100V High Efficiency Step-Down LED Driver

Description

The NDP3810KC is a high-efficiency step-down LED driver controller with a wide input voltage range of 7V to 100V.

The NDP3810KC 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 NDP3810KC implements PWM and analog dimming together through the DIM pin.

The NDP3810KC 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
- Analog and PWM Dimming
- 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
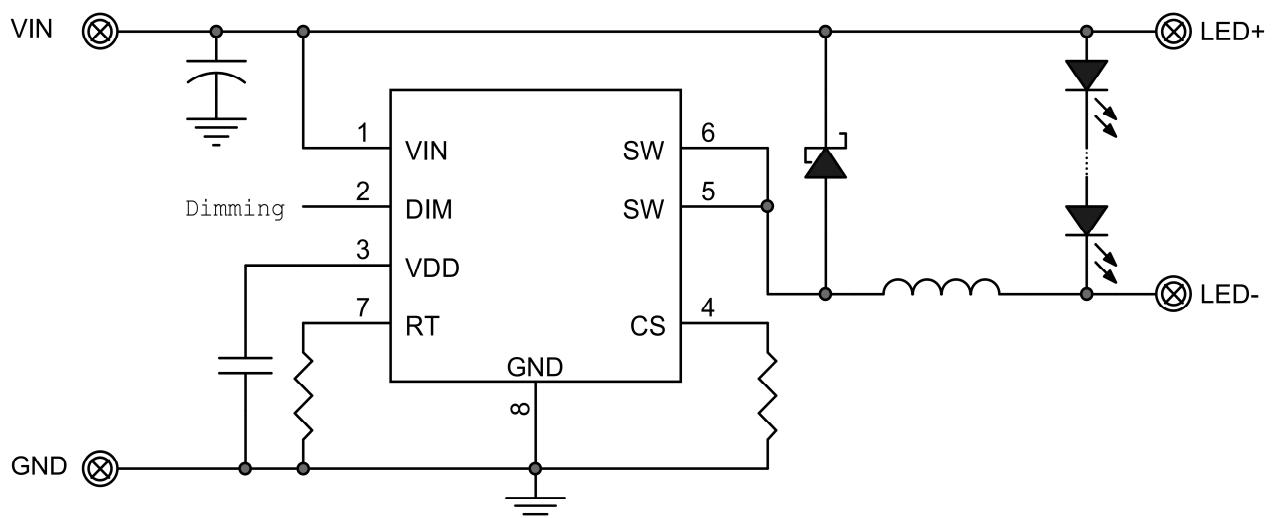
Absolute Maximum Ratings (at TA = 25°C)

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	
DIM to GND		-0.3 to +7	V
Junction to Ambient Thermal Resistance	$R_{\theta JA}$	90	°C/W
Junction to board thermal resistance	$R_{\theta JB}$	60	°C/W
Junction to case thermal resistance	$R_{\theta JC}$	42	°C/W

Pin Function And Descriptions

PIN	Name	Description
1	VIN	Power Input
2	DIM	PWM/Analog Diming Input
3	VDD	Internal Power Supply
4	CS	Connect sensor resistor to GND for measure FET on current.
5.6	SW	Power switch
7	RT	NMOS Off-time Setting, Connect a resistor to GND
8	GND	Ground
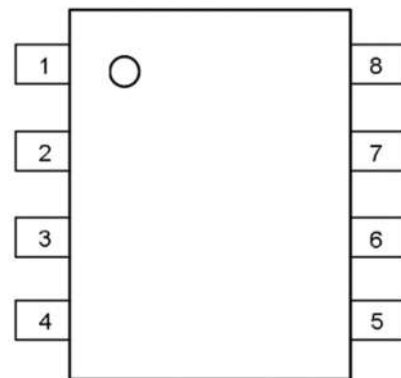
Order information

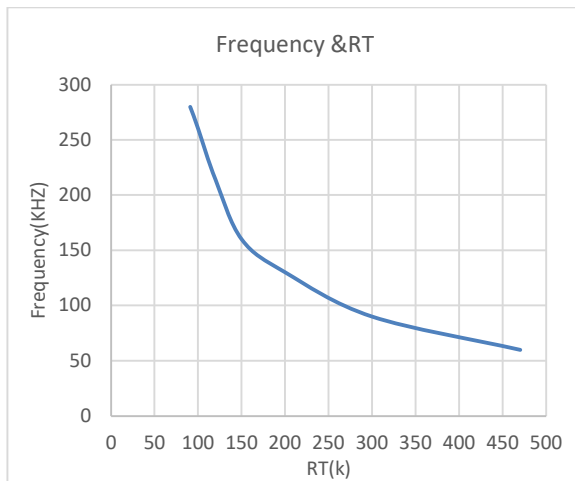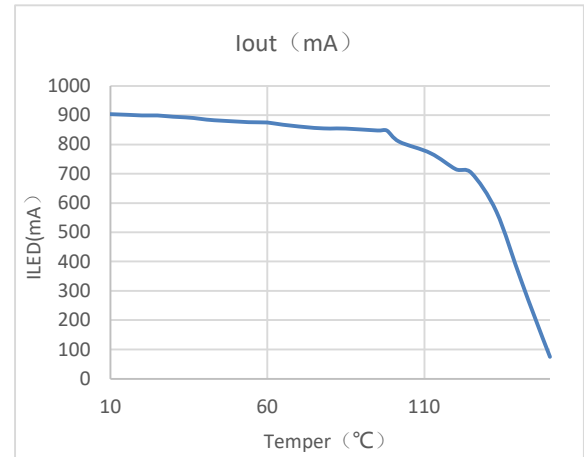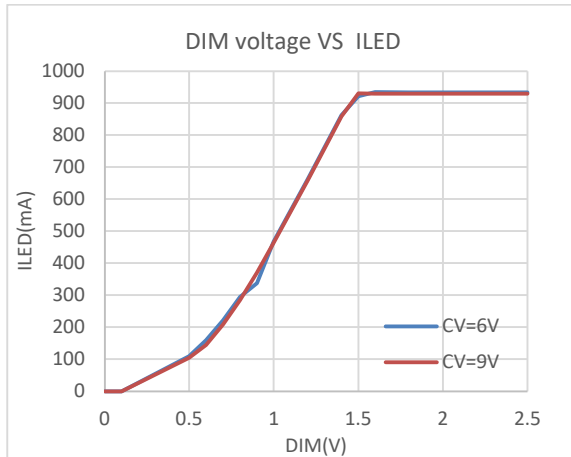| Order Information	Top Marking
NDP3810 K C Pin NO. C:8 Package K: SOP Product Number	NDP3810KC DYWWX PN : Part NO Y : Year (0=2020,A=2021,…) WW: Weekly (01-53)

Electrical Characteristics

TJ = 25°C. VIN = 12V, unless otherwise noted

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Input voltage	V_{IN}		7		100	V
VCC UVLO threshold	V_{UVLOTH}	VCC Rising		6.5		V
VCC UVLO hysteresis	$V_{UVLOHYS}$			0.4		V
Quiescent supply current	I_Q	No Switching		0.4	0.5	mA
VCC voltage	Vcc	DIM = 3.5V		5.7	6.5	V
average current sense	V_{cs}	DIM = 3.5V	270	280	290	mV
DIM voltage range	V_{DIM}	V_{DIM} Rising	0.1		1.5	V
Min recommended pwm dimming frequency	F_{PWMmin}			0.1		kHz
Max recommended pwm dimming frequency	F_{PWMmax}			20		kHz
Minimum off time	T_{OFF_MIN}			0.6		uS
Maximum off time	T_{OFF_MAX}			50		uS
Short circuit hiccup time	T_{HICCUP}			500		mS
MOSFET breakdown	BV_{DSS}		100			V
MOSFET ON resistance	R_{DSON}			420		m Ω
Thermal shutdown threshold		Temp Rising		150		°C
Thermal Shutdown Hysteresis	T_{SH}		-	30	-	°C

Block Diagram

Typical Performance

DIM voltage VS ILED

ILED(mA) — DIM(V)

CV=6V
CV=9V

Iout（mA）

ILED(mA) — Temper（℃）

Frequency &RT

Frequency(KHZ) — RT(k)

PWM&ILED

ILED(mA) — PWM(%)

1.5K
10K

Operation

Steady State

The NDP3810KC 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 NDP3810KC 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.

The internal 1.18V reference voltage provides a 0.1V reference to enable the part. When DIM>0.1V, the output of the comparator goes high and enables the other blocks. While the internal DIM pin without pull up and pull down, So do not let DIM pin floating.

Dimming Control

The NDP3810KC allows the DIM pin to control both Analog and PWM dimming. Whenever the voltage on DIM is less than 0.1V, the chip turns off. For analog dimming, when the voltage on DIM is from 0.1V to 1.5V, the LED current will change from 0% to 100% of the maximum LED current. If the voltage on DIM pin is higher than 1.5V, output LED current will equal the maximum LED current. For PWM dimming, the signal amplitude must exceed 1.5V. 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.

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

For $R_{SENSE}=0.3Ω$, 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 the resistor value between 100K and 300K.

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. RSENSE 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.
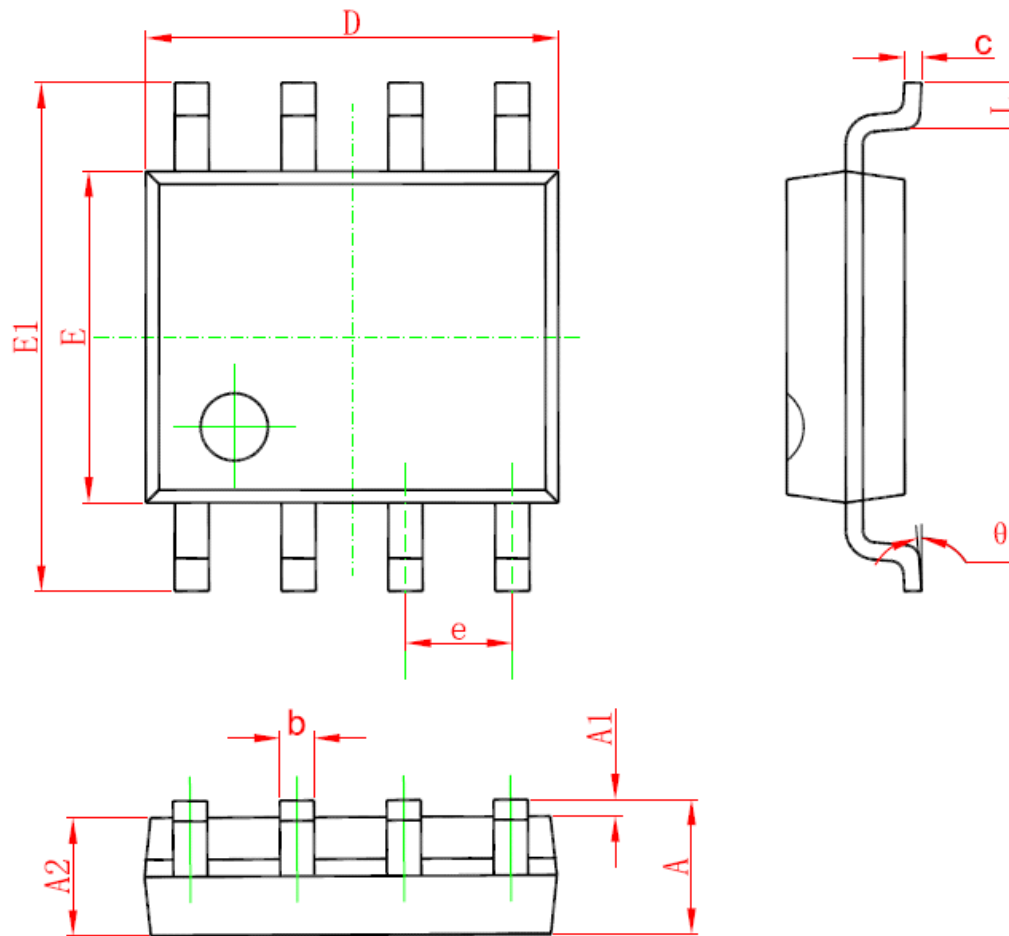
Typical Applications
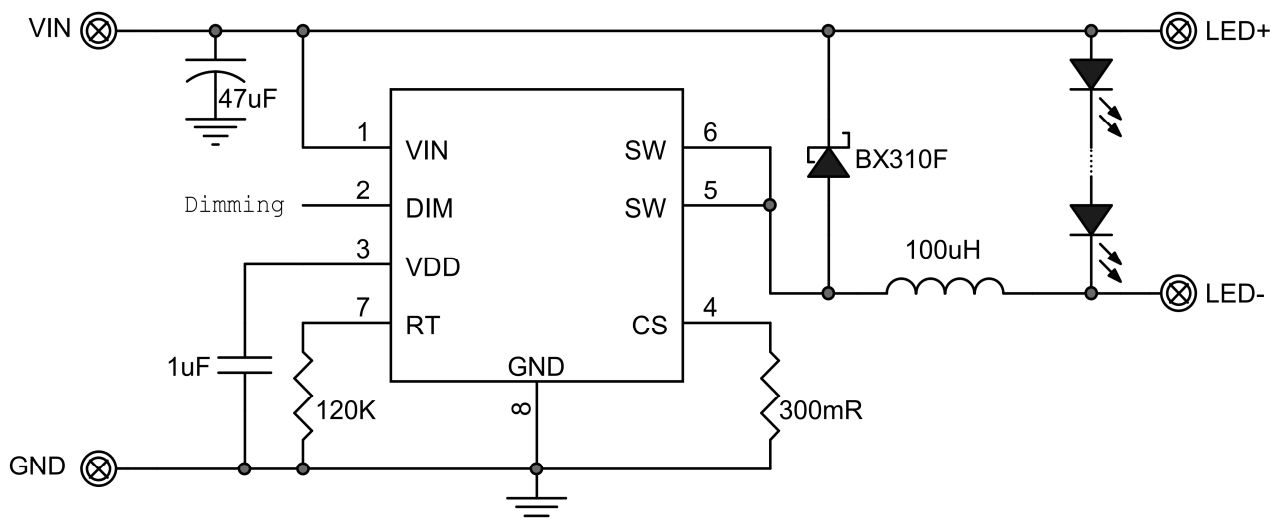
Package Description

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
θ	0º	8º	0º	8º