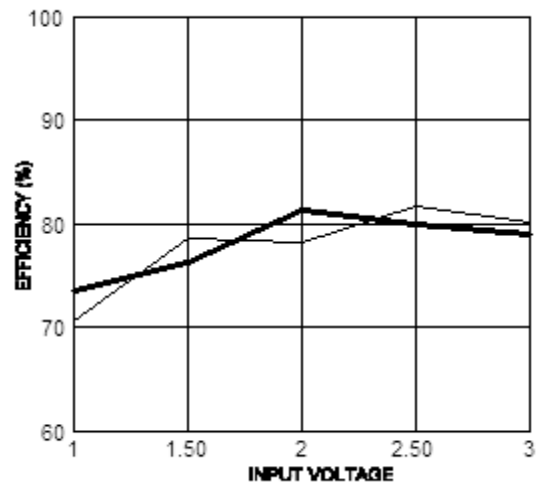|	
2	Alkaline cell(s)
1	Lithium 3V cell

• **Application examples**

1 or 2 cell flashlights/other portable lighting
Point of load conversion

Specification	Min	Max
Input Voltage	**1**	**3**
Output Voltage	**-**	**8**
LED Current	-	**500mA**
Efficiency	**70%** @1v	**85%** @2.5v
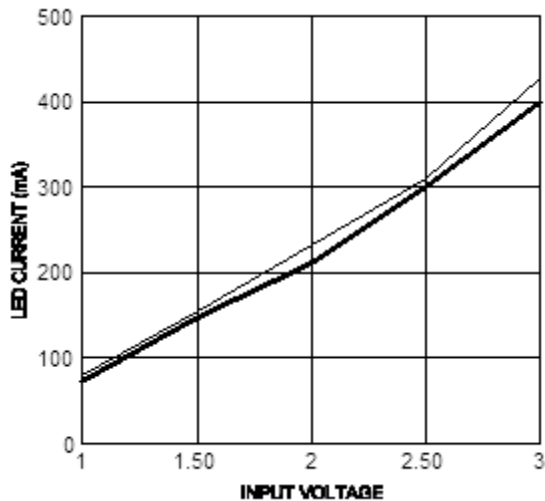
Figure 2. The 2009 driving 1W (thin line) and 3W (thick line) Luxeon emitters.

Figure 3. The 2009 driving 1W (thin line) and 3W (thick line) Luxeon emitters.

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2009 as a Buck Driver

• Applicable LED configuration:

15	Parallel 5mm LEDs @ 20mA ea.
24	Series/Parallel 2V LEDs @ 30mA ea
1	1W Luxeon^{TM} LED
1	1W ISP High-Power LED

• Suggested battery configurations

|	
4 or 5	Alkaline cells
4	NiHM, or NiCad cell(s)
2	Lithium 3V or 3.6V cell
1	6V Lantern Battery

• Application examples

3 to 5 cell flashlights
4 to 8 volt embedded bulb drivers
portable lighting
low voltage accent lighting
PC accent lighting (5v)
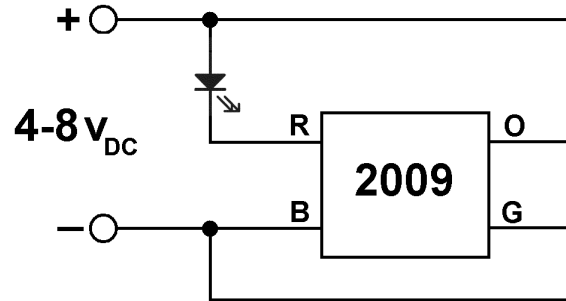
Figure 4. The 2009 configured as a buck converter. The load must be floating for this buck topology. The 2009 will not function with less than ~3.7 volts (LED V_f + 0.7) in this configuration.

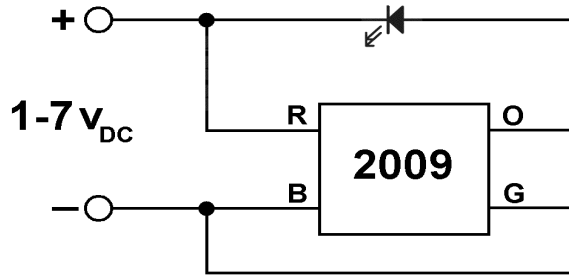| <u>Specification</u>	**Min**	**Max**
Input Voltage	**3.7**	**8**
LED Current	**-**	**500mA**
Efficiency	**82%** @7v	**90%** @4v
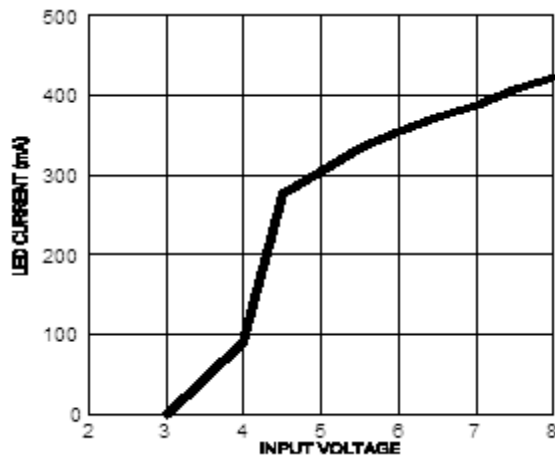
Figure 5. Operation is possible all the way up to 8 volts but the current quickly rises. Ideal 1W operation is at 6V, perfect for a four cell flashlight.
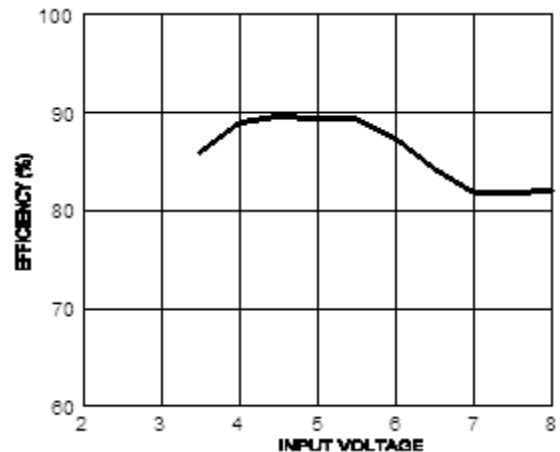
Figure 6. This figure demonstrates the inherent efficiency of a driver in buck mode. This topology is *12% more efficient* than the standard boost mode.

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2009 as a Buck/Boost Driver

Figure 7. 2009 configured in a novel buck/boost configuration. This topology boasts an extremely wide input voltage range that will continue to supply effective power as batteries become exhausted, but is 15% less efficient than boost.

• **Applicable LED configurations**

|	
15	Parallel 5mm LEDs @ 20mA
1	1W Luxeon™ LED
1	2W Nichia Jupiter™
1	1W ISP High-Power LED

• **Suggested battery configurations**

1 to 4	Alkaline cells
2	Lithium 3V or 3.6V cell
1	6V Lantern Battery

• **Application examples**

1 to 5 cell flashlights
6 volt embedded bulb drivers
low voltage accent lighting
portable lighting where completely exhausting batteries is desired

NOTE:
LED(s) must *always* be connected whenever power is applied!

Specification	Min	Max		Specification	Min	Max
Input Voltage	**1**	**7**		LED Current	-	**300mA**
Output Voltage	**-**	**10**		Efficiency	**65% @6v**	**72% @2v**
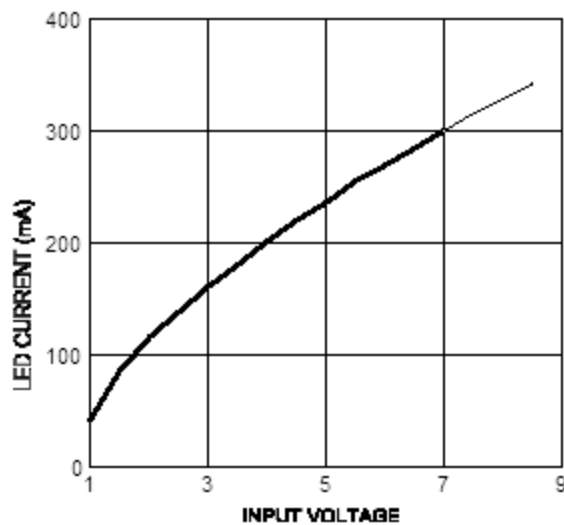
Figure 8. This circuit delivers substantial LED current from the maximum input of 7 volts all the way down to 1.5 volts!
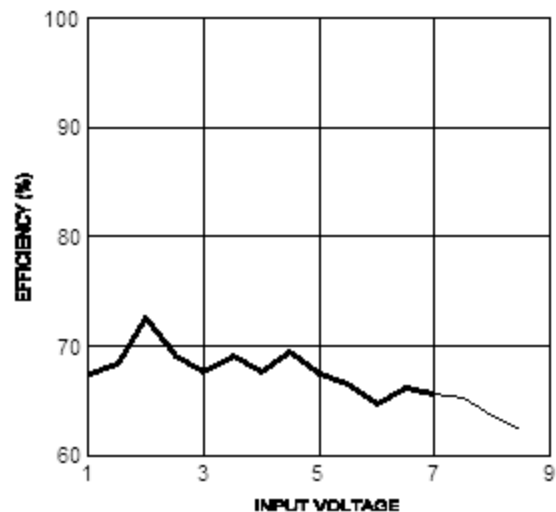
Figure 9. Efficiency is lower with this configuration than with buck or boost alone.

Two 2009s in Parallel, Boost

• **Applicable LED configurations**

1	5W Luxeon V™
1	3W Luxeon III™
1	3W Nichia Sirius™
2	2W Nichia Jupiter™
2-4	1W Luxeon™
2-4	1W ISP High-Power LED
30	5mm LEDs @ 20mA ea (parallel)

• **Suggested battery configurations**

1-3W	5W	
1-2	2-4	Alkaline standard cells
1	2	Lithium 3V cell(s)

• **Application examples**

Dual CR123 cell flashlight with Lux V emitter
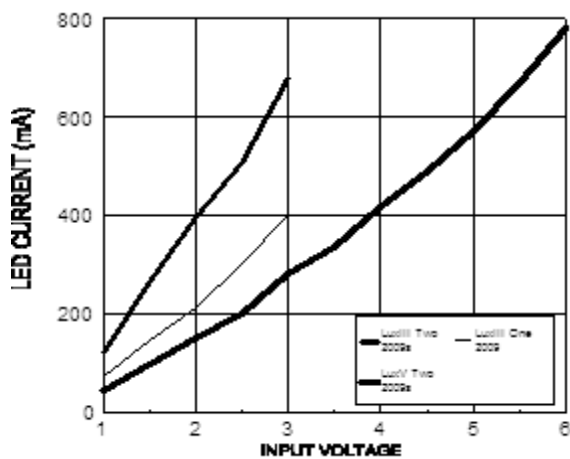Single CR123 cell flashlight with Lux III LED
1-4 cell flashlights

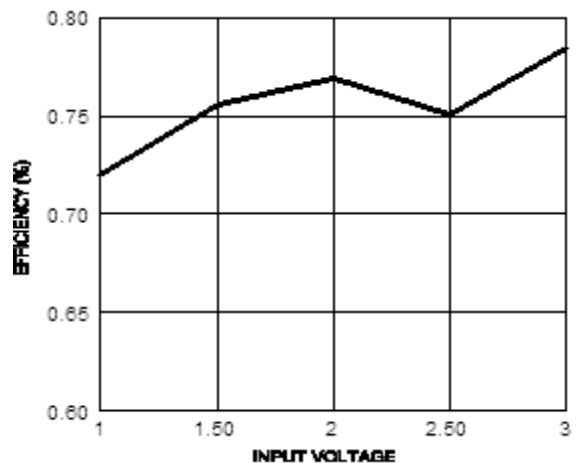> **NOTE:**:
> LED(s) must *always* be connected whenever power is applied!
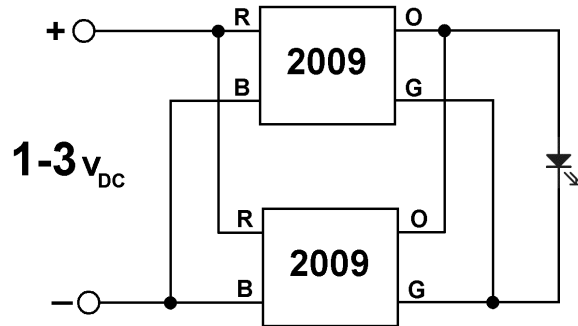
Figure 10. Two 2009s can be paralleled to nearly double LED current for a high-power emitter such as Luxeon III or V.

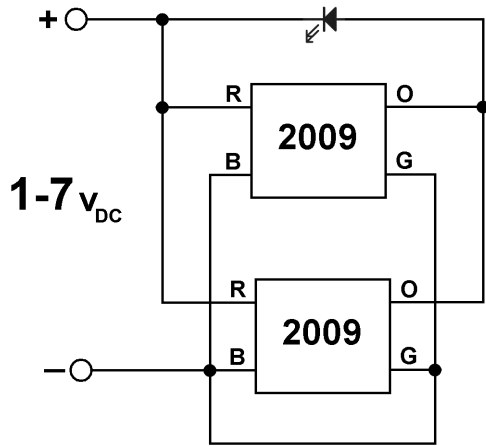| **Specification**	Min	Max
Input Voltage	**1**	**3**
Output Voltage	-	**8**
LED Current	-	**800mA**
Efficiency	**72%** 3W@1v	**78%** 3W@3v

Figure 11. Two 2009s driving a LuxIII and LuxV. A single 2009 driving a LuxIII is included for reference.

Figure 12. Two 2009s driving a Luxeon III emitter.

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Two 2009s in Parallel, Buck/Boost

1-7 v$_{DC}$

Figure 13. Two 2009s running buck/boost can be paralleled to nearly double LED current for a high-power emitter such as Luxeon III or Nichia Jupiter emitters. The second 2009 can be connected by switch to provide extra power only when necessary.

• **Applicable LED configurations**

|	
1	3W Luxeon III^{TM}
2	Nichia Jupiter^{TM}
1	Nichia Sirius^{TM}
2	1W Luxeon^{TM}
2	1W ISP High-Power LED
30	Parallel 5mm LEDs @ 20mA

• **Suggested battery configuration**s

1 to 4	Alkaline cells
2	Lithium 3V or 3.6V cell
1	6V Lantern Battery

• **Application examples**

1 to 5 cell flashlights
6 volt embedded bulb drivers
low voltage accent lighting
high power portable lighting

NOTE:
LED(s) must *always* be connected whenever power is applied!

Specification	Min	Max		Specification	Min	Max
Input Voltage	**1**	**7**		LED Current	-	**700mA**
Output Voltage	-	**10**		Efficiency	**65%** @7v	**72%** @2v
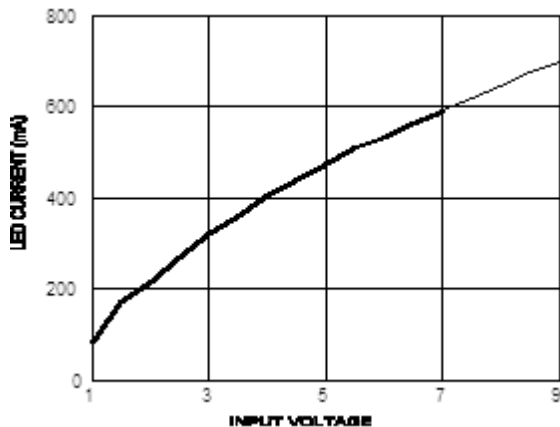
Figure 14. Two 2009s in parallel buck/boost running a LuxIII.
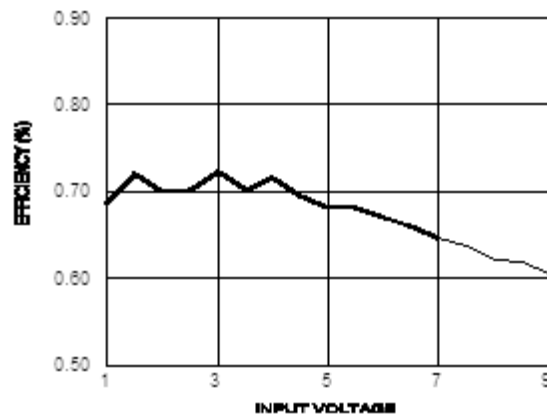
Figure 15. Two 2009's in parallel buck/boost running a LuxIII.

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