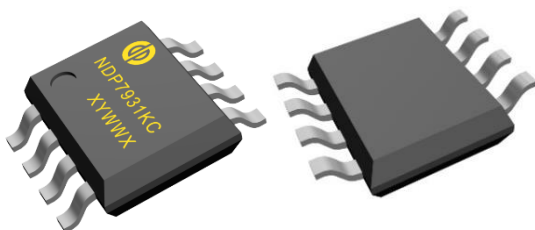


3.1A,60V Synchronous Rectifier

Description

NDP7931KC is a synchronous rectifier for switch mode power supplies, which combines an N-Channel MOSFET and a driver circuit designed for synchronous rectification in DCM, QR and CCM operation

The synchronous rectification can effectively reduce the secondary side rectifier power dissipation and provide high performance solution. By sensing MOSFET SW-to-Source voltage, NDP7931KC can output ideal drive signal with less external components. It can provide high performance solution for 3V to 30V output voltage application.



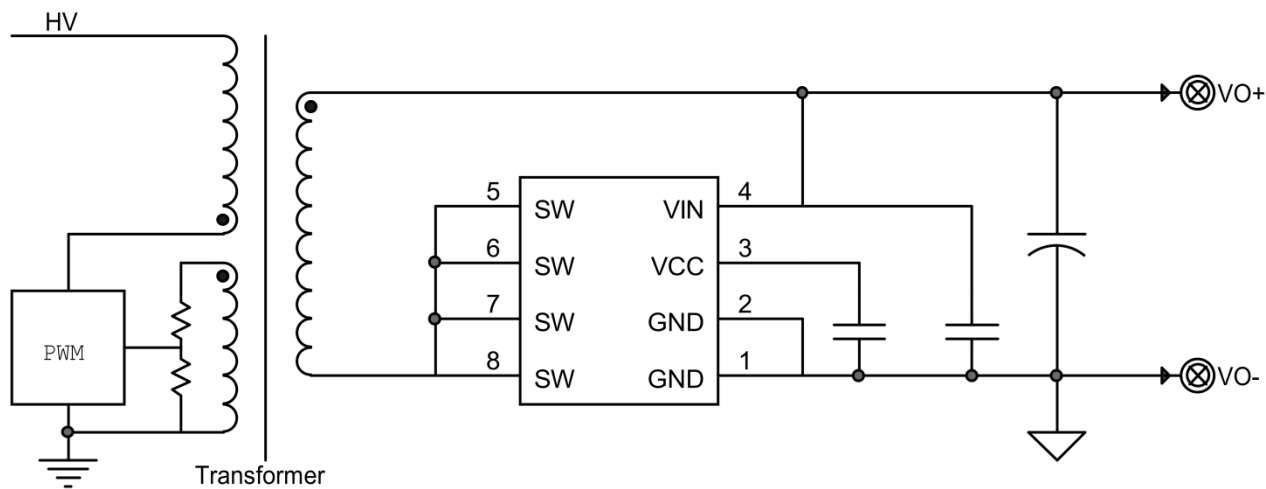
Features

- Supports CCM, DCM and Quasi-Resonant Topologies
- Wide VIN pin operating voltage up to 30V
- Optimized for output voltages from 3V to 30V in multi-level output voltage and current applications
- Supports Low-side/High-side Rectification
- Max 150kHz Switching Frequency
- Fast Turn-off Total Delay of 12ns
- Compatible with Energy Star
- ~320uA Low Quiescent Current
- Available in SOP8 Package

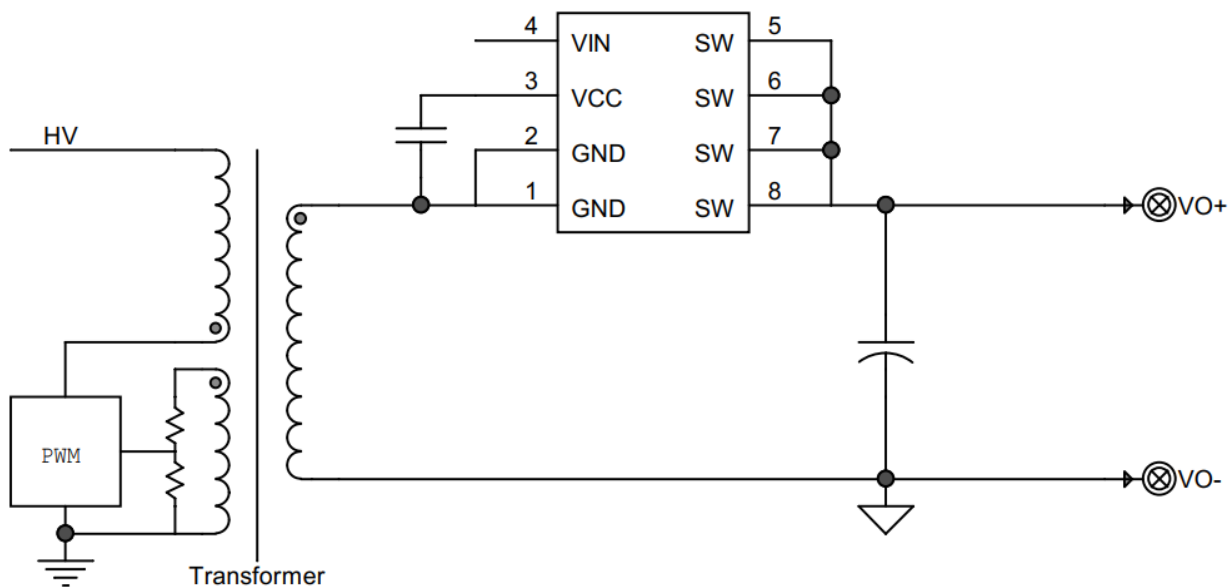
Applications

- Chargers for Cell Phones
- AC/DC adapter
- Industrial Power Systems
- Flyback Converters

Typical Application



Low-side Rectification

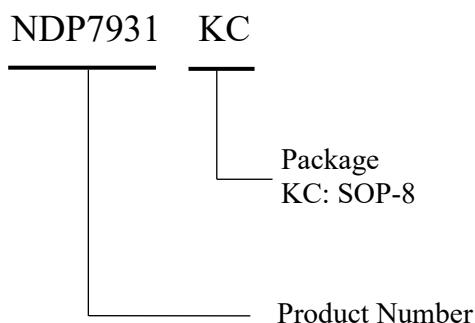


High-side Rectification

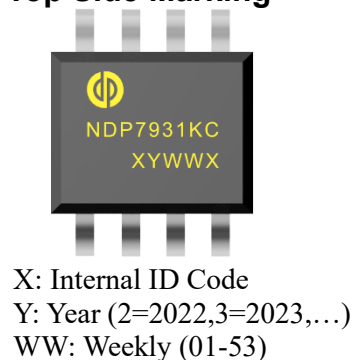
Order Information

Orderable Device	Package Type	Packing Qty/reel	MSL- Peak Temp -Floor Life	Eco Std	Marking Information
NDP7931KC	SOP-8	4000	MSL3-260°C-168hrs	RoHS & Green	Refer to below

Product Naming



Top Side Marking



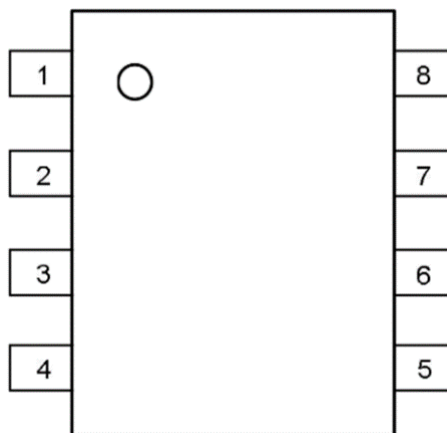
Notes:

- (1) **RoHS:** Quoted from **RoHS Directive (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 $\leq 1000\text{ppm}$ 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.

The information provided on this page represents **Deep-Pool's** knowledge and belief as of the date that it is provided. **Deep-Pool** bases its knowledge and belief on information provided by third parties and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. **Deep-Pool** has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. **Deep-Pool** and **Deep-Pool** suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

Pin Function and Definition

PIN	NAME	Description
1,2	GND	Ground
3	VCC	Output of Internal LDO, It Provides Bias Voltage for the Internal Circuit and MOSFET Driver. Connect this Pin to a Capacitor
4	VIN	Input of Internal LDO
5,6,7,8	SW	Drain of Internal N-MOS



Absolute Maximum Ratings (at TA = 25°C)

Characteristics	Symbol	Rating	Unit
VCC to GND		-0.3 to 8	V
SW to GND		-0.3 to 65	V
VIN to GND		-0.3 to 32	V
Operating Junction Temperature	T _A	-40 to 150	°C
Storage Junction Temperature	T _{stg}	-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

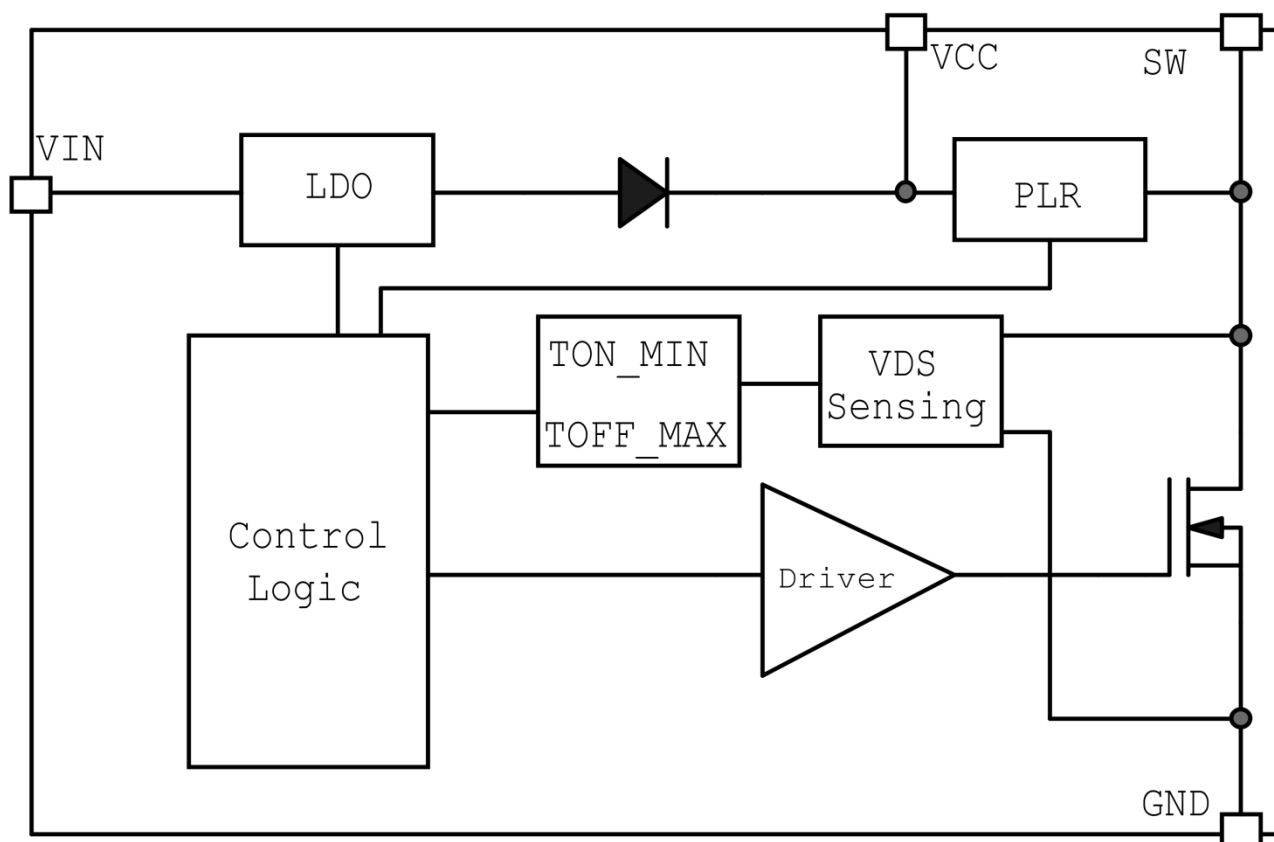
ELECTRICAL PARAMETER	MINIMUM	TYPICAL	MAXIMUM	UNIT
Input Voltage(V _{IN})	5		24	V
thermal Resistance from Junction to case (θ_{JC})		80		°C/W
Thermal Resistance from Junction to ambient (θ_{JA})		160		°C/W

Electrical Characteristics

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

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage	V_{IN}		5.0	-	30	V
VCC UVLO OFF Voltage	$V_{CC_{UVLO_OFF}}$				4	V
VCC UVLO ON Voltage	$V_{CC_{UVLO_ON}}$		2.7			V
VCC UVLO Hysteresis				0.2		V
VCC Output Voltage	V_{PLR}	SW >10V		6.2		V
VCC Output Voltage	V_{LDO}			7		V
Quiescent Current	$V_{IN_{ICQ}}$	No Switch	-	320	-	uA
Turn ON Threshold	V_{TH_ON}			-170		mV
Driver Voltage Regulator	V_{REG}			-70		mV
Turn OFF Threshold	V_{TH_OFF}			-40		mV
Turn-off Total Delay	T_{OFF_Delay}			12		nS
Minimum on Time	T_{min}			700		nS
NMOS RDSON	R_{DS_ON}			15		m Ω
Breakdown Voltage	BV_{DSS}		60			V
Thermal Shutdown Temperature	T_{SD}		-	150	-	$^{\circ}\text{C}$
Thermal Shutdown Hysteresis Temperature	T_{SH}		-	30	-	$^{\circ}\text{C}$

Block Diagram



Operational Description

The NDP7931KC supports operation in CCM, DCM and Quasi-Resonant topologies. Operating in either a DCM or Quasi-Resonant topology, the control circuitry controls the gate. It will turn the gate off when the MOSFET current is fairly low. In CCM operation, the control circuitry turns off the gate when very fast transients occur.

VCC Under Voltage Lockout (UVLO)

When the Vcc is below UVLO threshold, the part is in sleep mode and the internal N-MOS will be turned off.

Turn ON Phase

When the synchronous MOSFET is conducting, current will flow through its body diode which generates a negative Vds across it. Because this body diode voltage drop is much smaller than the turn on threshold of the control circuitry (-170mV), which will then turn on the N-MOS.

Conducting Phase

When the synchronous N-MOS is turned on, VDS becomes to rise according to its on resistance, as the current becomes smaller VDS rises above the Driver Voltage Regulator (-70mV), the circuitry starts

pulling down the gate driver which leads to the VDS be regulated to a fixed voltage (the internal reference).

Turn OFF Phase

When the Vds rises to trigger the turn off threshold(-40mV), the N-MOS gate voltage is pulled to low after about 12nS delay by the control circuitry, a 1.7uS blanking time is added after the synchronous N-MOS is turn off to avoid error trigger because of the ringing.

Blanking

The NDP7931KC control circuitry contains a blanking function. When it pulls the MOSFET OFF, it makes sure that the OFF state at least lasts for about ~1.7us, so it is not recommended to set the synchronous period less than 1.6us at CCM condition in flyback converter, otherwise shoot through may occur During normal operation.

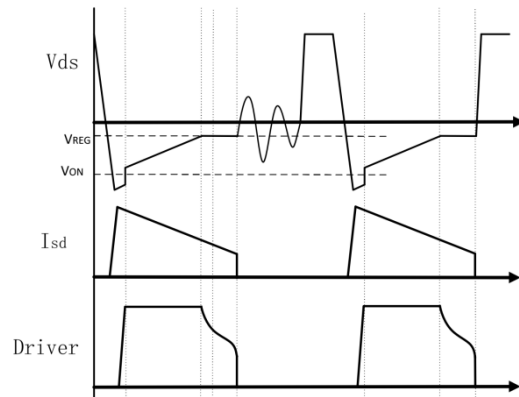


Figure 1 Operation in DCM mode

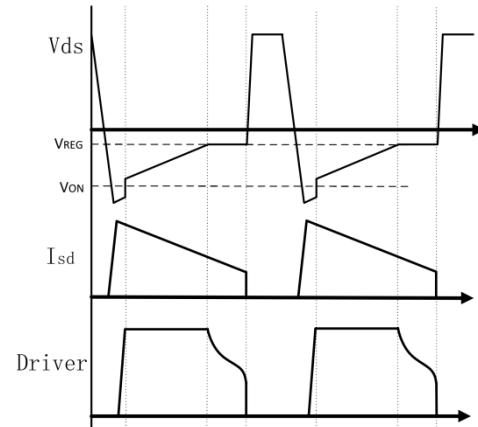
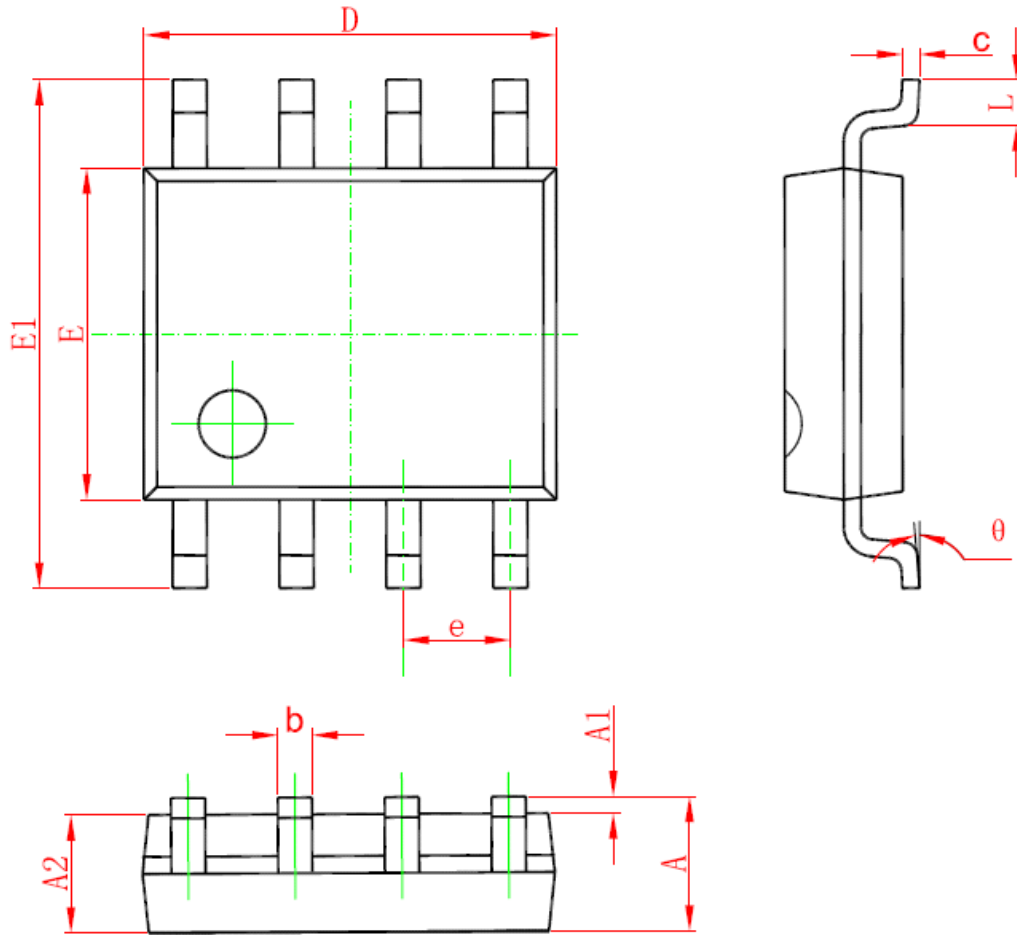


Figure 2 Operation in CCM mode

Package Outline Drawing

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°

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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