



## 40V High Efficiency Step-Down LED Driver

### Description

The NDP3435KC is a 3.5A synchronous buck converter for LED driver with a wide input voltage range of 7V to 40V. built in 55mΩ High-Side and 20mΩ Low-Side MOSFET, Require the minimal external component achieve high efficiency and precision output current, ideal for car lamp applications.

up to 3.5A Output Current with  $\pm 3\%$  accuracy. RS resistor is used to set the output current. NTC Resistor is an option for over temperature protect.

The NDP3435KC implements No external compensation component needed. Programable switching frequency with jitter function improves EMI performance.

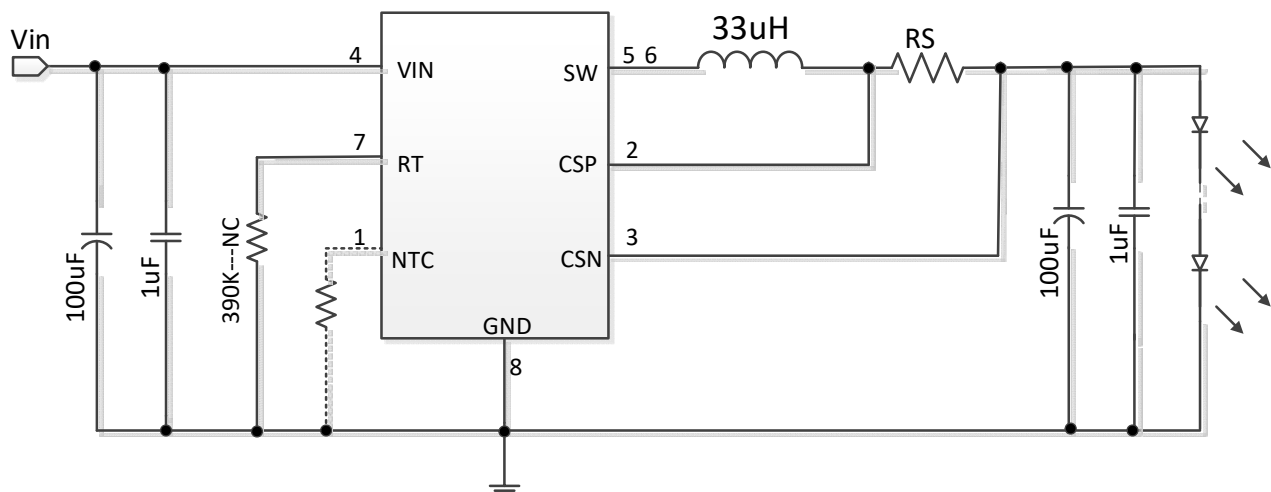
### Features

- Wide 7V to 40V Input Range
- 3V to 18V output Range
- Build in Power MOSFET
- Cycle by Cycle Current Limit
- 150mV Voltage Reference
- No External Compensation Needed
- Internal Thermal Regulation
- Input Under Voltage LockOut
- Open Loop Protection
- Short LED Protection
- Thermal Shutdown
- RoHS and Halogen free compliance.
- Available in SOP8 Package

### Applications

- Automotive lighting
- LED Driver
- Constant Current Source
- Decorative LED Lighting

### Typical Application





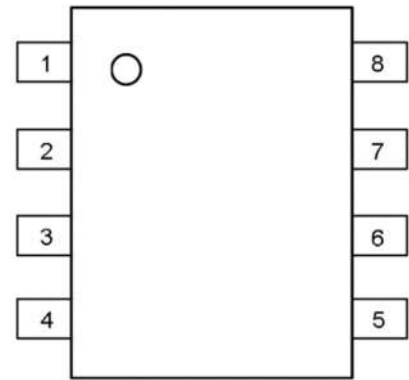
# NDP3435KC

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

Parameter	Value
VIN to GND	-0.3 to 42V
SW to GND	-0.3 to 42V
RT,NTC to GND	-0.3 to +6
CSP,CSN to GND	-0.3 to +25
Package Thermal Resistance ( $\theta_{jc}$ )	45°C / W
Lead Temperature & Time	260°C, 10S
ESD (HBM)	>2000V

## Pin Function And Descriptions

PIN	NAME	Description
1	NTC	Connect Negative temperature resistor to GND or Floating
2	CSP	Positive Pole of Current Sense
3	CSN	Negative Pole1 of Current Sense
4	VIN	Power Input Positive Pole
5,6	SW	Switching, Connected With a Inductor
7	RT	Connect a Resistor to GND for Frequency Config
8	GND	Ground



## Order information

Order Information	Top Marking
<p>NDP3435 K C</p> <p>Pin NO. C:8</p> <p>Package K: SOP8</p> <p>Product Number</p>	<p>PN : Part NO Y : Year (0=2020,A=2021,...) WW: Weekly (01-53)</p>



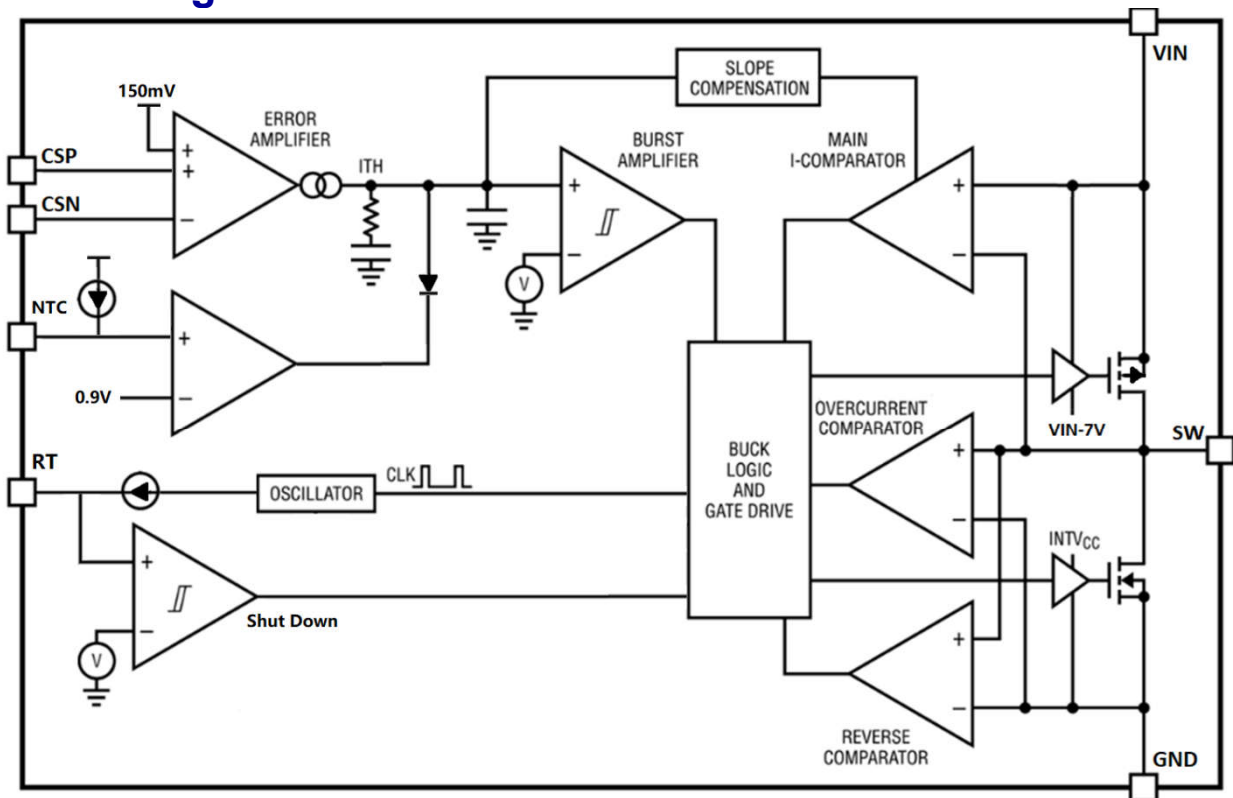
# NDP3435KC

## Electrical Characteristics

$T_J = 25^{\circ}\text{C}$ ,  $V_{IN} = 12\text{V}$ , unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{IN}$	Input Voltage		7	-	40	V
$V_{UVLO}$	UVLO Voltage			7		V
	UVLO Hysteresis			1		V
$V_{OUT_{ovp}}$	VOUT Over voltage protect		17	18		V
$I_{SB}$	Standby Current			1.6	3	mA
$F_{SW}$	Switching Frequency			135		KHz
$V_{CS}$	Reference Voltage of Constant Current	CSP-CSN	145.5	150	154.5	mV
$D_{MAX}$	Maximum Duty Cycle			100		%
$D_{MIN}$	Minimum On-Time			250		ns
High side	$R_{DS(on)}$ of Power MOS	$I_{OUT}=1\text{A}$	-	55	75-	$\text{m}\Omega$
Low side		$I_{OUT}=1\text{A}$	-	17	22-	$\text{m}\Omega$
$T_{SD}$	Thermal shutdown Temp		-	150	-	$^{\circ}\text{C}$

## Block Diagram

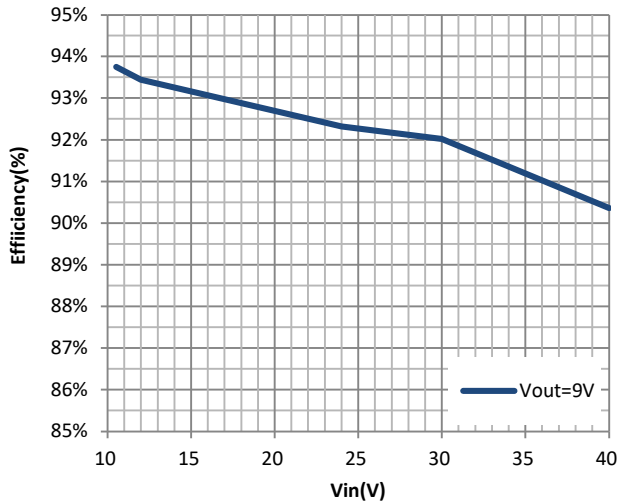




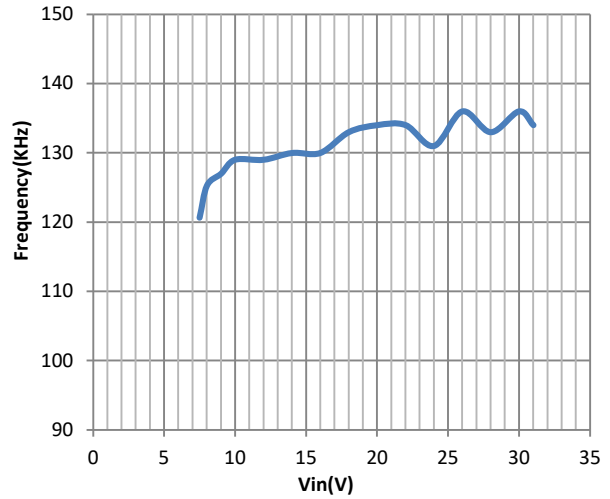
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## Typical Performance Characteristics

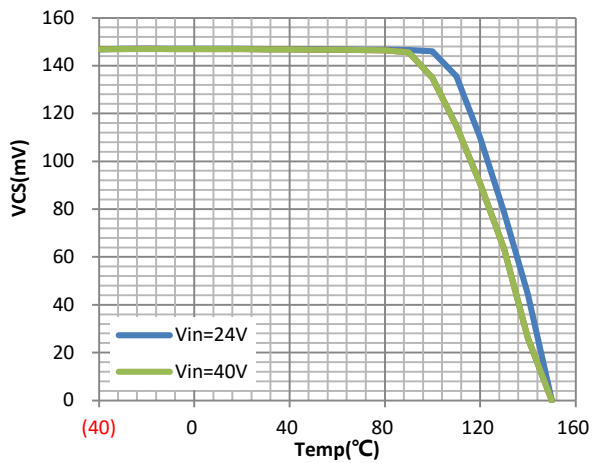
Efficiency vs. Vin



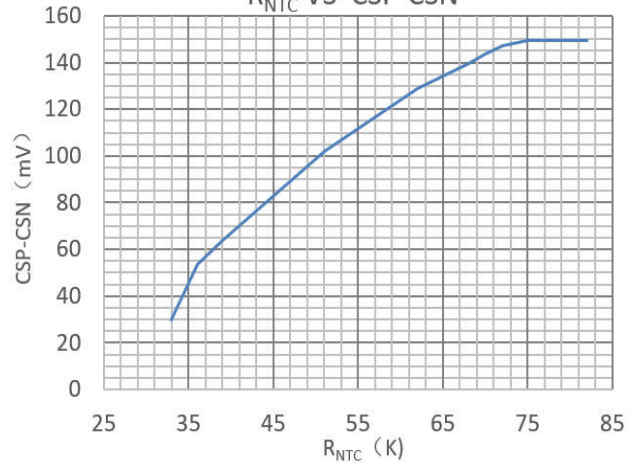
Switch Frequency vs. Input Voltage



Temperature vs. Vcs

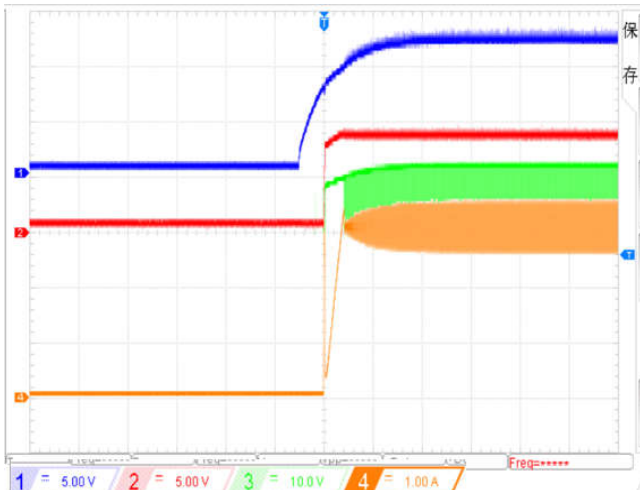


$R_{NTC}$  VS CSP-CSN



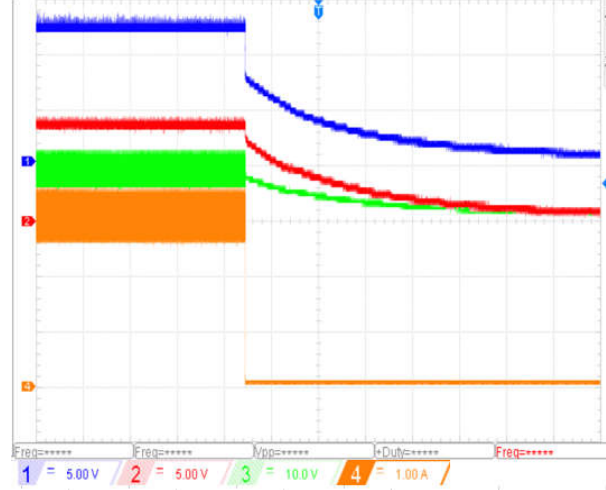
Power On

Vin=12V, Vout=9V, Iout=3A  
(CH1=Vin, CH2=Vout, CH3=SW, CH4=Isw)



Power Off

Vin=12V, Vout=9V, Iout=3A  
(CH1=Vin, CH2=Vout, CH3=SW, CH4=Isw)





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## DETAILED DESCRIPTION

### Input Under Voltage Protection

NDP3435KC contains an internal under-voltage lockout circuit(UVLO) on the VIN pin of the device. The input voltage range is 7V to 40V. If VIN below 6V, the UVLO circuit will turn off the MOSFET. Once VIN rises above 7V, The NDP3435KC starts to work ..

### Constant Current Output

NDP3435KC use a RS resistor to sense the output current (CSP-CSN), As the output current flowing through the resistor, the voltage drop between CSP and CSN is compared with an internal reference voltage(150mV) cycle by cycle to adjust the next high side MOSFET turn on time,

An internal compensated loop will provide enough gain and stability to ensure this voltage under the right conditions. When the internal loop works normally, the external output capacitor must be parallel to the LED load.The Output Current can be set by an external resistor using the following equation:

$$I_{OUT} = \frac{150mV(CSP - CSN)}{R_S}$$

Note that this equation only stands when the junction temperature is lower than the threshold value of thermal regulation.

### Frequency Selection and Shutdown

The switching frequency of the NDP3435KC can be programmed through an external resistor between 130kHz and 300 kHz, Floating this pin set the switching frequency to 130K, an external resistor can

set the frequency up to 300KHz.the switching frequency is set using the RT pins as shown in Table 1:

RT Resistor(KΩ)	Frequency(KHz)
Floating	130K
2M	160K
1M	190K
820K	210K
680K	225K
390K	300K

When the RT pin is below 0.3V, the NDP3435KC enters a low current shutdown state, reducing the DC supply current to 1.3mA

### Analog dimming NTC

As the temperature rise and NTC resistance reduce to about 75K, NDP3435KC will reduce the output current and ignore constant current settings. As the resistance is less than 33K, the output will be turned off. if no need NTC function please connect a resistor(value above 75k),or left floating

### Thermal Regulation

The NDP3435KC includes a thermal shutdown circuit to protect the device from over-temperature conditions. The device can overheat due to high ambient temperatures, high internal power dissipation, or both. In the event the die temperature reaches 150°C the device will reduces the internal 150mV reference voltage, thus the output current will reduce accordingly (i.e. when the junction temperature reaches to 145°C, the current will be drop to 75% of the original current; when reaches to 150°C, the current will be 50%).



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For a 30% current drop will cause a 51% heat drop generated by MOSFETs'  $R_{DS(ON)}$  due to  $P=I^2R$ , and since the DC power loss makes the most contribution to heat generation, normally, this method can stabilize the temperature at between 140°C and 150°C without turning off the output when the power

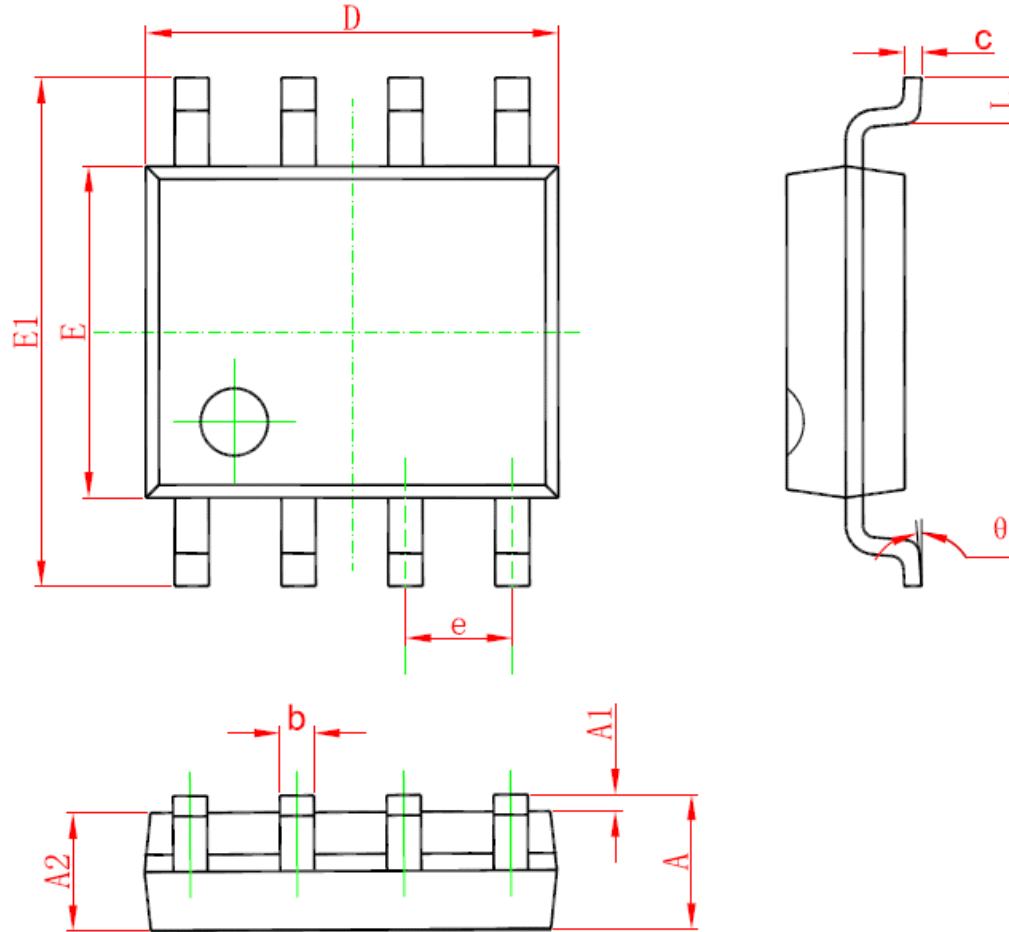
dissipation condition is insufficient (i.e. when the ventilation fan stops). But if external temperature continues to rise, the device will completely shut down. This is non-latch protection. Once the junction temperature drops, the reference voltage will rise again and the device will resume to work.



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## 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	0°	8°	0°	8°