

Integrated Constant-Current Buck Regulators

National Semiconductor offers a broad portfolio of easy to design, energy-efficient buck regulators ideal for driving LEDs in a wide variety of applications. With integrated switching MOSFETs and online design tools as well as extensive protection features and dimming capability, National's buck LED drivers maximize ease of design without sacrificing functionality. National's LED drivers also feature low feedback voltages and very high efficiencies to enable energy-efficient lighting solutions.



Features ▶

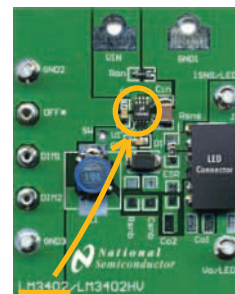
- Online design tools ease IC selection, enable design simulation, and offer orderable evaluation kits with custom BOMs
- Low external component counts
- Fast PWM dimming inputs
- Low (≤ 200 mV) feedback voltages
- Thermal, open-circuit, and short-circuit protection

Benefits ▶

- Design tools and integrated switches increase ease of design and time to market
- Low external component counts minimize BOM cost and total solution size
- Low feedback voltages, high efficiencies, and excellent package technologies maximize heat dissipation
- Wide input voltage ranges and high current capabilities increase design flexibility
- Supports all ceramic output capacitors and capacitor-less outputs for smallest solution size

Applications ▶

- General illumination
- Automotive lighting
- Industrial lighting
- Architectural lighting
- Signage



LM3402/02HV evaluation board with female 6-pin SIP connector and two standard 94 mil turret connectors for easy connection to LED array

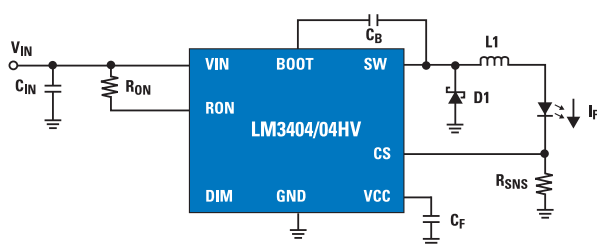
Product Specifications ▶

Part Number	Type	Dimming Type	Number of LEDs/String	Number of Strings	Configuration	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Peak Efficiency (%)	Diagnostic Capabilities*	Interface	Markets
LM3402	Buck	PWM	1-10	1	Series	6-42	40	500	90	Over-current protection/TSD/LOD	PWM	CL FL TR BL SI
LM3402HV		PWM	1-20	1	Series	6-75	70	500	90	Over-current protection/TSD/LOD	PWM	CL FL TR BL SI
LM3404		PWM	1-10	1	Series	6-42	40	1,000	90	Over-current protection/TSD/LOD	PWM	CL FL TR BL SI
LM3404HV		PWM	1-20	1	Series	6-75	70	1,000	90	Over-current protection/TSD/LOD	PWM	CL FL TR BL SI
LM3405		PWM	1-4	1	Series	3-15	14	1,000	90	Over-current protection/TSD/LOD/OVM/UVLO	PWM	CL FL TR BL SI
LM3405A		PWM	1-5	1	Series	3-22	20	1,000	90	Over-current protection/TSD/LOD/OVM/UVLO	PWM	CL FL TR BL SI
LM3407		PWM	1-7	1	Series	4.5-30	27	350	96	Over-current protection/TSD/LOD/UVLO	PWM	CL FL TR BL SI

MARKETS LEGEND

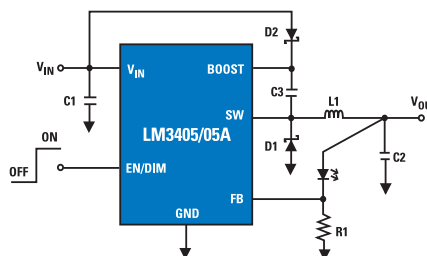
CL COMMERCIAL LIGHTING FL FLASHLIGHTS TR TRANSPORTATION BL BACKLIGHTING SI SIGNAGE

*Diagnostic capabilities: TSD: Thermal shutdown, OVM: Output voltage monitoring, UVLO: Under voltage lock out, LOD: LED open detection



LM3404/04HV schematic

The LM3404/04HV are constant-current buck regulators capable of up to 1A of output current. The LM3404HV can support up to fifteen 1W or 3W LEDs in series



LM3405/05A schematic

The LM3405/05A are 1A constant-current buck regulators designed to provide simple, high-efficiency solutions for driving high-power LEDs. These devices feature a low 205 mV feedback voltage to reduce heat dissipation, and can support up to five 1W or 3W LEDs in series

LED Reference Designs



National's power reference design library provides a comprehensive library of practical reference designs to speed system design and time-to-market.

LED WEBENCH® Online Tool



Design a power supply for 1 to 60 LEDs instantly! Select, optimize, and simulate your LED driver in this FREE online design and prototyping environment.

Visit lighting.arrow.com/designtools to access free design tools, including National's LED reference designs and LED WEBENCH online tools.

Arrow Electronics Lighting Group

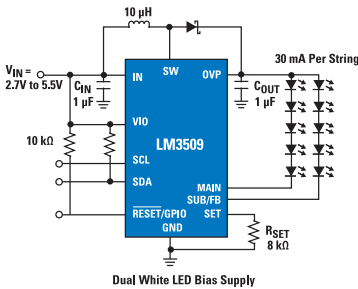
1.888.9LIGHT1

<http://lighting.arrow.com>



Constant-Current Boost Regulators

National's portfolio of constant-current boost regulators features inductive and switched-capacitor solutions for applications such as backlighting, flash, and portable lighting. For higher currents, National has a variety of high-efficiency inductive-boost LED drivers. National's switched-capacitor LED drivers offer small, inductor-less, low-noise solutions for both parallel and series LED configurations. Features such as multiple dimming interfaces and current matching can also be found in inductive and switched capacitor drivers.



The LM3509 is a high-efficiency boost converter for white LEDs and/or OLED displays with dual-current sinks and I²C-compatible brightness control. This LED driver is ideal for small-to medium-sized displays in battery-powered applications.

Features ▶

- PWM, analog, and I²C dimming interfaces
- Built-in current matching
- Adjustable and fixed switching frequency options
- Thermal shutdown, flash timeout, open-circuit, and short-circuit protection
- Supports OLED displays

Benefits ▶

- Multiple dimming interfaces increases design flexibility
- Current matching ensures parallel LED arrays have even, balanced brightness
- Various switching frequency options allow for solution size, efficiency, and EMI optimization
- Micro SMD and leadless LLP packages provide very small footprints and minimize solution size

Applications ▶

- Backlighting
- Flash LED
- Portable lighting (handheld devices, flashlights)
- Automotive lighting

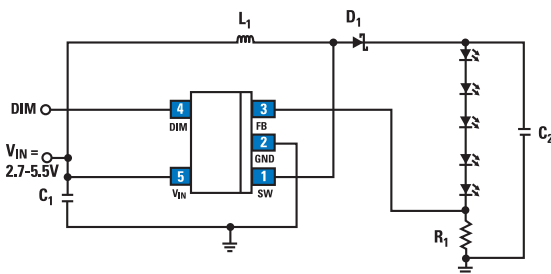
Product Specifications ▶

Part Number	Type	Dimming Type	Number of LEDs/String	Number of Strings	Configuration	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Peak Efficiency (%)	Diagnostic Capabilities*	Interface	Markets
LM3410	Boost, SEPIC	PWM	1-6	1	Series	2.7-5.5	24	1,000	88	Over-current protection/TSD/LOD	PWM	CL FL BL SI
LM3430/32	Boost	PWM/analog	1-20	6	Series/parallel	6-40	80	40 per string	92	Over-current protection/TSD/LOD/UVLO	PWM/analog	CL TR BL SI
LM3431		PWM/analog	1-10	3	Series/parallel	5-36	40	150 per string	88	Over-current protection/TSD/OVM/LOD	PWM/analog	CL TR BL SI
LM3509		I ² C	1-5	2	Series/parallel/OLED	2.7-5.5	21	30 per string	92	TSD/soft start	I ² C	CL TR BL SI
LM2756		I ² C	1	8	Parallel	2.7-5.5	4.6	180	91	TSD/OVP/soft start	I ² C	BL
LM2757		NA	1-10	NA	NA	2.7-5.5	4.1/4.5/5	180	92	Over-current protection/TSD/shutdown w/high impedance/soft start	Binary	BL
LM3553		NA	1-2	1	Series	2.7-5.5	19	1,200	90	TSD/OVM/Flash pulse safety timer	I ² C	BL
LM4510		NA	NA	NA	Series/parallel/OLED	2.7-5.5	18	280	85	TSD/output short-circuit protection/feed-back fault protection/input UVLO/soft start/true shutdown isolation	Binary	FL
LM2755		I ² C	1	3	Parallel	3-5.5	5	90	90	TSD/soft start	I ² C	BL
LM5022	Boost, SEPIC, flyback	PWM	1-20	1	Series	6-60	80	1,000	95	Over-current protection/TSD/LOD/UVLO	PWM	BL

MARKETS LEGEND

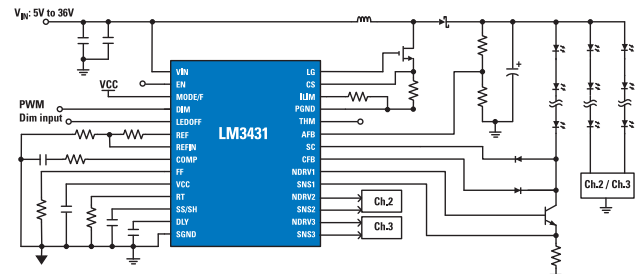
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*Diagnostic capabilities: TSD: Thermal shutdown, UVLO: Under voltage lock out, LOD: LED open detection



LM3410 schematic

The LM3410 is a high-frequency, very small, constant-current boost LED driver. A low external component count makes this driver easy to design and minimizes the total solution size and cost. The LM3410 has an input voltage range down to 2.7V to support single Li-Ion cells



LM3431 schematic

The LM3431 is a 3-channel linear current controller combined with a boost-switching controller ideal for driving LED backlight panels in space-critical applications. It accepts both analog and digital control signals and can achieve contrast ratios greater than 1,000:1

High-Current LED Drivers

National offers buck and boost regulators that can drive up to and greater than 6A, ideal for applications such as backlighting and projection. For example, the LM3433 supports over 6A of current and allows the LED anodes to be tied directly to the chassis ground for optimal heat dissipation. Also, National's LM3401 buck regulator is capable of achieving 100 percent duty cycle in order to support a maximum number of LEDs.



Features ▶

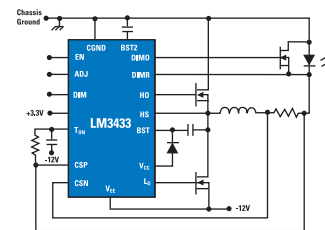
- PWM and analog dimming interfaces
- Capable of achieving up to 100% duty cycles
- Common-anode configuration allows LED anodes to be tied directly to chassis ground
- Adjustable switching frequencies up to 2 MHz
- Supports high-current applications with buck, boost, SEPIC, and flyback solutions

Benefits ▶

- Common-anode configuration maximizes heat dissipation and reduces heat sink requirements
- High duty cycles allow maximum number of LEDs to be powered by a single LED driver to shrink solution size and cost
- Multiple dimming interfaces provide design flexibility
- Adjustable switching frequency options allow for solution size, efficiency, and EMI optimization

Applications ▶

- Backlighting
- Projection
- Automotive lighting
- Industrial lighting
- General illumination



The LM3433 is an adaptive, constant, on-time buck controller designed to provide constant current for illuminating high-power LEDs. It can drive currents greater than 6A and supports a thermal, performance-enhancing common-anode LED configuration

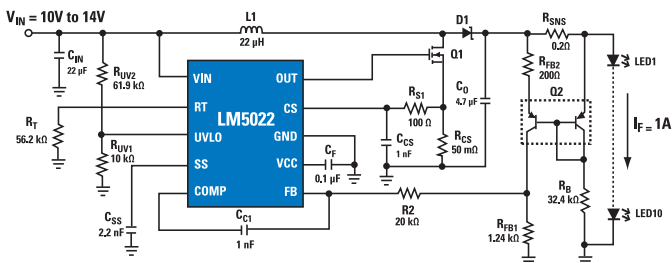
Product Specifications ▶

Part Number	Type	Dimming Type	Number of LEDs/String	Number of Strings	Configuration	Input Voltage (VDC)	Output Voltage (VDC)	Output Current (mA)	Peak Efficiency (%)	Diagnostic Capabilities*	Interface	Markets
LM3433	Buck	PWM/analog	1	1	Series	-9 to -14	-6	>6,000	96	TSD/LOD	PWM/analog	CL TR BL SI
LM3401		PWM	1-9	1	Series	4.5 to 35	35	>3,000	95	TSD/LOD	PWM	CL FL TR SI
LM5022	Boost, SEPIC, flyback	PWM	1-20	1	Series	6 to 60	80	>1,000	95	TSD/LOD	PWM	CL TR BL SI

MARKETS LEGEND

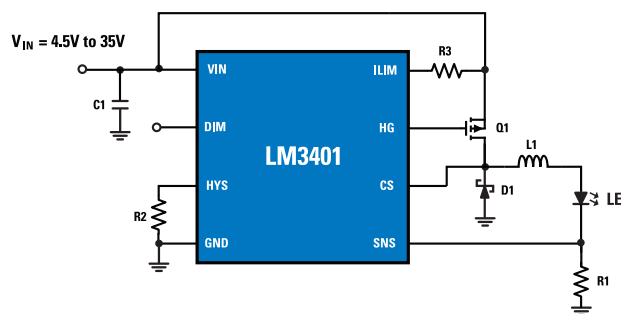
CL COMMERCIAL LIGHTING FL FLASHLIGHTS TR TRANSPORTATION BL BACKLIGHTING SI SIGNAGE

*Diagnostic capabilities: TSD: Thermal shutdown, LOD: LED open detection



LM5022 schematic

The LM5022 is a high voltage controller that supports boost, SEPIC, and flyback configurations. Output current regulation is based on current-mode control, which eases the design of loop compensation while providing inherent input voltage feed-forward



LM3401 schematic

The LM3401 is a buck-switching controller with an external P-MOSFET switch, which allows the device to run at 100% duty cycle and continue to drive a string of LEDs when the total forward voltage drop is equal to V_{IN} . Adjustable, dual-side hysteresis allows very flexible inductor selection, switching frequency customization, and reduced propagation delay error