30V/1.5A High Brightness Step-Down LED Driver

Description

The NDP3315SG is a high-efficiency step-down LED driver controller with a wide input voltage range of 6V to 30V.

The NDP3315SG employs a continuous conduction mode architecture that accurately regulates LED current with a feedback coming from an external current-sense resistor. This control scheme optimizes circuit stabilization and fast response time without loop compensation. Its low 100mV/200mV average feedback voltage reduces power loss and improves the converter's efficiency.

The NDP3315SG implements PWM and analog dimming together through the DIM pin.

The NDP3315SG also Includes thermal regulation protection in case of output overload.

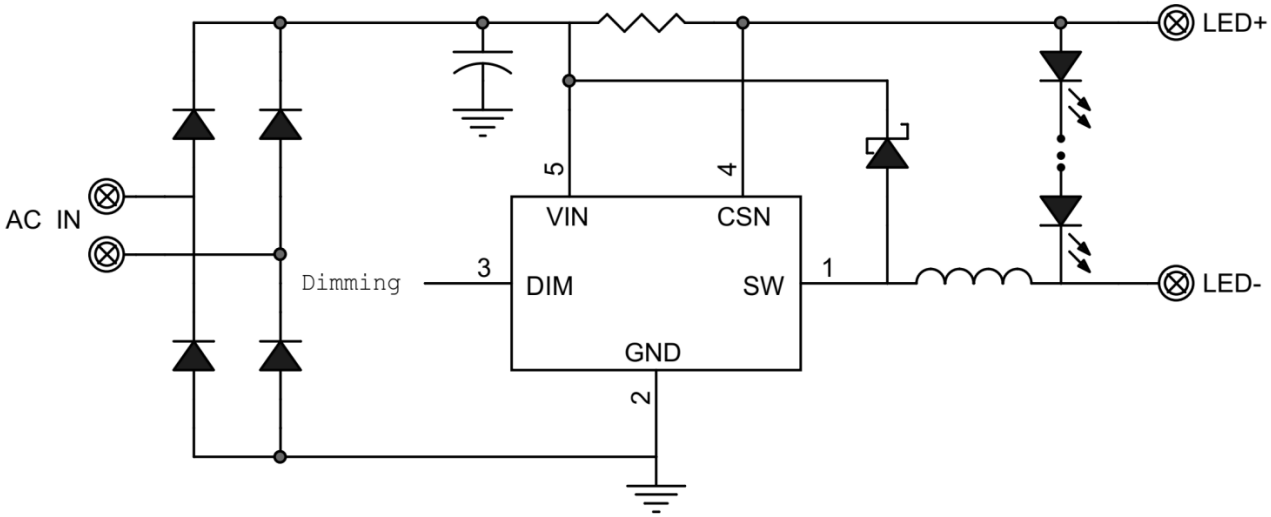
Features

- VIN Range : 6V to 30V
- Able to Drive <1.5A LED Load
- Output Current Accuracy : ±3%
- Up to 1MHz Switching Frequency
- High Efficiency
- Feedback Voltage: 100mV/200mV
- Analog and PWM Dimming
- Open LED Protection
- No Need Compensation
- Thermal Regulation
- RoHS and Halogen Free Compliance.
- Available in SOT89-5 Package

Applications

- Low Voltage Halogen Replacement
- DC/DC or AC/DC LED Driver Application
- Automotive/Decorative LED Lighting
- Emergency Lighting
- LED Backlighting

Typical Application



Order Information

Orderable Device	Feedback Voltage Version	Package Type	Packing Qty/reel	MSL- Peak Temp -Floor Life	Eco Std	Marking Information
NDP3315SG	100mV	SOT89-5	1000	MSL3-260℃-168hrs	RoHS & Green	1-FYYWWX
NDP3315SG	200mV	SOT89-5	1000	MSL3-260℃-168hrs	RoHS & Green	2-FYYWWX

Product Naming

NDP3315 SG

Package
SG: SOT89-5

Product Number

Top Side Marking

K: FB Voltage ID Code(1=100mV,2=200mV)
F: Internal ID Code
YY: Year (23=2023,24=2024,…)
WW: Weekly (01-53)
X : Internal ID Code

Notes:

(1) **RoHS**: Quoted from **RoHS Detective (EU) 2015/863**, Deep-Pool defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. Deep-Pool may reference these types of products as "**Pb-Free**".

(2) **RoHS Exempt:** Deep-Pool defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

(3) **Green**: Deep-Pool defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JEDEC (**JS709C**) low halogen requirements of <=1000ppm threshold.

(4) **MSL**, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC (**J-STD-020F**) industry standard classifications, as well as the peak solder temperature of SMT and the floor life after unpacking, which customers should pay attention and strictly comply with the standard to use.

(5) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

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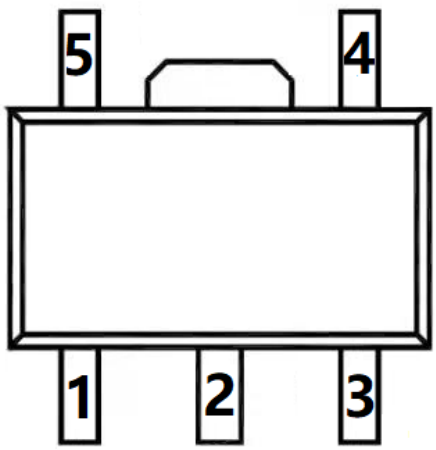
Pin Function and Definition

PIN	Name	Description
1	SW	Drain of the Internal NMOS
2	GND	Ground
3	DIM	PWM/Analog Diming Input. Internal Week Pull Up. Drive DIM Low to Turn Off the Output
4	CSN	Connect Sensor Input Reference to VIN for Measure Output Current.
5	VIN	Power Input



Absolute Maximum Ratings (at T_A= 25°C)

Characteristics	Symbol	Rating	Unit
VIN,CSN to GND		-0.3 to 36	V
SW to GND		-0.3 to VIN+0.3	V
DIM to GND		-0.3 to +6.5	V
Operating Junction Temperature	T_A	-40 to 150	°C
Storage Junction Temperature	Tstg	-65 to 150	°C

Notes:

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

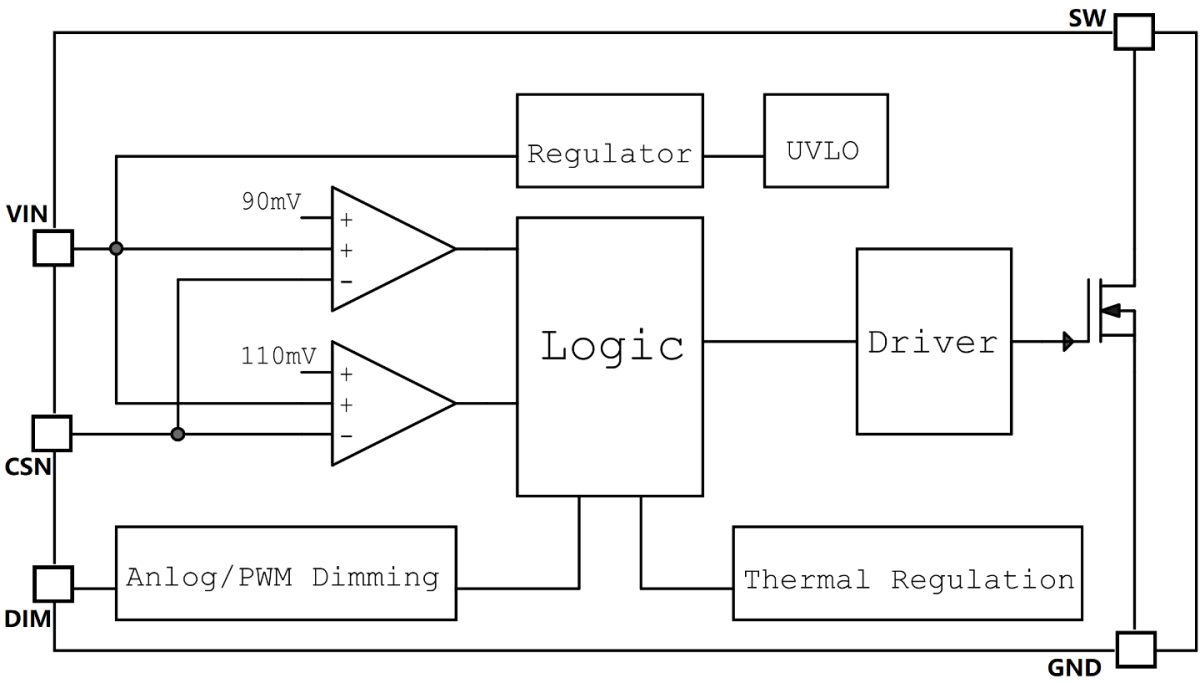
RECOMMENDED OPERATING RANGE				
ELECTRICAL PARAMETER	MINIMUM	TYPICAL	MAXIMUM	UNIT
Input Voltage (V_{IN})	8		24	V
Output Voltage (V_{OUT})	3		18	V
Output Current (I_{OUT})			1.5	A
Thermal Resistance from Junction to ambient (θ_{JA})		45		°C/W

Electrical Characteristics

TJ = 25℃ , V_{IN} = 12V , unless otherwise noted.

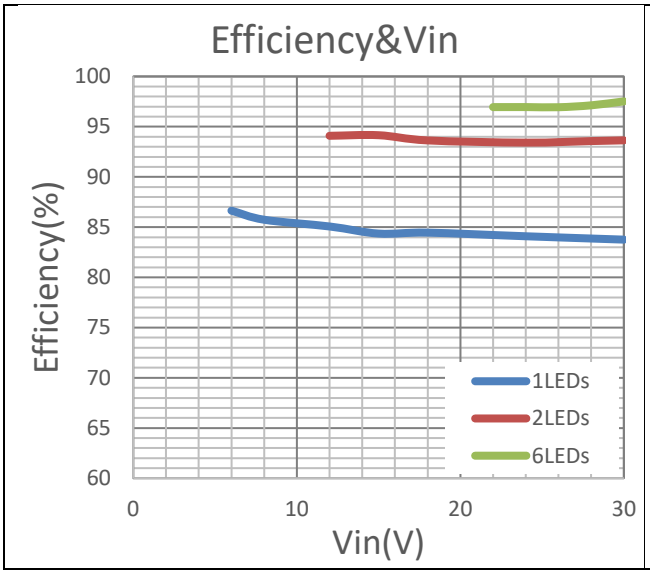
Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage	V_{IN}		6		30	V
VCC UVLO Threshold	V_{UVLOTH}	VCC Rising		5.6		V
VCC UVLO Hysteresis	$V_{UVLOHYS}$			0.4		V
Quiescent Supply Current	IQ	No Switching		270		uA
Current Sense Voltage	V_{CS}	VIN-CSN(1-FYYWWX)		100		mV
		VIN-CSN(2-FYYWWX)		200		mV
Current Sense Threshold	V_{CS_HY}			15		%
CSN Input Current	I_{CSN}			3		uA
DIM Floating Voltage	V_{DIM_F}			3.8		V
DIM Input Leakage Current	I_{DIM_PU}	IDIM=5V		27		uA
DIM Pull Up Current	I_{DIM_PU}	IDIM=0V		-25		uA
DIM Input High	V_{DIM_H}		2.5			V
DIM Input Low	V_{DIM_L}				0.3	V
DIM Voltage Range	V_{DIM}	VDIM Rising	0.5		2.5	V
Min Recommended Pwm dimming Frequency	F_{PWMmin}			0.1		kHz
Max Recommended Pwm Dimming Frequency	F_{PWMmax}			20		kHz
Maxmum Switch Frequency	F_{MAX}			1		MHz
MOSFET ON Resistance	R_{DSON}			240		mΩ
Thermal Regulate	T_{REG}	Temp Rising		105		℃
Thermal Shutdown	T_{SH}		-	160	-	℃

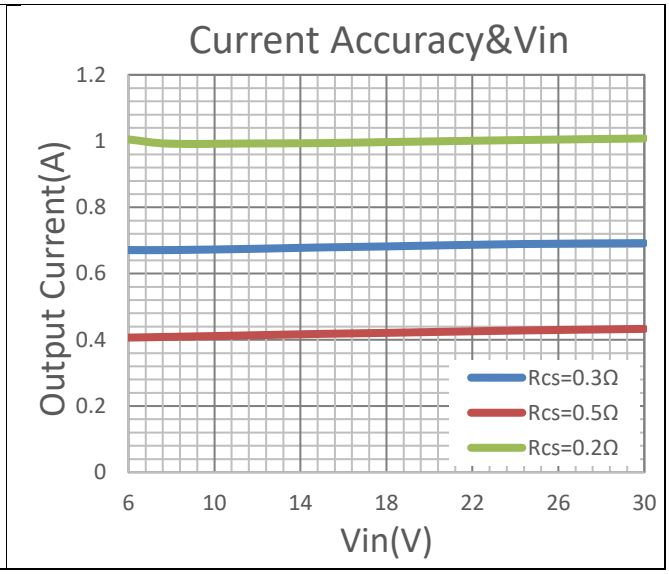
Block Diagram



Typical Performance Characteristics

TJ = 25°C , V_{IN} = 12V , unless otherwise noted.

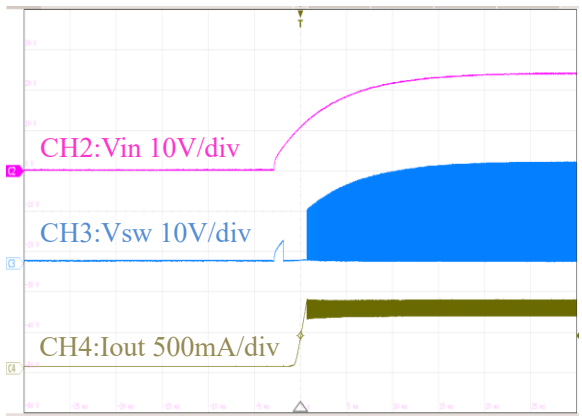




CH1=V_{IN} , CH2=V_{SW} , CH3=V_{OUT} , CH4=I_{SW} , unless otherwise noted.

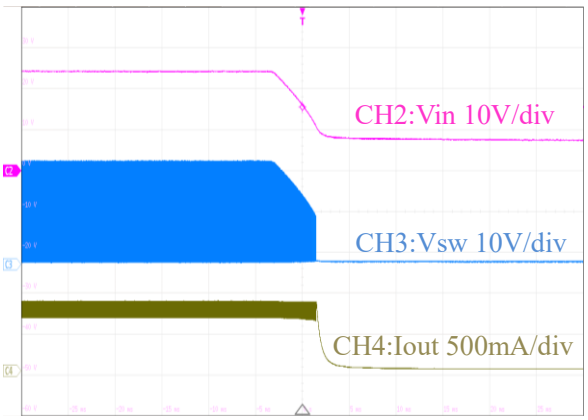
Power ON

V_{IN}=24V, L=33uH, 4LEDs

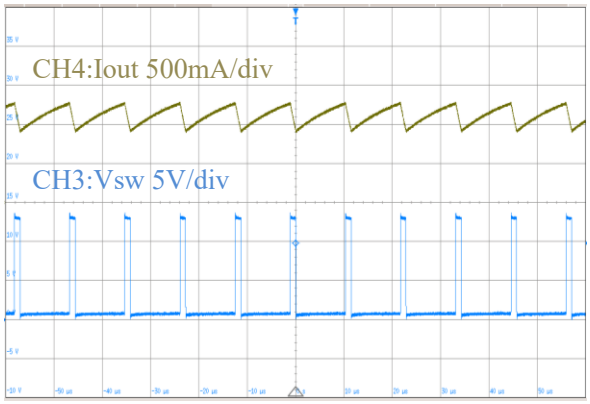


Power OFF

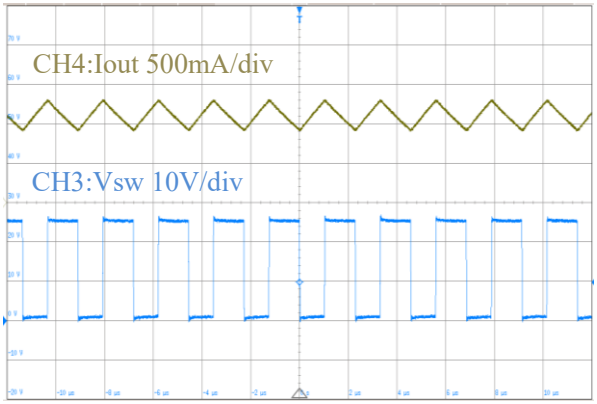
V_{IN}=24V, L=33uH, 4LEDs



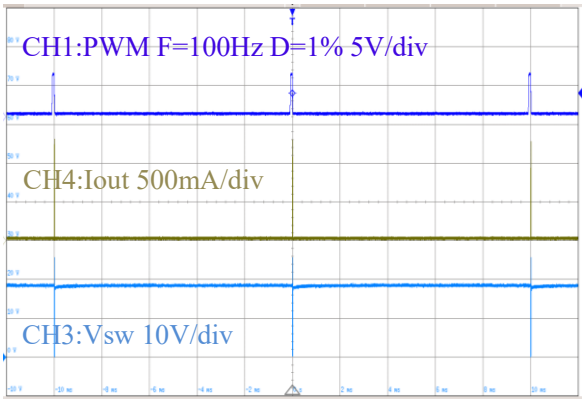
Operation waveform
Vin=12V, L=33uH, 4LEDs



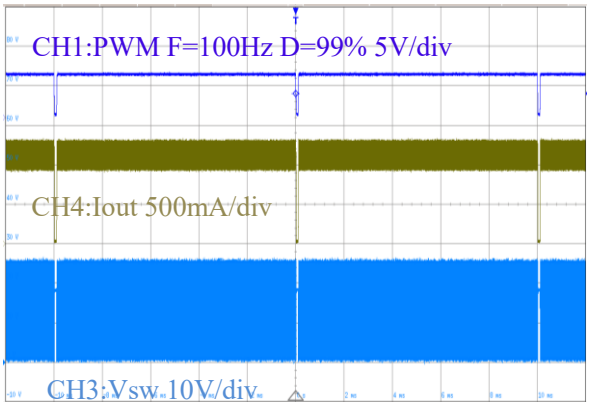
Operation waveform
Vin=24V, L=33uH, 4LEDs



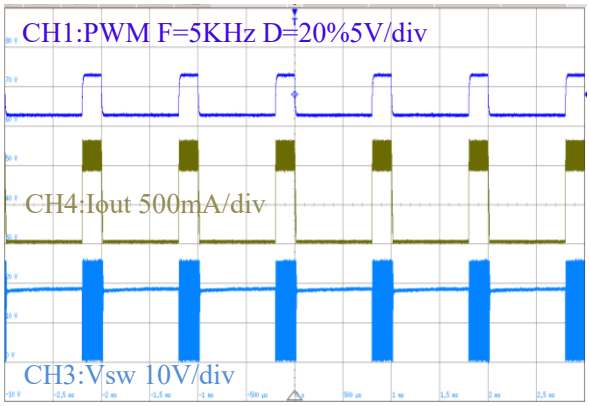
PWM Dimming
Vin=24V, L=33uH, Iout=1A, 4LEDs



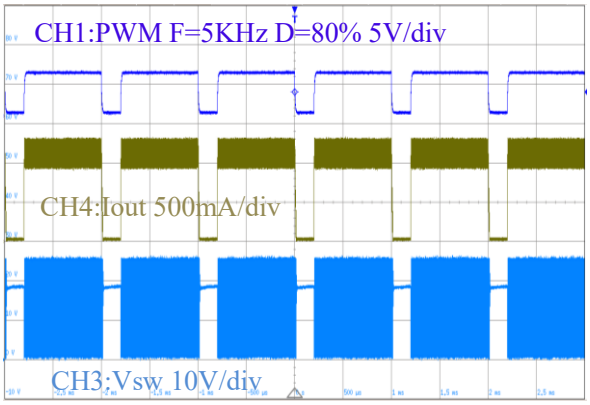
PWM Dimming
Vin=24V, L=33uH, Iout=1A, 4LEDs



PWM Dimming
Vin=24V, L=33uH, Iout=1A, 4LEDs



PWM Dimming
Vin=24V, L=33uH, Iout=1A, 4LEDs



Operational Description

Steady State

The NDP3315SG is a step-down LED-current convertor that is easily configured for a wide input that ranges from 6V to 30V input. The NDP3315SG uses a High-side current-sense resistor to detect and regulate LED current. The average voltage across the current- sense resistor is measured and regulated in the 100mV/200mV range.

Dimming Control

The NDP3315SG allows the DIM pin to control both Analog and PWM dimming. Whenever the voltage on DIM is less than 0.3V, the chip turns off. For analog dimming the LED current will change from 0% to 100% of the maximum LED current according to the DIM voltage of 0.5V to 2.5V. If the voltage on DIM pin is higher than 2.5V, output LED current will equal the maximum LED current. For PWM dimming, the signal amplitude must exceed 2.5V. Choose a PWM frequency in range of 100Hz to 20kHz for good dimming linearity.

Applications Information

Setting the LED Current

The LED current is identical and set by the current sense resistor CS and GND.

RSENSE=100mV/ILED

RSENSE=200mV/ILED

For RSENSE=0.2Ω, the LED current is set to 1A Selecting the Inductor Lower value of inductance can result in a higher switching frequency, which causes a larger switching loss. Choose a switch frequency between 100kHz to 500kHz for most application. According to switching frequency, inductor value can be estimated as:

$$L = \frac{(1-\frac{V_{OUT}}{V_{IN}}) \times V_{OUT}}{0.3 \times I_{LED} \times f_{SW}}$$

For higher efficiency, choose an inductor with a DC resistance as small as possible.

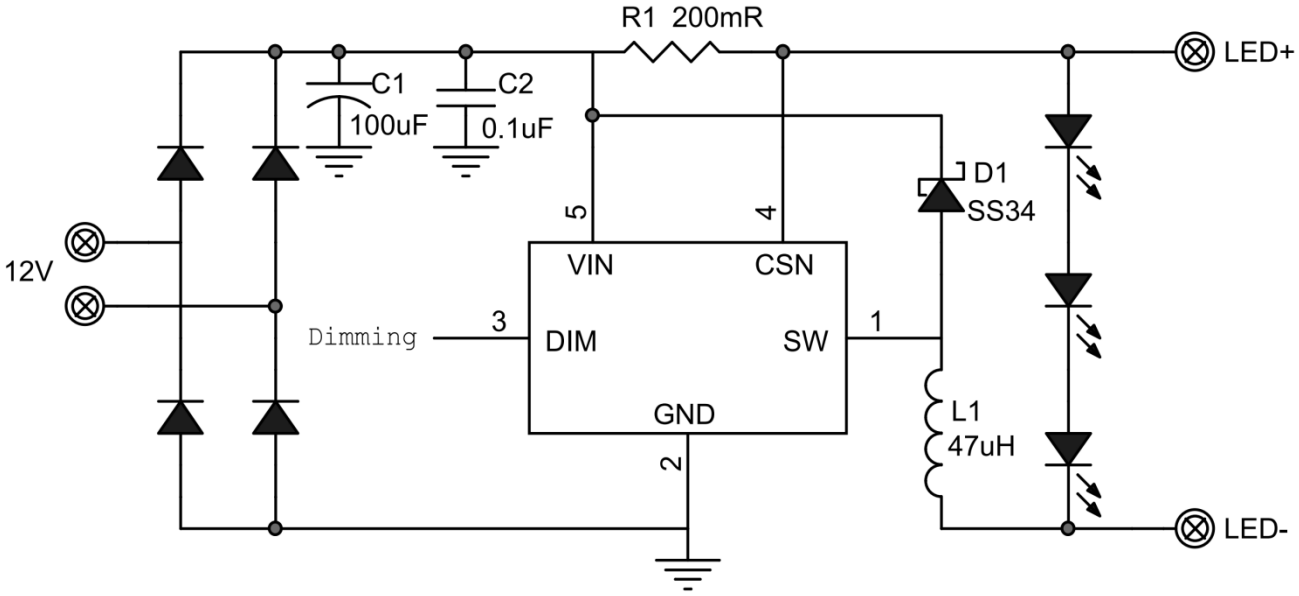
Selecting the Input Capacitor

The input capacitor reduces the surge current drawn from the input supply and the switching noise from the device. Choose a capacitor value of 100μF for most applications. The voltage rating should be greater than the input voltage. Use a low ESR capacitor for input decoupling.

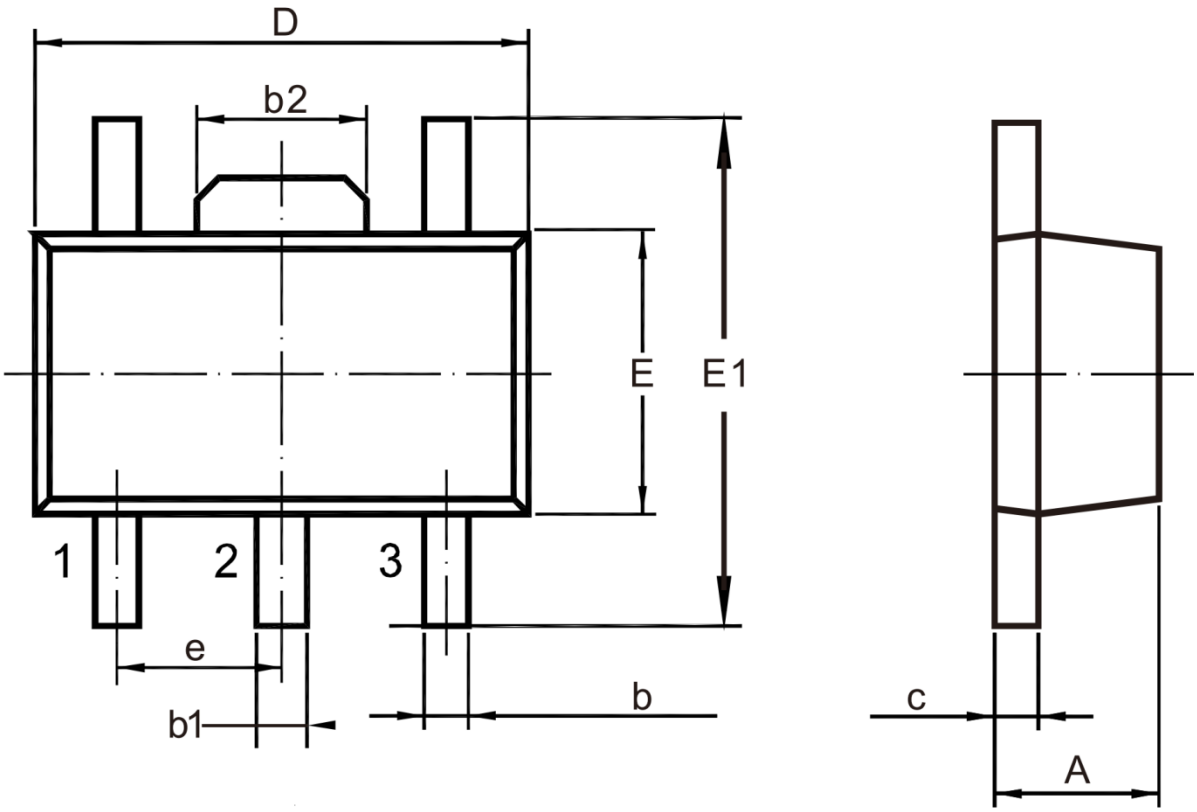
Layout Consideration

Pay careful attention to the PCB layout and component placement. R1 should be placed close to the VIN pin and CSN pin in order to minimize current sense error. The input loop—including input capacitor, Schottky diode, and MOSFET—should be as short as possible.

Typical Applications



Package Outline Drawing



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	1.4	1.6
b	0.35	0.45
b1	0.47	0.53
b2	1.5	1.6
c	0.3	0.5
D	4.4	4.6
E	2.4	2.6
E1	4.3	4.7
e	1.5 (BSC)	

Notes

1. Use millimeters as the primary measurement
2. Dimensioning and tolerances conform to ASME Y14.5M. – 1994
3. These dimensions do not include mold flash or protrusions.
4. Mold flash or protrusions shall not exceed 0.15mm

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