



## 100V High Efficiency Step-Down LED Driver

### Description

The NDP3812KC is a high-efficiency step-down LED driver controller with a wide input voltage range of 7V to 100V.

The NDP3812KC employs a constant off-time 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 280mV average feedback voltage reduces power loss and improves the converter's efficiency.

The NDP3812KC implements Full / Half brightness with the mode pin.

The NDP3812KC also includes thermal overload protection in case of output overload.

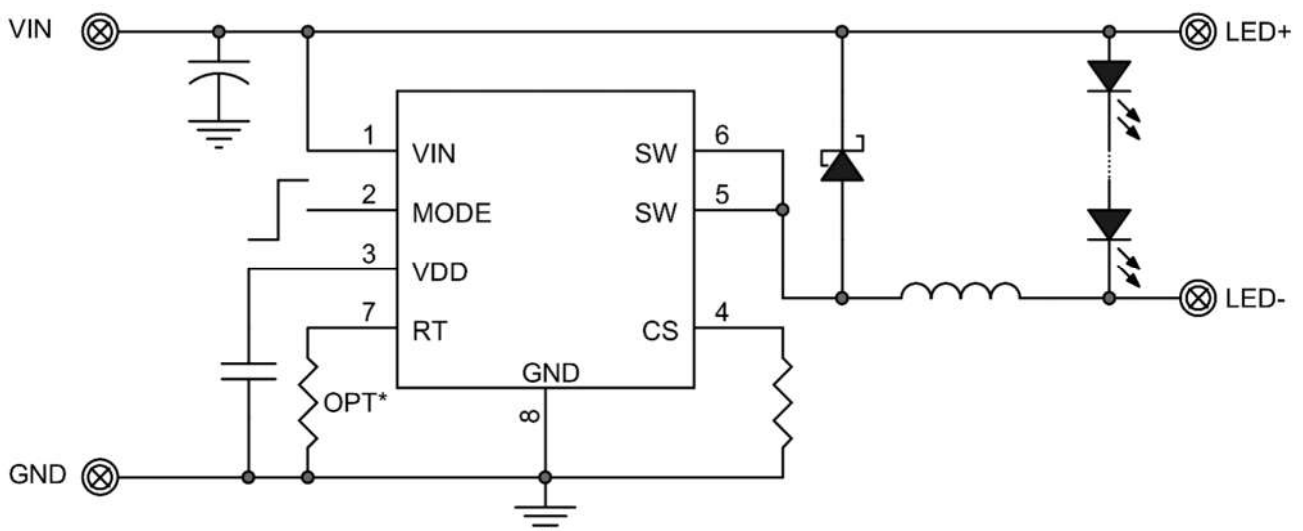
### Features

- Wide 7V to 100V Input Range
- Able to Drive <1.2A LED Load
- Constant Off-time Control
- High Efficiency
- Full / Half brightness control
- Open LED Protection
- Short LED Protection
- Thermal Shutdown
- RoHS and Halogen free compliance.
- Available in SOP8 Package

### Applications

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

### Typical Application



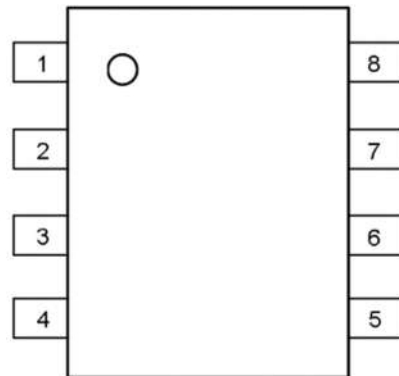


## Absolute Maximum Ratings (at TA = 25°C)

Characteristics	Symbol	Rating	Unit
VIN to GND		-0.3 to 105	V
CS to GND		0.3 to +7	V
VCC to GND		-0.3 to +7	
MODE to GND		-0.3 to +7	V
Junction to Ambient Thermal Resistance	R <sub>θJA</sub>	90	°C/W
Junction to board thermal resistance	R <sub>θJB</sub>	60	°C/W
Junction to case thermal resistance	R <sub>θJC</sub>	42	°C/W

## Pin Function And Descriptions

PIN	Name	Description
1	VIN	Power Input
2	MODE	Full / Half brightness control
3	VDD	Internal Power Supply
4	CS	Connect sensor resistor to GND for measure FET on current.
5.6	SW	Power switch
7	RT	a resistor Connect to GND for Off-time Setting,
8	GND	Ground



## Order information

Order Information	Top Marking
<p>NDP3812 KC</p> <p>Pin NO. C:8 Package K: SOP Product Number</p>	<p>PN : Part NO Y : Year (0=2020,A=2021,...) WW: Weekly (01-53) D/X: internal code</p>

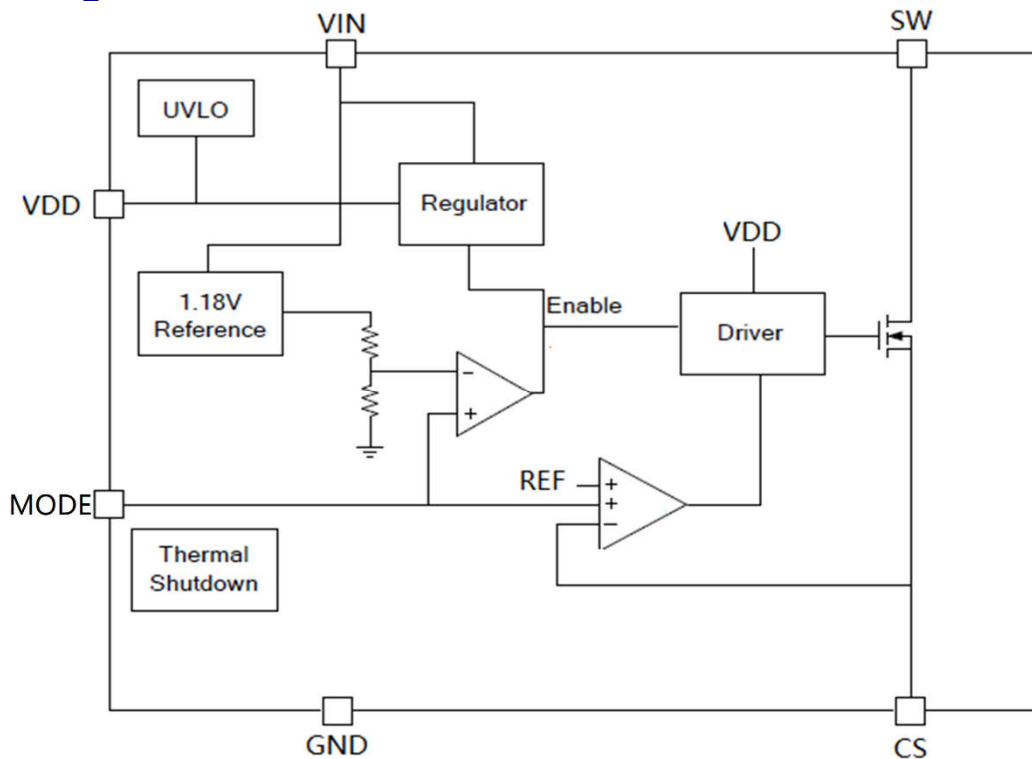


## Electrical Characteristics

T<sub>J</sub> = 25°C. V<sub>IN</sub> = 12V, unless otherwise noted

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Input voltage	V <sub>IN</sub>		7		100	V
VCC UVLO threshold	V <sub>UVLOTH</sub>	VCC Rising		6.5		V
VCC UVLO hysteresis	V <sub>UVLOHYS</sub>			0.4		V
Quiescent supply current	I <sub>Q</sub>	No Switching		0.4	0.5	mA
VCC voltage	V <sub>CC</sub>	MODE= 3.5V		5.7	6.5	V
Average current sense	V <sub>CS</sub>	MODE= 0V	270	280	290	mV
MODE input high	V <sub>HMODE</sub>	V <sub>MODE</sub> Rising	1.5		6.5	V
Minimum off time	T <sub>OFF_MIN</sub>			0.6		μs
Maximum off time	T <sub>OFF_MAX</sub>			50		μs
Short circuit hiccup time	T <sub>HICCUP</sub>			500		ms
MOSFET breakdown	BV <sub>DSS</sub>		100			V
MOSFET ON resistance	R <sub>DSON</sub>			420		mΩ
Thermal shutdown threshold		Temp Rising		150		°C
Thermal Shutdown Hysteresis	T <sub>SH</sub>		-	30	-	°C

## Block Diagram





## Operation

### Steady State

The NDP3812KC is a step-down LED-current controller with a constant off-time control that is easily configured for a wide input that ranges from 7V to 100V input. The NDP3812KC uses a Low-side current-sense resistor to detect and regulate LED current. The peak voltage across the current-sense resistor is measured and regulated in the 280mV±10mV range.

### MODE Control

The NDP3812KC allows the MODE pin to select full or half brightness. Low input of MODE pin set the output Average current to full range ( $I_{LED}=280\text{mV}/R_{sense}$ ) and high input of MODE pin set the output Average current to half ( $I_{LED}=140\text{mV}/R_{sense}$ )

## Applications Information

### Setting the LED Current

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

$$R_{SENSE}=280\text{mV}/I_{LED}$$

For  $R_{SENSE}=0.3\Omega$ , the LED current is set to 0.93A. 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 300kHz 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.

### Setting Switching Frequency

Connect a resistor between RT and GND pin to set the MOSFET turn off time, and the working frequency is auto adjusted by the system, for most applications it is recommended let RT floating.

### 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 between 10μF and 100μF for most applications. The voltage rating should be greater than the input voltage. Use a low ESR capacitor for input decoupling.

### Selecting the Output Capacitor

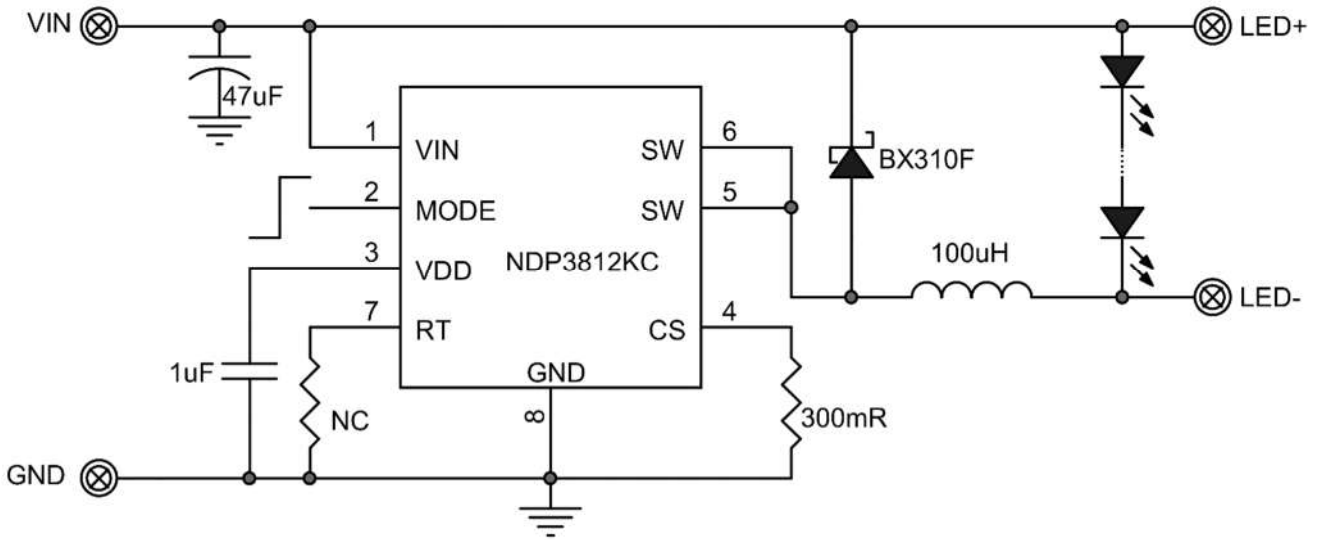
For applications that require that the peak-to-peak LED ripple current falls below 30% of the average current, add a capacitor across the LEDs. Higher capacitor values will result in proportionally lower ripple. A value of 47μF will meet most requirements.

### Layout Consideration

Pay careful attention to the PCB layout and component placement.  $R_{SENSE}$  should be placed close to the CS pin and GND pin in order to minimize current sense error. The input loop—including input capacitor, Schottky diode, and MOSFET—should be as short as possible.



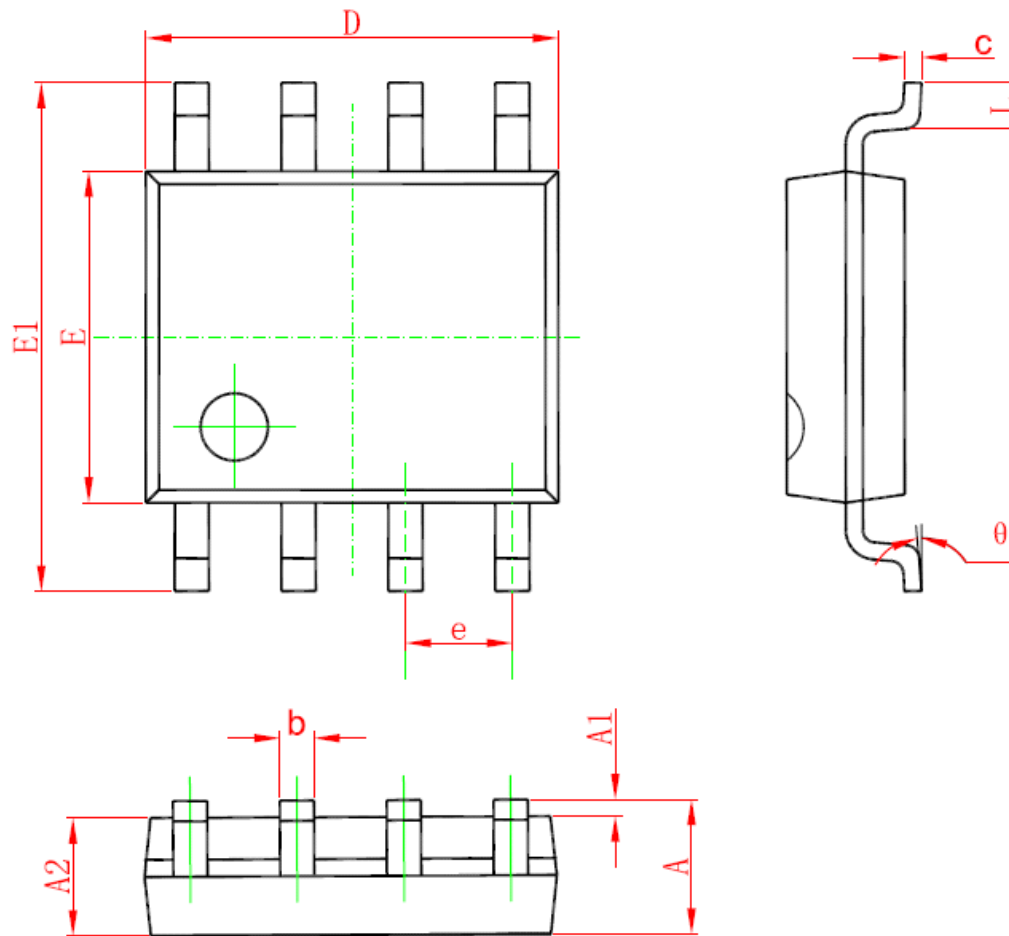
## Typical Applications





## Package Description

8-Lead Standard Small Outline Package [SOP-8]



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.250	0.002	0.010
A2	1.250	1.650	0.049	0.065
b	0.310	0.510	0.012	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.150	0.185	0.203
E	3.800	4.000	0.15	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.05 (BSC)	
L	0.400	1.270	0.016	0.050
$\theta$	0°	8°	0°	8°