

Supporting Continuous Current Mode Synchronous Rectification Converter with Integrated Power MOSFET

General description

PN8309H consists of a synchronous rectification controller and an avalanche-rugged N-channel power MOSFET, specifically designed for a high performance AC/DC flyback converter to replace traditional rectifying schottky diode.

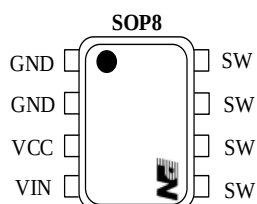
PN8309H integrates a much lower voltage drop MOSFET to increase output current capability and efficiency, makes converter's efficiency satisfy the standard of Energy star Class VI.

PN8309H offers complete additional functions including UVLO, Minimum turn on time etc. The dual-power supply is designed to support a wider range of output voltages when the PN8309H is applied on the low-side, also resulting in better reliability.

Features

- Internal 10mΩ 100V Trench MOSFET (PN8309HSE-A1)
- Internal 10mΩ 75V Trench MOSFET (PN8309HSE-B1)
- Suitable for CCM, DCM, QR operation
- Current tracking turn-off technology
- High voltage self-supply technology

Package/Order Information

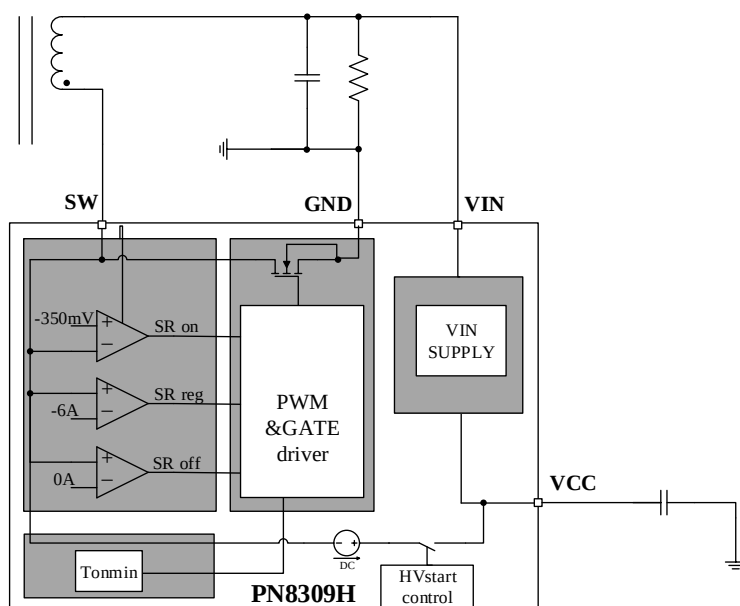


Order code	Package
PN8309HSE-A1	SOP8
PN8309HSE-B1	SOP8

Application

- Adapter
- Quick-Charger

Typical Circuit



Pin Definitions

Pin Name	Pin Number	Pin Function Description
GND	1,2	Ground.
VCC	3	Power Supply.
VIN	4	System output.
SW	5,6,7,8	SR MOSFET drain.

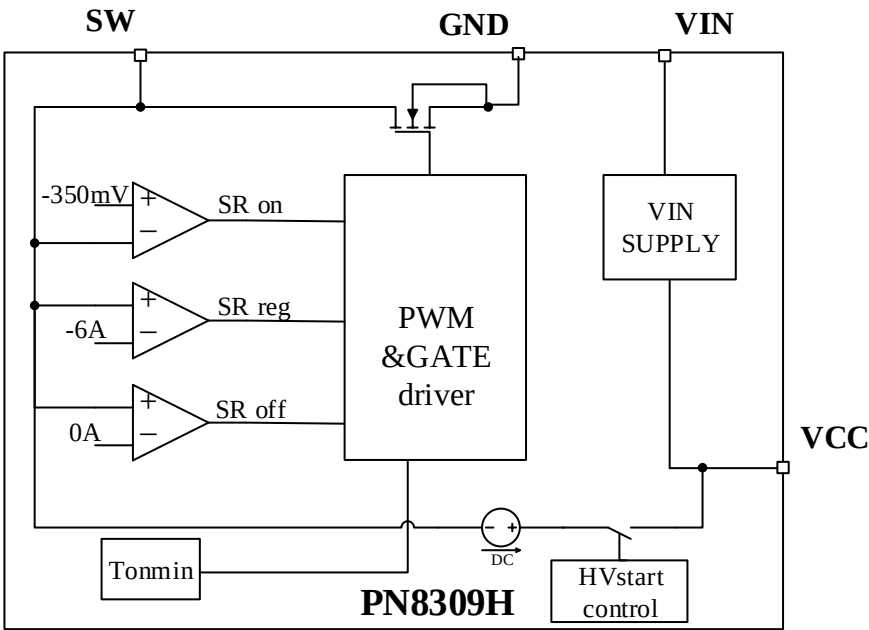
Typical Power

Part number	Package	Adapter
		90~265V _{AC}
PN8309H	SOP8	3.5A ⁽¹⁾

Note:

1. Typical maximum output current measured at 45 °C in adapter, with enough cooling conditions.

Block Diagram



Absolute Maximum Ratings

Supply voltage Pin, VIN.....-0.3~28V
 Supply voltage Pin, VCC.....-0.3~20V
 Input Voltage Pin, SW(DC) :
 PN8309HSE-A1..... -0.3~100V
 PN8309HSE-B1..... -0.3~75V
 Operating Junction Temperature.....-40~150 °C
 Storage Temperature Range.....-55~150 °C

Input Voltage Pin, SW (Pulse With ≤500ns):
 PN8309HSE-A1..... -1~105V
 PN8309HSE-B1..... -1~80V
 Lead Temperature (Soldering, 10Secs).....260 °C
 Package Thermal Resistance θ_{JC} (SOP8).....40 °C /W
 HBM ESD Protection ⁽¹⁾±3kV

Note:

1. Test standard: ANSI/ESDA/JEDEC JS-001-2017.

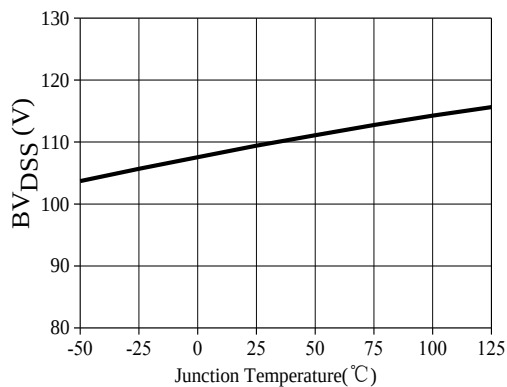
Electrical Characteristics

(T_A= 25 °C, VDD=12V, unless otherwise specified)

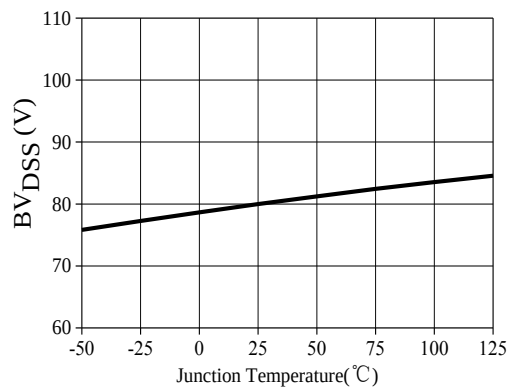
PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Power Section						
MOSFET VDS breakdown voltage PN8309HSE-A1	BV _{DSS}	I _{SW} = 250uA, VCC=12V	100	105		V
MOSFET VDS breakdown voltage PN8309HSE-B1			75	80		V
Zero Gate voltage Drain current PN8309HSE-A1	ID _{SS}	V _{SW} = 100V, VCC=12V			1	uA
Zero Gate voltage Drain current PN8309HSE-B1		V _{SW} = 75V, VCC=12V			1	uA
On resistance PN8309HSE-A1	R _{DS(on)}	I _{SW} =6A, V _{GS} =10V, T _J = 25 ℃		10		mΩ
On resistance PN8309HSE-B1				10		mΩ
Gate Threshold Voltage PN8309HSE-A1	V _{TH}		1.3	2	2.8	V
Gate Threshold Voltage PN8309HSE-B1			1	1.5	1.8	V
Supply section						
VCC start threshold voltage	VCC _{on}	VCC increase	5.5	6	6.5	V
VCC off threshold voltage	VCC _{off}	VCC decrease	5	5.5	6	V
VCC static current	ID _{DOP}	VCC=12V, no switch.	0.3	0.5	0.7	mA
VCC current at absolute maximum voltage	ID _{DLT}	VCC=20V, no switch.	0.4	0.65	1	mA
VIN current at absolute maximum voltage	IVIN _{LT}	VIN=35V, no switch.	0.4	0.6	0.8	mA
VCC current at absolute maximum voltage	LDO	VIN=12V		9.5		V
High voltage startup OFF	HV _{st} off	VCC increase		7		V
High voltage Charging Current	IHV			100		mA
SW detection section						
SR MOSFET turn on threshold voltage	V _{th_SR_on}		-450	-350	-250	mV
SR MOSFET regulation threshold current	I _{th_SR_reg} off			-6		A
SR MOSFET turn off threshold current	I _{th_SR_off}			0		A
SR MOSFET turn on delay	ON _{_delay}				75	ns
SR MOSFET turn off delay	OFF _{_delay}				50	ns
SR MOSFET minimum on time	Ton _{_min}		1.2	1.5	1.9	us

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
SR MOSFET minimum off time	Toff_min		1.8	2.3	2.8	us
Driver section						
GATE output high level	V _{OH}			9.5		V
GATE output low level	V _{OL}				0.5	V
Source current	I _{SOURCE}			1.4		A
Sink current	Rpull			1		Ω

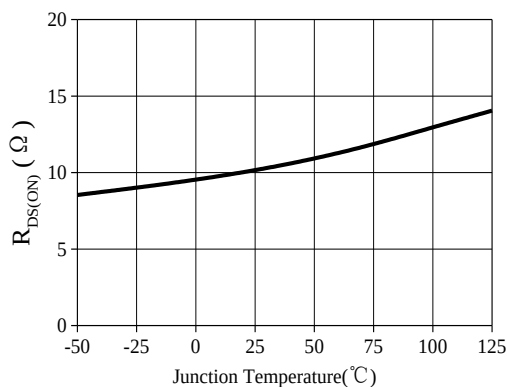
Typical Characteristics Plots



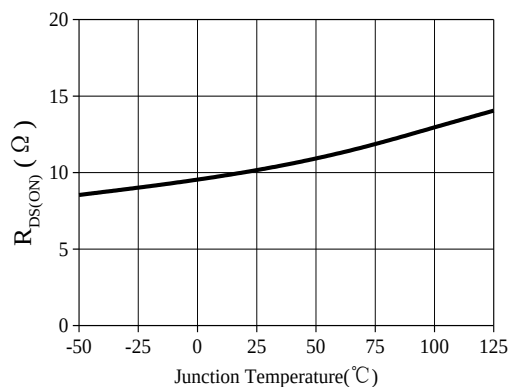
(a) BV_{DSS} VS T_j
PN8309HSE-A1



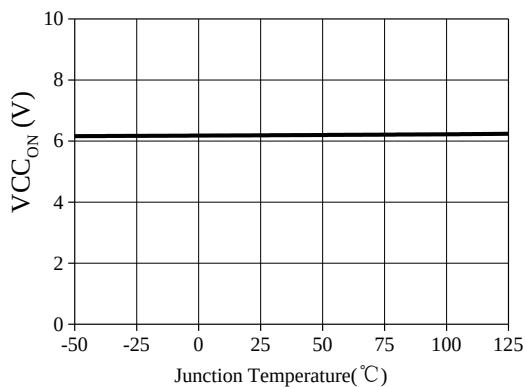
(b) BV_{DSS} VS T_j
PN8309HSE-B1



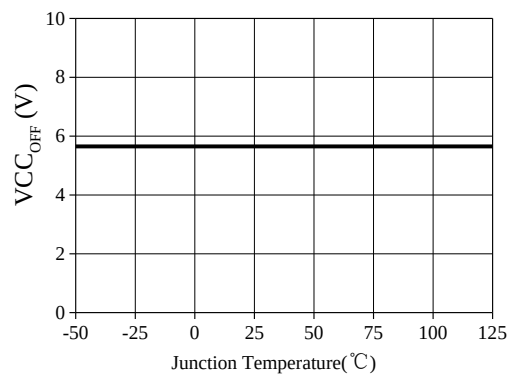
(c) $R_{DS(ON)}$ VS T_j
PN8309HSE-A1



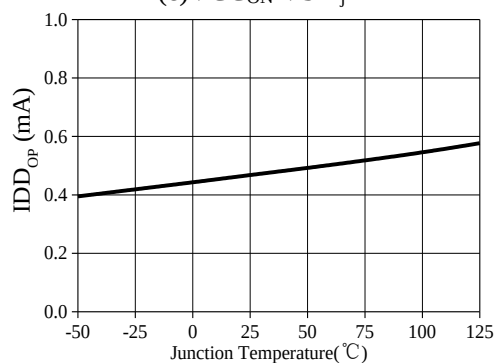
(d) $R_{DS(ON)}$ VS T_j
PN8309HSE-B1



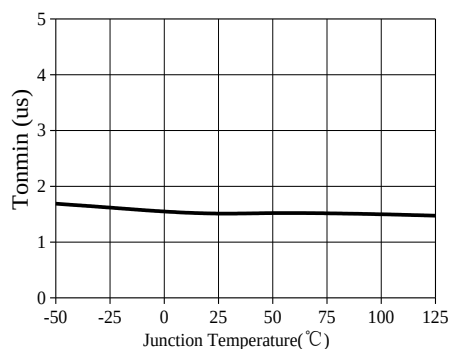
(e) $V_{CC_{ON}}$ VS T_j



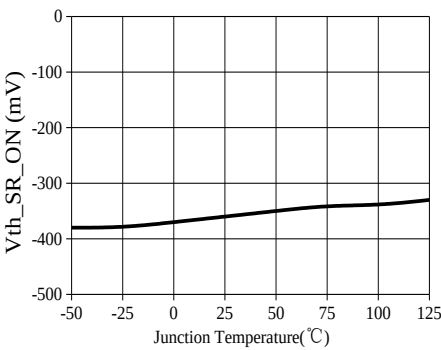
(f) $V_{CC_{OFF}}$ VS T_j



(g) $I_{DD_{OP}}$ VS T_j



(h) T_{onmin} VS T_j



(i) $V_{th_SR_ON}$ VS T_j

Functional Description

1. Startup

At start up, the chip is mainly powered by high voltage self-powered supply. When the terminal of DRAIN is at high voltage, it will charge the VCC capacitor. The VCC voltage gradually stabilizes at HVstiff. When the voltage of VIN is equal to or higher than 8V, the LDO supply continues to charge the VCC capacitor. The VCC voltage gradually stabilizes at LDO. When the voltage of VCC increases to VCC_{on}, the chip starts to work.

When the voltage of VCC downs to VCC_{off}, the chip stops working, the internal body diode of MOSFET in chip continues to work.

2. Synchronization rectifier mode

The chip controls the turn-on and turn-off of synchronization rectifier MOSFET. The specific working mechanism is as follows:

When the chip detects the V_{ds} is less than the turn on threshold voltage, the controller drives the Power MOSFET to turn on. At this time, the V_{gs} rises to the maximum voltage. The V_{gs} will not change until the I_{sd} reduces to the regulation threshold. Subsequently, the V_{gs} will decrease with the reduction of the I_{sd}. When the primary-side Power MOSFET turns on, the I_{sd} will decrease to the turn off threshold suddenly, the controller will turn off the Power MOSFET quickly.

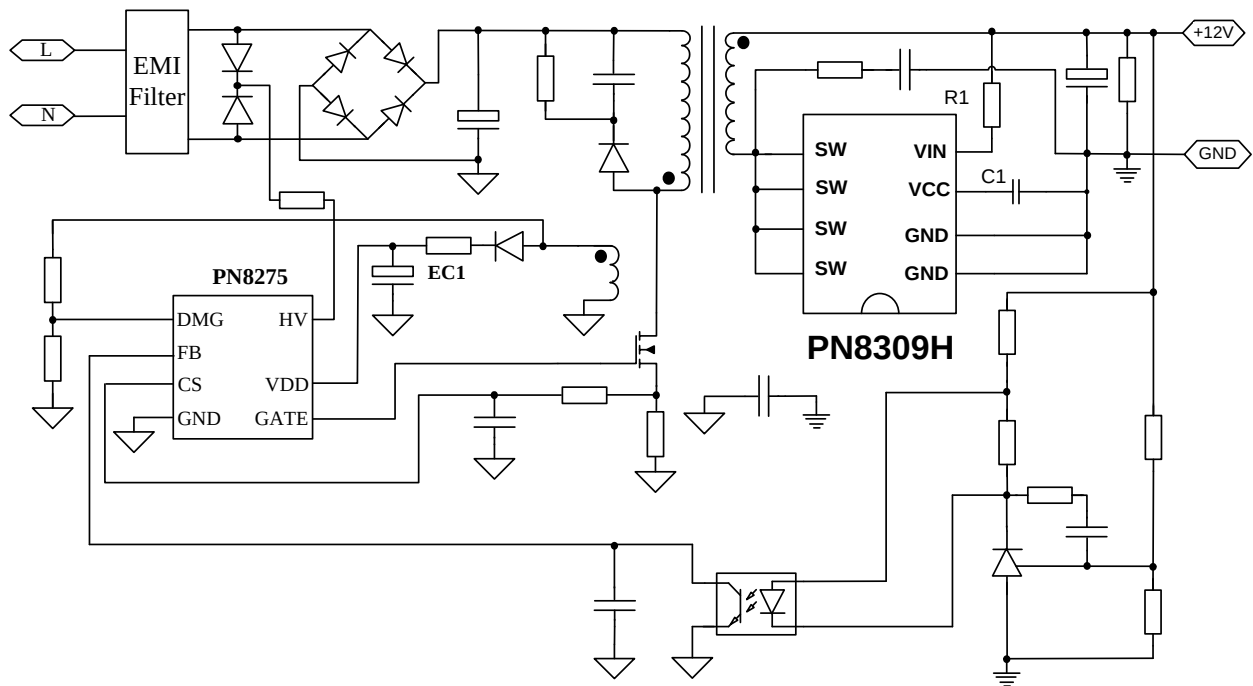
3. Minimum turn on time

When the chip turns on the MOSFET, there is a larger noise signal to interfere the drain voltage of the MOSFET. In order to avoid the turning off of the MOSFET by mistake, the chip adds the blanking time. During the blanking time, the turn off threshold voltage will increase. At the end of this time, the turn off threshold voltage will recover to the normal value.

4. Minimum turn off time

When the chip turns off the MOSFET, there is a ring signal in the drain of the MOSFET. In order to avoid the turning on the MOSFET by mistake when ring signal too low to less than V_{th_SR_on}, the chip adds the blanking time. At the end of this time, the chip will allow to turn on.

Typical Application

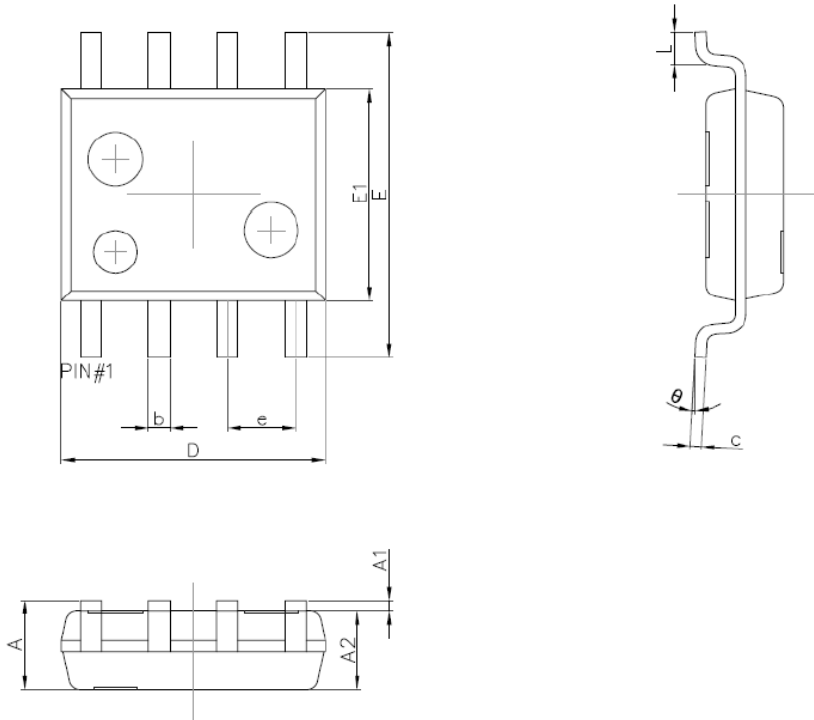


Component Parameter and Layout Considerations:

1. To satisfy the higher reliability requirement of the system, it is suggested that the resistance R1. The recommend value is 4.7~10 ohm.
2. The capacitor C1 of VCC should be placed closest to VCC PIN and GND PIN. The recommend value is 1.0 uF.
3. The clamp circuit of RC, The recommend value of R2 is 4.7~15 ohm, the recommend value of C2 is 470pF~2.2nF.
4. During PCB layout, too large area copper coating is prohibited under SOP8 package to avoid package seal failure caused by abnormal wave soldering

Package Information

Package Information SOP8



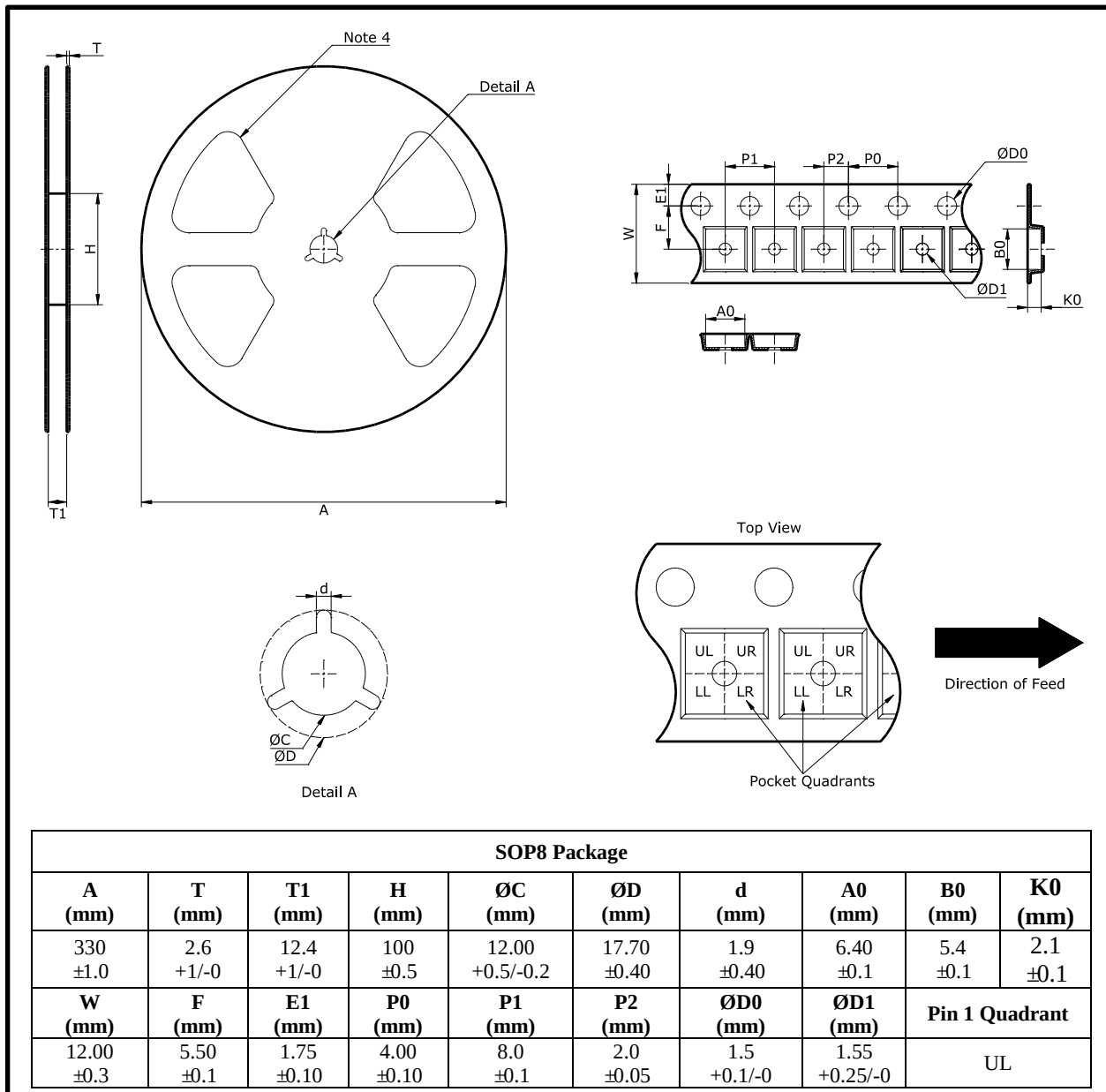
Symbol	Size	Min. (mm)	Max. (mm)	Symbol	Size	Min. (mm)	Max. (mm)
A		1.35	1.75	E		5.80	6.20
A1		0.050	0.250	E1		3.80	4.00
A2		1.350	1.550	e		1.270 (BSC)	
b		0.306	0.510	L		0.400	1.270
c		0.17	0.25	θ		0 °	8 °
D		4.70	5.10				

Top mark	Package
PN PN8309H YWWXXXXX	SOP8

Note: Y: Year Code; WW: Week Code; XXXXX: Internal Code

- Notes:
1. This drawing is subjected to change without notice.
 2. Body dimensions do not include mold flash or protrusion.

Tape and Reel Information



Notes:

1. This drawing is subjected to change without notice.
2. All dimensions are nominal and in mm.
3. This drawing is not in scale and for reference only. Customer can contact Chipown sales representative for further details.
4. The number of flange openings depends on the reel size and assembly site. This drawing shows an example only.

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