TNS8015PB

Non-synchronous Step-down Converter

Description

The TNS8015PB is a high voltage, non-synchronous step-down converter operates over a wide range input voltage 9V to 80V. The TNS8015PB integrates a 100V,400mΩ high-side MOSFET.

The TNS8015PB delivers 1.5A continuous load current with up to 95%efficiency. It operate with fixed frequency peak current control with built-in compensation eliminates the need for external components. Cycle-by-cycle current limit in high-side MOSFET protects the converter in an overload condition. Hiccup mode protection is triggered if the over-current condition has persisted for longer than the present time.

The TNS8015PB exhibits protection features that protect the load from faults like under-voltage, over-current and over-temperature.

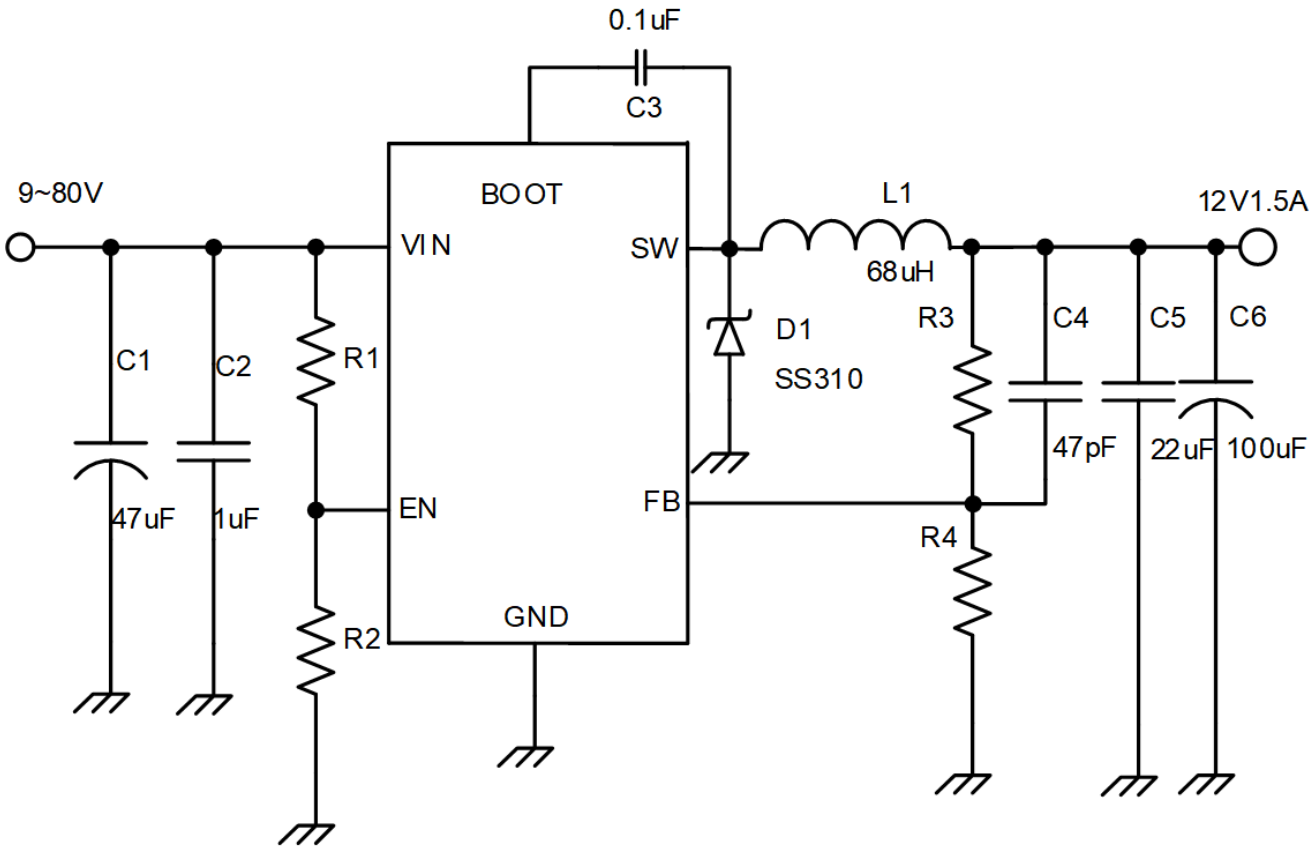
Features

- Input Voltage Range: 9V~80V
- Continuous Output Current: 1.5A
- Peak Efficiency: 95%
- Operating Quiescent Current: 400μA
- 100V,400mΩ high-side MOSFET
- Peak Current Mode Control
- Fixed Frequency: 150 kHz
- Internal Compensation for Ease of Use
- Up to 92% Duty Cycle
- 0.8V Voltage Reference
- 1μA Shutdown Current
- 3A Cycle-by-Cycle Current Limit
- 150ms Hiccup Mode Short Circuit Protection Function
- Thermal Shutdown Function
- ESOP-8 Package

Applications

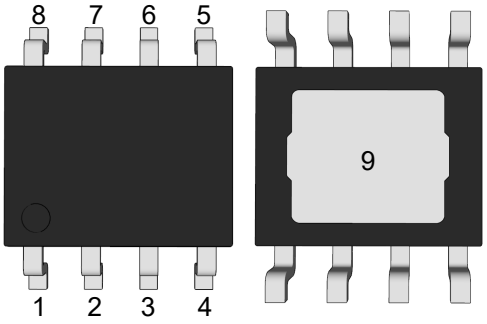
- Charger in Vehicle
- Battery Chargers
- Power Adapte

Typical Application Circuit



Pin Distribution

ESOP-8

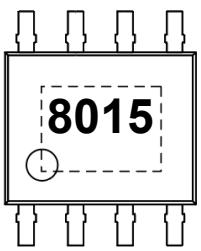


(Top View) **(Bottom View)**

Functional Pin Description

Pin	Name	Pin Function
1	EN	**Enable input.** Pull EN below the specified threshold to shut down the TNS8015PB. Pull EN above the specified threshold to enable the TNS8015PB.
2	VIN	**Input supply.** VIN supplies power to all of the internal control circuitries, both BOOT regulators, and the high-side switch.
3,4	GND	**Ground.** GND should be placed as close to the output capacitor as possible to avoid the high-current switch paths. Connect the exposed pad to GND plane for optimal thermal performance.
5	FB	**Feedback.** FB is the input to the voltage hysteretic comparators. The average FB voltage is maintained at 800mV by loop regulation.
6	NC	No Connection
7	BOOT	**Bootstrap.** BOOT is the positive power supply for the internal, floating, high-side MOSFET driver. Connect a bypass capacitor between BOOT and SW.
8	SW	**Switch node.** SW is the output from the high-side switch. A low forward voltage Schottky rectifier to ground is required. The rectifier must be placed close to SW to reduce switching spikes.

Ordering Information

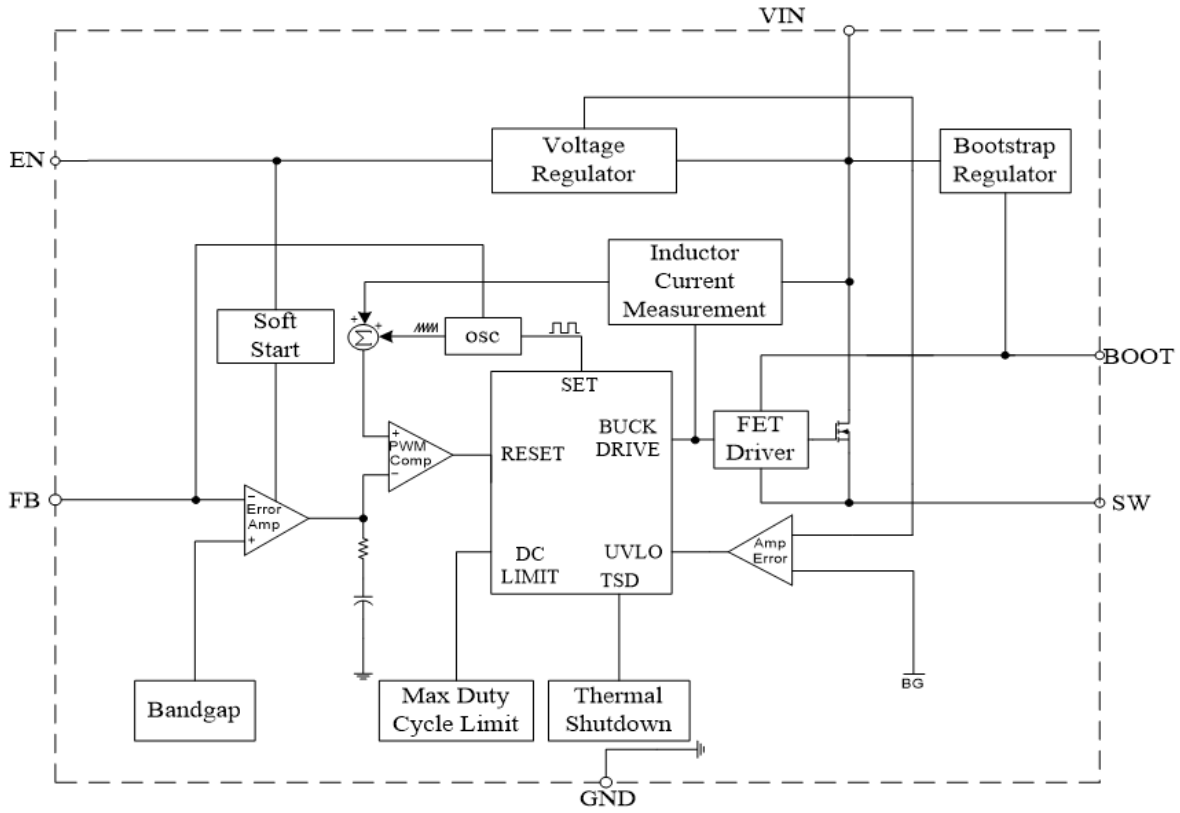
Orderable Device	Package	Reel (inch)	Package Qty (PCS)	Eco Plan [Note]	MSL Level	Marking Code
TNS8015PB	ESOP-8	13	4000	RoHS & Green	MSL3	

Note:

RoHS: TN defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials.

Green: TN defines "Green" to mean Halogen-Free and Antimony-Free.

Block Diagram



Absolute Maximum Ratings Note1

Ratings at 25℃ ambient temperature unless otherwise specified.

Parameter	Symbol	Value	Unit
SW，EN，VIN Voltage	V_{SW}, V_{EN}, V_{IN}	-0.3 ~ +105	V
FB Voltage	V_{FB}	-0.3 ~ +7	V
BOOT Voltage	V_{BOOT}	V_{SW}-0.3 ~ V_{SW}+7	V
Storage Temperature Range	T_{STG}	-55 ~ +150	°C
Lead Temperature	T_L	260°C, 10s	-
Human Body Model Voltage	V_{ESD}	2	kV

Note: 1. Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect.

Electrical Characteristics

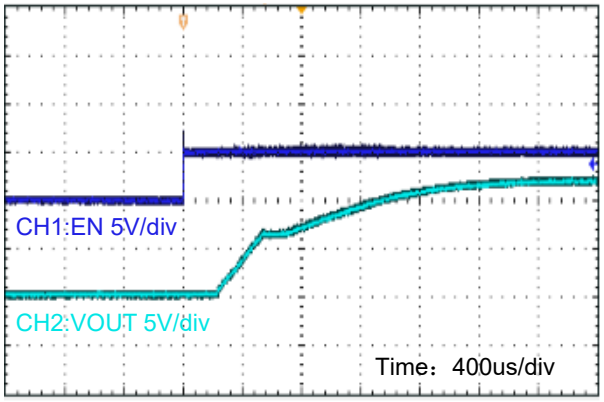
(V_{IN}=48V, V_{OUT}=12V, T_A=25℃ , unless otherwise noted.)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
VCC Supply Voltage						
Input Voltage	V_{IN}		9	--	80	V
UVLO	V_{STRAT}		--	8	--	V
UVLO Hysteresis	V_{UVLO1}		--	0.3	--	V
Shutdown Supply Current	I_{SHUT}	V_{EN}=0V	--	9	--	uA
Input Quiescent Current	I_Q	V_{FB}=1V	--	500	--	uA
Enable						
Enable Threshold Voltage	V_{EN}		--	2.2	--	V
Enable Threshold Voltage Hysteresis	V_{UVLO2}		--	0.2	--	V
Feedback						
FB Reference Threshold	V_{FB}		--	0.8	--	V
Feedback Short Voltage	$V_{FB(short)}$		--	0.35	--	V
Feedback Short Voltage Hysteresis	V_{FB2}		--	0.42	--	V
Oscillator						
Switching Frequency	F	I_{OUT}=500mA	--	150	--	kHz
Maximum Duty Cycle	D_{MAX}	V_{IN}=12V	--	92	--	%
Current Limit						
Current Limit Threshold	I_{PEAK}		--	3	--	A
High-Side MOSFET						
On-Resistance	R_{DSON}	V_{IN}=18V	--	400	--	mΩ
Thermal Shutdown						
Thermal Shutdown Temp	T_{SD}		--	150	--	°C
Thermal Shutdown Temp Hysteresis	T_{SH}		--	30	--	°C

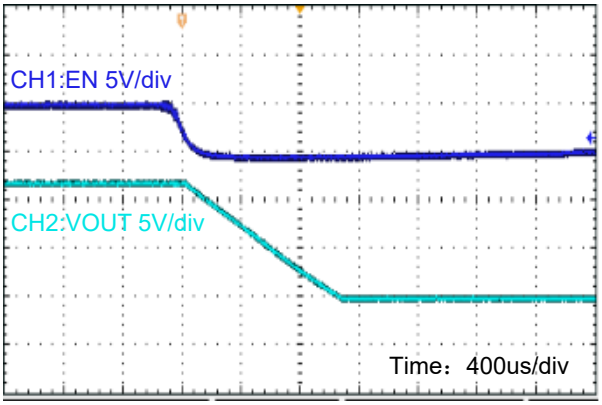
Typical Electrical Curves

(V_{IN}=48V, V_{OUT}=12V, T_A=25℃ , unless otherwise noted.)

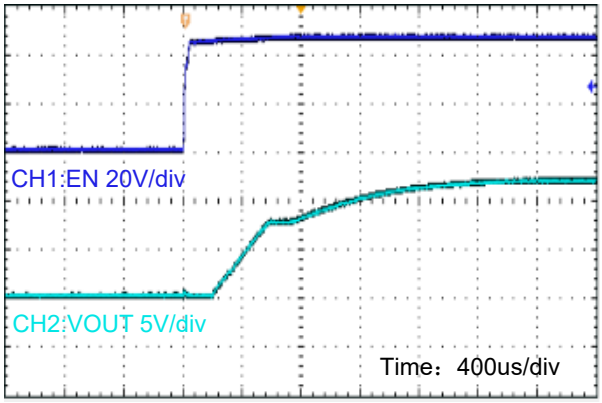
EN Start up (V_{IN}=48V V_{EN}=5V)



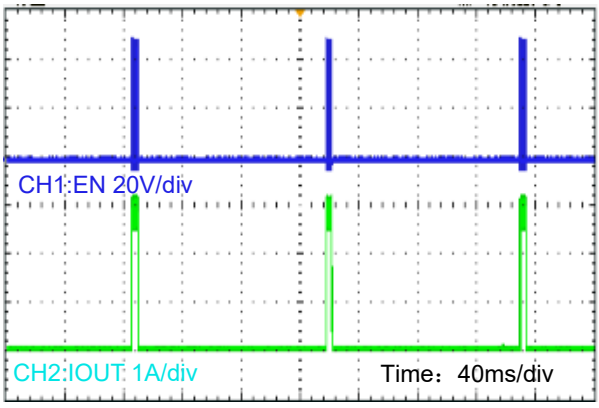
EN Turn off (V_{IN}=48V V_{EN}=5V)



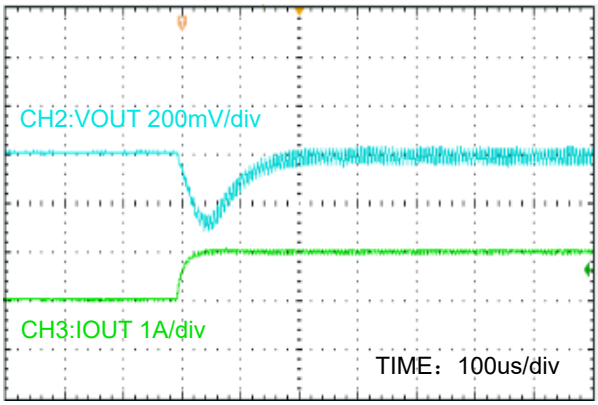
Start up (V_{IN}=48V I_{OUT}=0A)



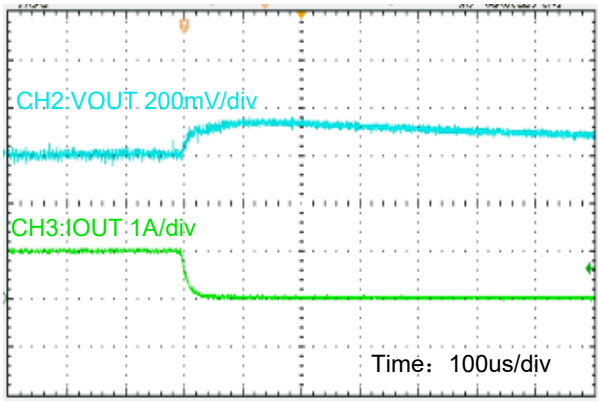
Start up (V_{IN}=48V I_{OUT}=1A)

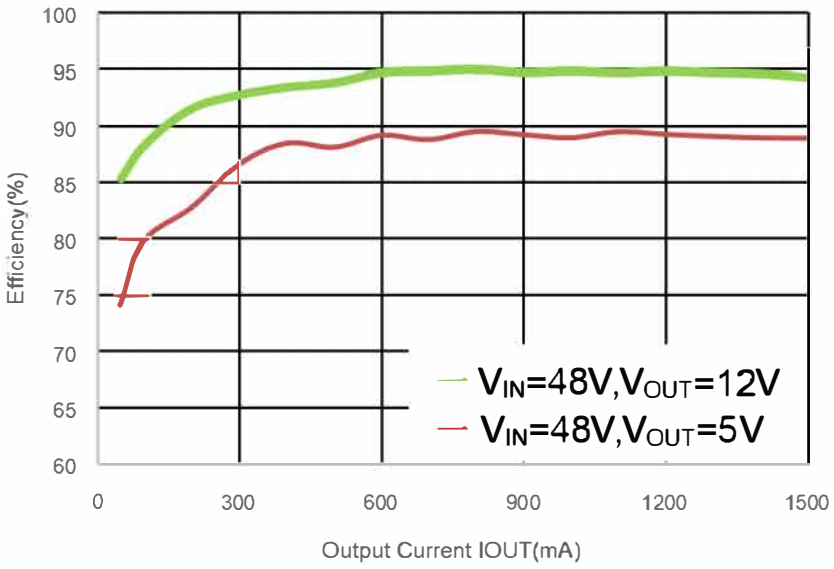


Load Transient (V_{IN}=48V I_{OUT}=10mA~1A)



Load Transient (V_{IN}=48V I_{OUT}=1A~10mA)

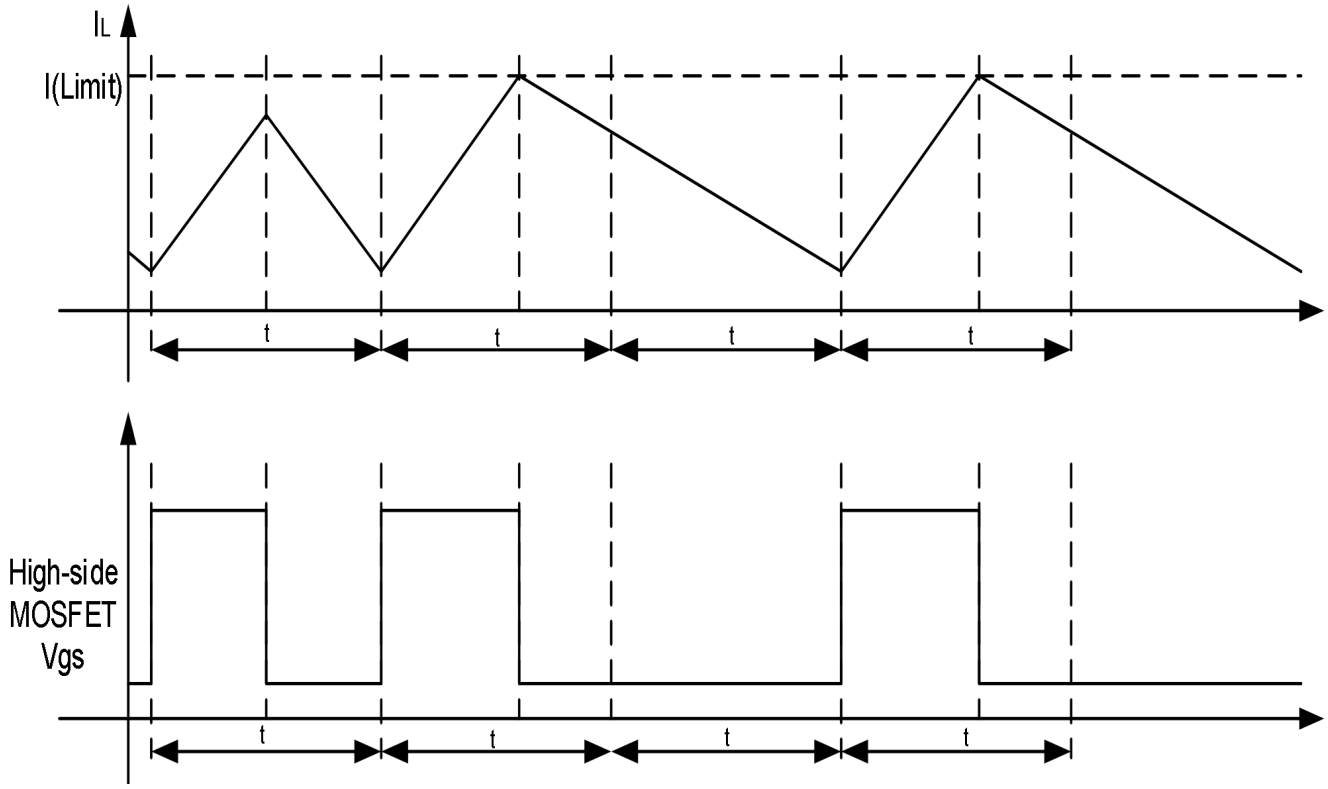




Application Information

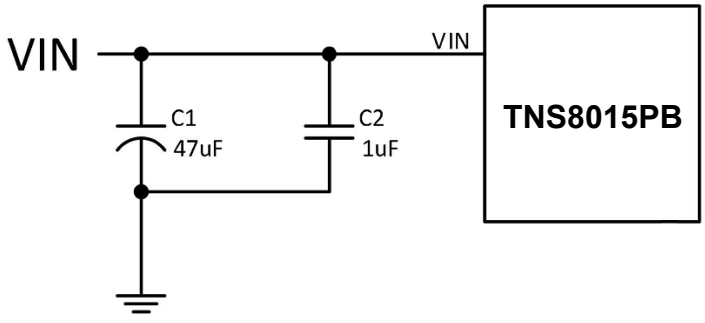
Overcurrent Protection

The TNS8015PB implements current-mode control which uses the internal COMP voltage to control the turn on and the turn off of the high-side MOSFET on a cycle-by-cycle basis.During each cycle,the switch current and the current reference generated by the internal COMP voltage are compared. When the peak switch current intersects the current reference the high-side switch turns off. Furthermore,if an output overload condition occurs for more than the hiccup wait time,which is programmed for 512 switching cycles,the device shuts down and restarts after the hiccup time of 16384 cycles. The hiccup mode helps to reduce the device power dissipation under severe overcurrent conditions.



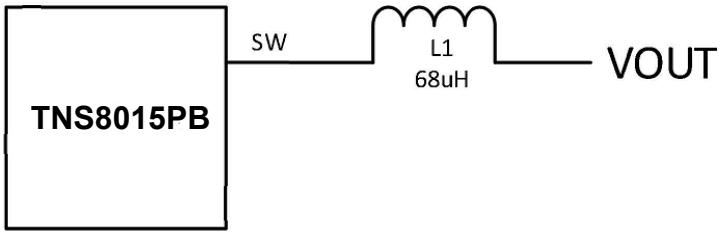
C1: This capacitor's purpose is to supply most of the switch current during the on-time, and limit the voltage ripple at VIN.To allow for the capacitor's tolerance, temperature effects, and voltage effects, a 47 µF, capacitor is used.

C2: This capacitor helps avoid supply voltage transients and ringing due to long lead inductance at VIN. A low ESR, 1µF ceramic chip capacitor is recommended, located close to the TNS8015PB.



The capacitor on the VIN

L1: The inductance is determined based on the switching frequency, load current, inductor ripple current, and the minimum and maximum input voltages designated VIN(min) and VIN(max), respectively. The peak inductor current during an overload condition is limited to 3 A nominal.Use the value of 68μH,5A to prevent saturation.



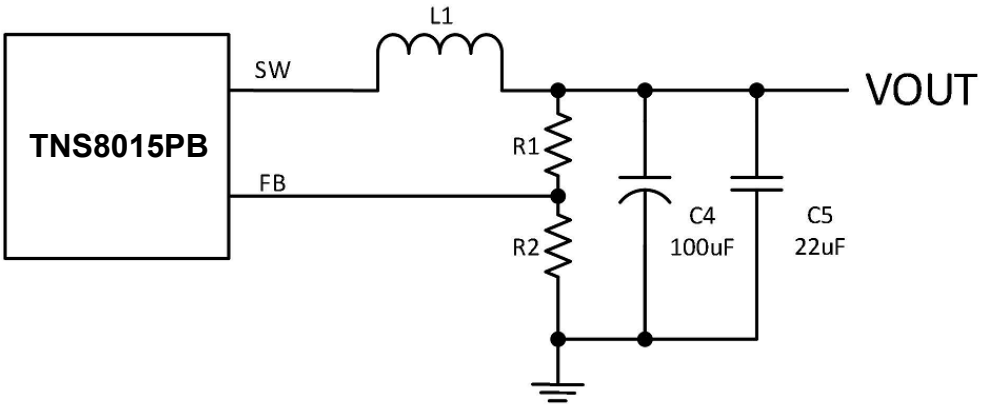
The inductor on the choice

D1:A power Schottky diode is recommended. Ultra-fast recovery diodes are not recommended as the high speed transitions at the SW pin may inadvertently affect the IC's operation through external or internal EMI. The important parameters are reverse recovery time and forward voltage. The reverse recovery time determines how long the reverse current surge lasts with each turn-on of the internal buck switch. The forward voltage drop affects efficiency. The diode's reverse voltage rating must be at least as great as the maximum input voltage, plus ripple and transients, and its current rating must be at least as great as the maximum current limit specification.

C4/C5: The output capacitor filters the inductor ripple current and provides a source of charge for transient load conditions. The best performance is typically obtained using ceramic or polymer electrolytic type components. Typical tradeoffs are that the ceramic capacitor provides extremely low ESR to reduce the output ripple voltage and noise spikes. In order to meet output ripple specification, we should choose a ceramic capacitor of 22uF and a polymer electrolytic capacitor of 100uF.

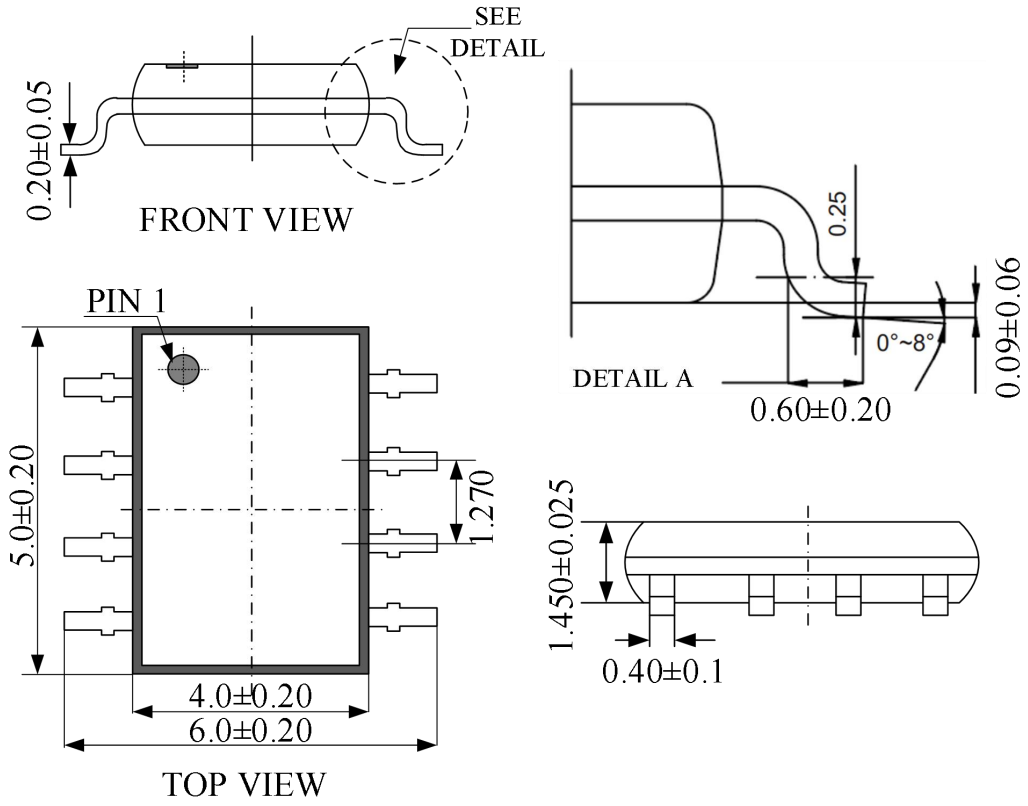
R1/R2: The output voltage (VOUT) is programmed by two external resistors as shown in the Figure15. The regulation point can be calculated as follows:

$$VOUT = 0.8 \times (R1 + R2) / R2$$



Output Capacitors and Output Configuration

Outline Drawing – SOP-8(Dimensions in mm)



Package Information

Package Type	Description	Quantity（pcs）	Standard
SOP-8	Reel -13″ tape	4000	EIA-481

Contact Information

TANI website: **http://www.tanisemi.com** Email:tani@tanisemi.com

For additional information, please contact your local Sales Representative.

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