TPS61291 支持旁路操作的低 Iq 升压转换器

1 特性

- 输入电压范围 0.9V 至 5V
- 启动电压 1.5V（20mA 负载时）
- 引脚可选输出电压：3.3V、3V、2.5V
- 旁路模式静态电流典型值 15nA
- 升压模式静态电流典型值 5.7μA
- 旁路开关从 VIN 到 VOUT
- V_{OUT} = 3.3V、V_{IN} = 1.8V 时 I_{OUT} > 200mA
- 内部反馈分压器断开连接（旁路模式）
- 受控旁路转换功能可防止反向电流流入电池
- 轻负载状态下的省电模式
- 过热保护
- 冗余过压保护
- 小型 2mm x 2mm 小外形尺寸无引线 (SON) 6 引脚封装

2 应用

- 测量（燃气表、水表、智能仪表）
- 遥控
- 住宅安保/家庭自动化
- 由单节 3V 锂锰电池或 2 节 1.5V 碱性电池供电的应用

3 说明

TPS61291 是引脚输出电压可选且支持集成旁路模式的升压转换器。 进行旁路操作时，该器件可提供从输入到系统的直接路径，并允许低功耗微控制器 (MCU)（如 MSP430）直接由单节 3V 锂锰电池或两节碱性电池供电运行。

在旁路模式下，用于升压模式操作的集成分压器网络将从输出端断开，并且静态电流消耗会降至仅为 15nA（典型值）。

在升压模式下，该器件可提供的最小输出电流为 200mA（V_{OUT} = 3.3V，V_{IN} = 1.8V）。 升压模式用于需要稳定的电源电压并且无法通过输入源直接操作的系统组件。 升压转换器基于使用同步整流的电流模式控制器，可实现最大效率，所消耗的输出电流典型值为 5.7uA。 升压转换器启动期间，将读取 VSEL 引脚并且集成反馈网络会将输出电压设为 2.5V、3V 或 3.3V。

旁路模式或升压模式操作都由系统通过 EN/BYP 引脚进行控制。

该器件集成有增强型旁路模式控制功能，可防止升压模式操作期间存储在输出电容中的电荷倒流至输入端并给电池充电。

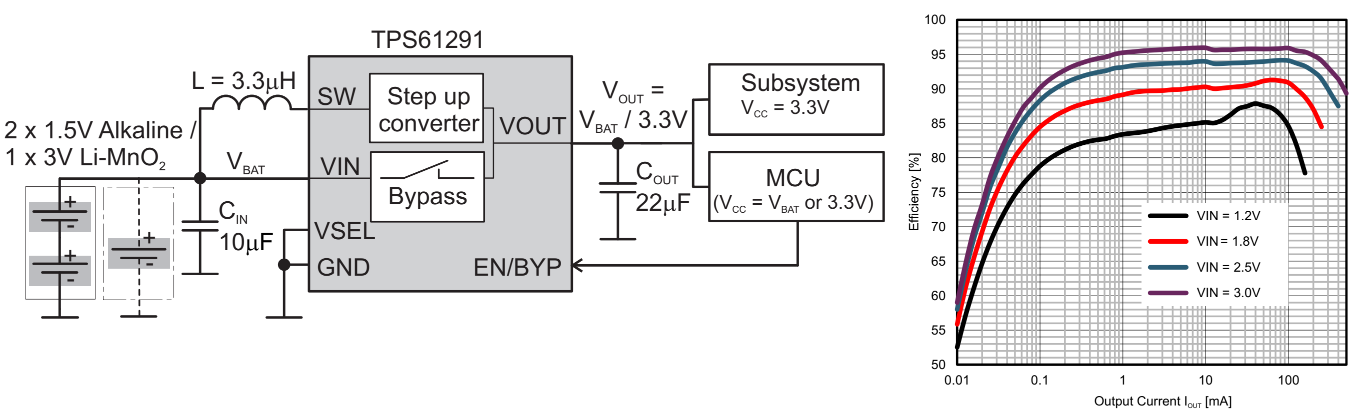
此器件采用小型 6 引脚 2.0mm × 2.0mm x 0.75mm SON 封装 (DRV)。

器件信息(1)

部件号	封装	封装尺寸（标称值）
TPS61291	SON (6)	2.00mm x 2.00mm

(1) 如需了解所有可用封装，请见数据表末尾的可订购产品附录。

简化电路原理图和效率曲线



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4 修订历史记录

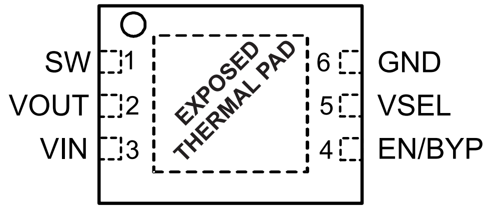
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (September 2014) to Revision A — **Page**

- Changed "Bypass Mode Operation" description 9
- Added sub-section "Controlled Transition into Bypass Mode" 9
- Added NOTE to the "Application and Implementation" section. 10
- Changed "List of Inductors" table 11

5 Pin Configuration and Functions

DRV Package
6 Pin
Top View



Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
SW	1	I	Switch node of the converter. Connect the inductor between this pin and the input capacitor C_{IN}.
VOUT	2	O	Boost converter output. Connect the output capacitor C_{OUT} between this pin and GND close to the device.
VIN	3	PWR	Input voltage supply pin for the boost converter. Connect the input capacitor C_{IN} between this pin and GND as close as possible to the device.
EN/BYP	4	I	Control pin of the device. A high level enables the boost mode operation. A low level disables the boost converter and enables bypass mode operation. EN/BYP must be actively terminated high or low. Usually, this pin is controlled by the MCU in the system.
VSEL	5	I	Output voltage selection pin. The logic level of this pin is read out during startup and internally latched. Connect this pin only to GND, VOUT, or leave it floating.
GND	6	PWR	Ground pin of the device.
EXPOSED THERMAL PAD		NC	Not electrically connected to the IC, but must be soldered to achieve specified thermal performance. Connect this pad to the GND pin and use it as a central GND plane.

Output Voltage Setting

EN/BYP Pin	VSEL Pin at Startup	V_{OUT}	Mode
high	GND	3.3V	Boost Mode Operation
high	VOUT	3.0V	
high	floating	2.5V	
low	GND / VOUT / floating	$V_{OUT} = V_{IN}$ (Bypass Mode)	Bypass Mode Operation

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) (1)

		MIN	MAX	UNIT
Pin Voltage Range (2)	VIN	-0.3	5.5	V
	SW	-0.3	7	
	EN/BYP, VOUT	-0.3	5.5	
	VSEL	-0.3	VOUT + 0.3V	
Output Current	In Bypass Operation (EN/BYP = GND)		250	mA
T_J	Maximum Junction Temperature	-40	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) All voltage values are with respect to network ground terminal GND.

6.2 Handling Ratings

			MIN	MAX	UNIT
T_{stg}	Storage temperature range		–65	150	°C
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM) per ANSI/ESDA/JEDEC JS-001, all pins(1)	-2	2	kV
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins(2)	-0.5	0.5	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

		MIN	NOM	MAX	UNIT
V_{IN}	Supply voltage for startup	1.5			V
	Supply voltage range (once device has started)	0.9		5	
	Supply voltage range for step up conversion (once device has started)	0.9		V_{OUT}	
T_A	Operating ambient temperature	-40		85	°C
T_J	Operating junction temperature	–40		125	

6.4 Thermal Information

THERMAL METRIC(1)		TPS61291 DRV (2x2 SON) 6 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	71.2	°C/W
$R_{\theta JCtop}$	Junction-to-case (top) thermal resistance	93.5	
$R_{\theta JB}$	Junction-to-board thermal resistance	46.7	
ψ_{JT}	Junction-to-top characterization parameter	2.5	
ψ_{JB}	Junction-to-board characterization parameter	41.1	
$R_{\theta JCbot}$	Junction-to-case (bottom) thermal resistance	11.1	

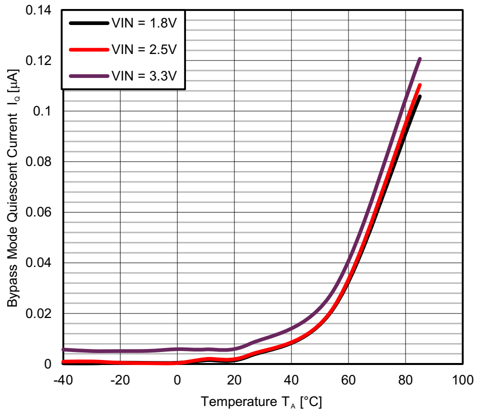
(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.

6.5 Electrical Characteristics

T_A = –40°C to 85°C. Typical values are at T_A = 25°C (unless otherwise noted)

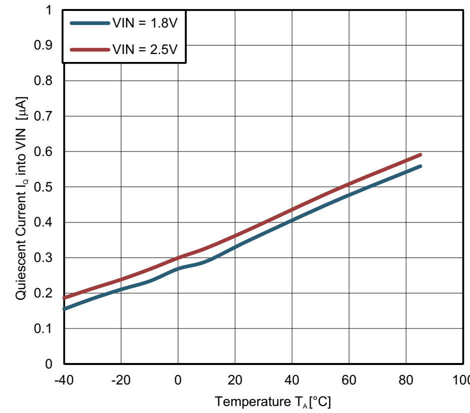
PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
SUPPLY							
V_{IN}	Startup voltage		V_{OUT} = 3.3V, I_{OUT} = 20mA			1.5	V
	Input voltage range		Operating voltage range	0.9		5	
I_Q	Quiescent current in boost mode	VIN	I_{OUT} = 0 mA, $V_{EN/BYP}$ = V_{IN} = 1.8 V, V_{OUT} = 3.3V, device not switching		0.4	1.5	µA
		VOUT			5.7	9	
	Quiescent current in bypass mode	VIN	$V_{EN/BYP}$ = low, V_{IN} = 3 V, I_{OUT} = 0 mA		0.015	0.5	
I_{LkSW}	Leakage current into SW		$V_{EN/BYP}$ = low, V_{IN} = 1.2 V, V_{SW} = 1.2 V		0.01	0.5	µA
V_{UVLO}	Undervoltage lockout threshold		V_{IN} decreasing		0.65	0.9	V
	Overtemperature protection		T_J rising		140		°C
	Overtemperature hysteresis				20		°C
INPUTS							
I_{IN}	EN/BYP, input current		EN/BYP = low or EN/BYP = V_{IN}		0.01	0.1	µA
V_{IL}	EN/BYP, input low voltage		V_{IN} ≤ 1.5 V			0.2 × V_{IN}	V
			5 V > V_{IN} > 1.5 V			0.3	
V_{IH}	EN/BYP, input high voltage		V_{IN} ≤ 1.5 V	0.8 × V_{IN}			V
			5 V > V_{IN} > 1.5 V	1.2			
V_{IL}	VSEL, input low voltage		$V_{EN/BYP}$ = high			0.3	V
V_{IH}	VSEL, input high voltage		$V_{EN/BYP}$ = high	V_{OUT} - 0.3			V
I_{IN}	VSEL, input current		$V_{EN/BYP}$ = high, VSEL = VOUT = 3V		0.01	0.1	µA
POWER SWITCHES							
$R_{DS(ON)}$	Rectifying switch on resistance		V_{OUT} = 3.3 V		0.6		Ω
	Main switch on resistance		V_{OUT} = 3.3 V		0.4		Ω
	Bypass switch on resistance		V_{IN} = 1.8V, I_{OUT} = 50 mA, EN/BYP = low		1.2		Ω
I_{SW}	Switch current limit		V_{OUT} = 3.3V	700	1000	1300	mA
OUTPUT							
V_{OUT}	Output voltage accuracy		V_{IN} = 1.8V, I_{OUT} = 10 mA, V_{OUT} 3.3V, 3.0V, 2.5V, EN/BYP = high	-2	+1	+4	%
	Line regulation		V_{OUT} = 3.3V, V_{IN} = 2V to 3.0V, I_{OUT} = 50 mA, EN/BYP = high		+0.15		%/V
	Load regulation		V_{IN} = 2V, V_{OUT} = 3.3V, I_{OUT} = 1 mA to 200 mA, EN/BYP = high		-0.007		%/mA
V_{OVP}	Output overvoltage protection		V_{OUT} rising, EN/BYP = high		5.4		V

6.6 Typical Characteristics



EN/BYP = low VSEL = low IOUT = 0mA

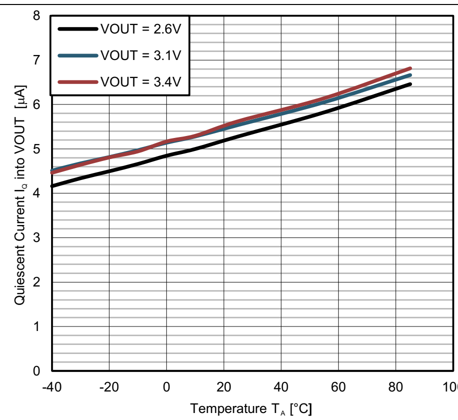
Figure 1. Quiescent Current I_Q into VIN Pin in Bypass Mode



EN/BYP = high

Boost mode operation
Device not switching

Figure 2. Quiescent Current I_Q into VIN Pin in Boost Mode



EN/BYP = high
IOUT = 0mA

Boost mode operation
Device not switching

Figure 3. Quiescent Current I_Q into VOUT Pin in Boost Mode

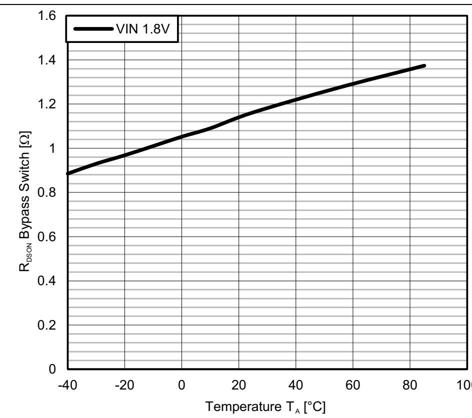
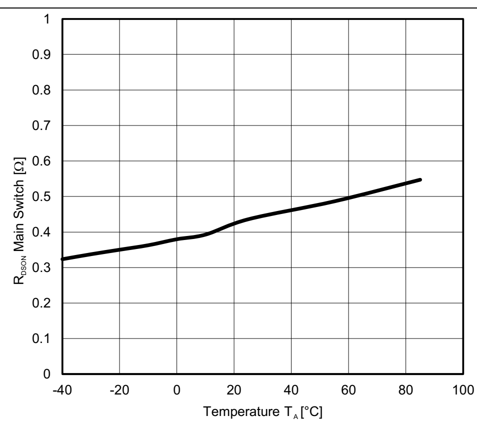
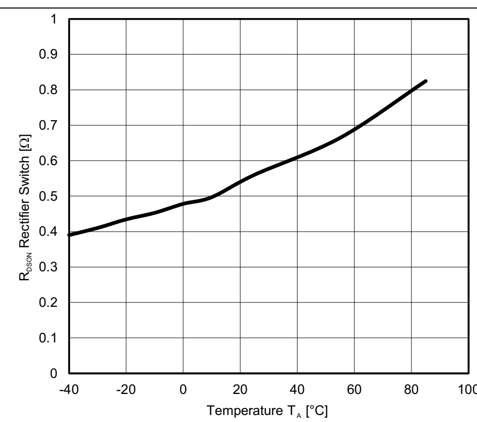


Figure 4. R_{DSON} Bypass Switch



VOUT = 3.3V

Figure 5. R_{DSON} Main Switch



VOUT = 3.3V

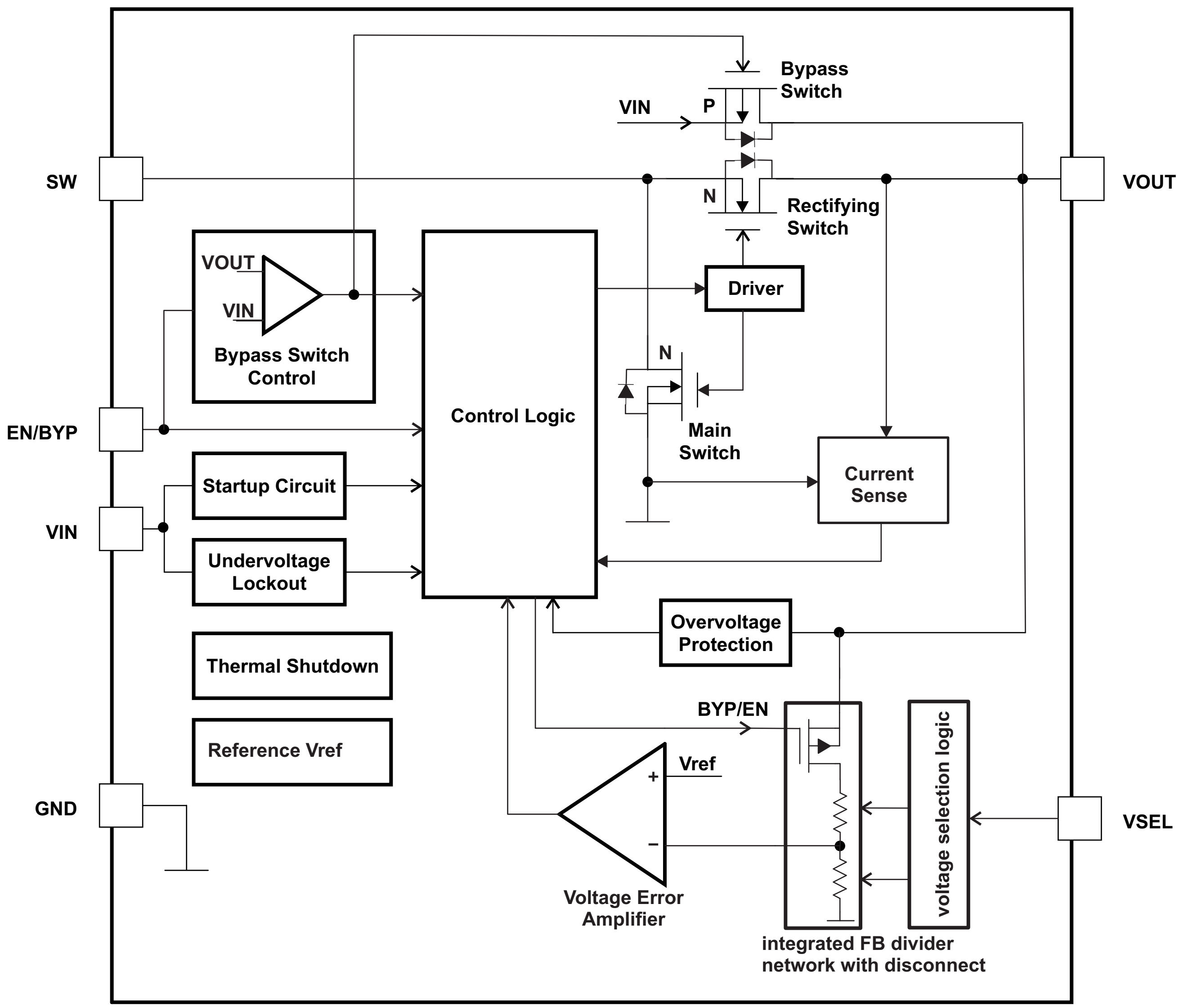
Figure 6. R_{DSON} Rectifier Switch

7 Detailed Description

7.1 Overview

The TPS61291 provides two operating modes: high efficiency boost mode to generate an output voltage higher than the input voltage and bypass mode, which connects the output of the device directly to the input.

7.2 Functional Block Diagram



7.3 Feature Description

7.3.1 Bypass / Boost Mode Operation EN/BYP

The EN/BYP pin selects the operating mode of the device. With the EN/BYP pin pulled low, the device operates in bypass mode. With a high level on the EN/BYP pin, the device operates as a boost converter. The EN/BYP pin is usually controlled by an I/O pin of a MCU, powered from the output of the TPS61291 and should not be left floating. See Figure 8. See also sections Boost Mode Operation and Bypass Mode Operation for more detailed descriptions.

Feature Description (continued)

7.3.2 Output Voltage Selection VSEL

In boost mode operation, the device supports three internally set output voltages: 2.5V, 3V and 3.3V. Leaving the VSEL pin open sets the output voltage to 2.5V, VSEL = VOUT to 3.0V and VSEL= GND to 3.3V. The VSEL pin condition is detected during the startup of the boost converter and internally latched. For proper operation, it must be connected to either GND, VOUT or left floating. Depending on the VSEL condition, an integrated feedback divider network is selected. Changing the VSEL pin condition during operation does not change the output voltage.

7.3.3 Feedback Divider Disconnect

In boost mode operation, the integrated feedback divider network, which is required for regulation, is connected to the VOUT pin. To achieve the low quiescent current in bypass mode, the integrated feedback divider network is disconnected from the output pin VOUT.

7.3.4 Undervoltage Lockout

An undervoltage lockout function stops the operation of the boost converter if the input voltage drops below the undervoltage lockout threshold. This function is implemented in order to prevent malfunction of the boost converter. The undervoltage lockout function has no control of the bypass switch.

7.3.5 Overtemperature Protection

The device has a built-in temperature sensor which monitors the internal junction temperature in boost mode operation. If the junction temperature exceeds the threshold (140 °C typical), the device stops operating. As soon as the junction temperature has decreased below the programmed threshold, it starts operating again. There is a built-in hysteresis to avoid unstable operation at IC temperatures at the overtemperature threshold. The overtemperature protection is not active in bypass mode operation.

7.3.6 Overvoltage Protection

In boost mode operation (EB/BYP = high), the device features a redundant over voltage protection circuit (OVP), which is independent from the reference, the regulation loop and feedback divider network. The redundant over voltage protection circuit limits the output voltage to typically 5.4V. The over voltage protection can only limit the output voltage in boost mode operation, when the input voltage V_{IN} is smaller than the output voltage V_{OUT}.

7.4 Device Functional Modes

7.4.1 Boost Mode Operation

The device is enabled and operates in boost mode operation when the EN/BYP pin is set high. The bypass switch is turned off once the boost converter has started switching.

In boost mode operation, the device is controlled by a hysteretic current mode controller. This controller regulates the output voltage by keeping the inductor ripple current constant in the range of 300 mA and adjusting the offset of this inductor current depending on the output load. If the required average input current is lower than the average inductor current defined by this constant ripple, the inductor current goes discontinuous to keep the efficiency high at low load conditions. To achieve high efficiency, the power stage is realized as a synchronous boost topology.

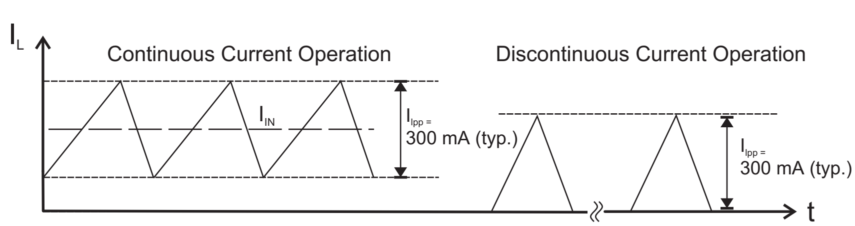


Figure 7. Hysteretic Current Operation

Device Functional Modes (continued)

The output voltage V_{OUT} is monitored via the integrated feedback network which is connected to the voltage error amplifier. To regulate the output voltage, the voltage error amplifier compares this feedback voltage to the internal voltage reference and adjusts the required offset of the inductor current accordingly.

The hysteretic current mode architecture allows fast response to load variations.

7.4.2 Bypass Mode Operation

The TPS61291 includes a P-channel MOSFET (Bypass Switch) between the VIN and VOUT pins. When the IC is disabled (EN/BYP = low), bypass mode is activated to provide a direct, low impedance connection from the input voltage (at the VIN pin) to the load (V_{OUT}). The bypass switch is not impacted by undervoltage lockout, or thermal shutdown. The bypass switch is not current-limit controlled. In bypass operation, the OVP circuit is disabled.

7.4.3 Controlled Transition into Bypass Mode

When changing from boost mode into bypass mode, the output capacitor is usually charged up to a higher voltage than the battery voltage V_{BAT}. In order to prevent current flowing from the output capacitor C_{OUT} via the bypass switch into the battery (reverse battery current), the internal bypass control circuit delays the bypass switch activation until the output voltage V_{OUT} has decreased to the input voltage level.

7.4.4 Operation at Output Overload

If the peak inductor current reaches the internal switch current limit threshold in boost mode operation, the main switch is turned off to stop a further increase of the input current. In this case the output voltage will decrease since the device cannot provide sufficient power to maintain the set output voltage. If the output voltage drops below the input voltage, the backgate diode of the rectifying switch gets forward biased and current starts to flow through it. Because this diode cannot be turned off, the load current is only limited by the remaining DC resistance. As soon as the overload condition is removed, the converter automatically resumes normal operation and enters the appropriate soft start mode depending on the operating conditions.

7.4.5 Startup

After the EN/BYP pin is tied high, the device starts to operate. If the input voltage is not high enough to supply the control circuit properly, a startup oscillator starts to operate the switches. During this phase, the switching frequency is controlled by the oscillator and the switch current is limited. As soon as the device has built up the output voltage to about 1.8 V, high enough for supplying the control circuit, the device switches to its normal hysteretic current mode operation.

8 Applications and Implementation

NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

8.1 Application Information

The TPS61291 is a boost converter with pin selectable output voltages and an integrated bypass mode. In bypass operation, the device provides a direct path from the input to the system and allows a low power micro controller (MCU) to operate directly from a single 3V Li-MnO2 battery or dual alkaline battery cells. In bypass mode, the quiescent current consumption is typically only 15nA and supports low power modes of MCUs such as the MSP430. In boost mode operation, the device provides a regulated output voltage (e.g. 3.3V) to supply circuits which require a higher voltage than provided by the battery. See Figure 8.

The device also extends battery life in applications which can run partially directly from the battery, but need a boost conversion to maintain sufficient system voltage when the battery voltage drops due to discharge. In this case, the system runs off the battery in bypass mode operation until the battery voltage trips the minimum system operating voltage. Then the system turns on the boost converter, providing a sufficient output voltage down to the cut off voltage of the battery. See Figure 9 and Figure 26.

8.2 Typical Application

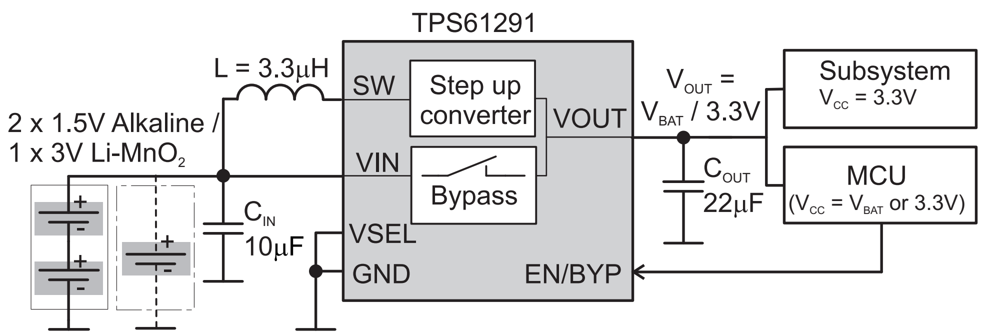


Figure 8. Typical Application Circuit with Regulated 3.3V VOUT / VBAT

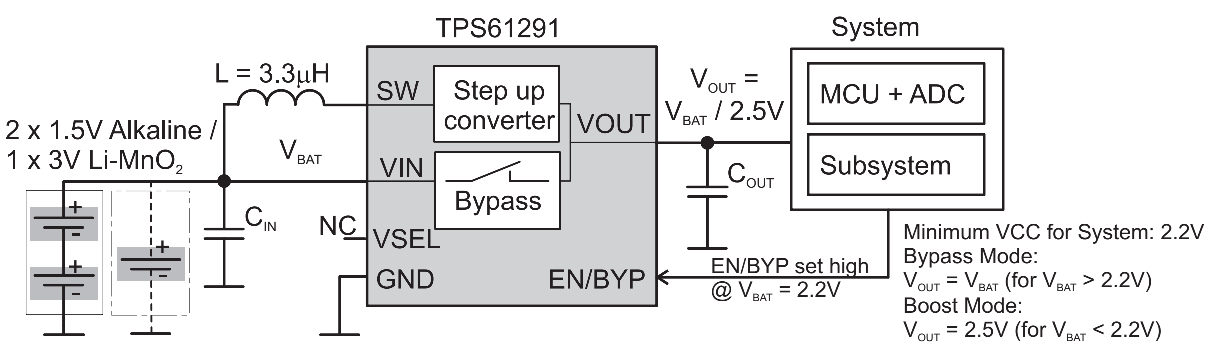


Figure 9. Bypass Mode / Boost Mode Operation to Maintain Sufficient System Voltage

8.2.1 Design Requirements

The TPS61291 is a highly integrated boost converter. The output voltage is set internally via a VSEL pin without any additional components. For operation, only an input capacitor, output capacitor, and an inductor are required. Table 1 shows the components used for the application characteristic curves.

Typical Application (continued)

Table 1. Components for Application Characteristic Curves[1]

Reference	Description	Value	Manufacturer	
TPS61291	Low Iq Boost Converter with Bypass Operation		Texas Instruments	
C_{IN}	Input capacitor	10µF	Murata	GRM219R61A106KE44D
C_{OUT}	Output capacitor	22µF	Murata	GRM21BR60J226ME39L
L	Inductor	3.3µH	Coilcraft	LPS3314 3R3

(1) See the Third-Party Products Disclaimer in the Device Support section.

8.2.2 Detailed Design Procedure

The external components have to fulfill the needs of the application but also the stability criteria of the device's control loop. The TPS61291 is optimized to work within a range of L and C combinations. The LC output filter inductance and capacitance must be considered together. The output capacitor sets the corner frequency of the converter while the inductor creates a Right-Half-Plane-Zero degrading the stability of the converter. Consequently with a larger inductor a bigger capacitor has to be used to guarantee a stable loop. Table 2 shows the output filter component selection.

Table 2. Recommended LC Output Filter Combinations

Output voltage [V]	Inductor value [µH][1]	Output capacitor value [µF][2]		
		22	22 + 10	2 x 22
3.3 / 3.0	3.3	√[3]	√	√
	4.7			√
2.5	2.2	√	√	√
	3.3		√[3]	√

(1) Inductor tolerance and current de-rating is anticipated. The effective inductance can vary by 20% and -30%.
(2) Capacitance tolerance and bias voltage de-rating is anticipated. The effective capacitance can vary by 20% and -50%.
(3) This LC combination is the standard value and recommended for most applications.

8.2.2.1 Inductor Selection

The device is optimized to operate with a 3.3µH inductor value. Other inductor values can be used, per Table 2. The maximum inductor current can be approximated by the I_{LMAX}, from Equation 1. For proper operation, the inductor needs to be rated for a saturation current which is higher than the switch current limit of typically 1A. Table 3 lists inductors that have been tested with the TPS61291.

$$I_{L\,max} := \frac{V_{OUT} \times I_{OUT}}{0.8 \times V_{IN}} + 150\ \text{mA} \quad \text{continuous current operation}$$

$$I_{L\,max} := 300\ \text{mA} \quad \text{discontinuous current operation} \tag{1}$$

Table 3. List of Inductors[1]

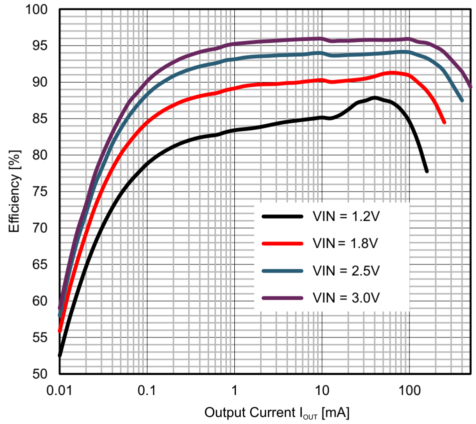
INDUCTANCE	DIMENSIONS [mm³]	TYPE	SUPPLIER
3.3	3.3 x 3.3 x 1.3	LPS3314	Coilcraft
3.3	2.95 x 2.95 x 1.4	LPS3015	
3.3	3 x 2.5 x 1.5	VLF302515	TDK
3.3	2 x 2 x 1.2	MDMK2020T3R3M	Taiyo Yuden
3.3	2.5 x 2.0 x 1.2	DFE252012	Toko
3.3	3.0 x 3.0 x 1.5	74438335033	Würth

(1) See the Third-Party Products Disclaimer in the Device Support section.

8.2.2.2 Input and Output Capacitor Selection

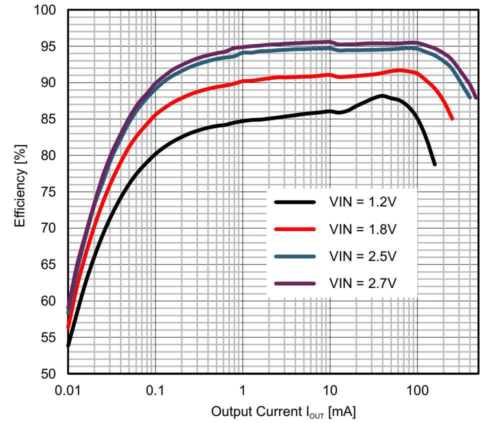
For best output and input voltage filtering, low ESR X5R or X7R ceramic capacitors are recommended. The input capacitor minimizes input voltage ripple, suppresses input voltage spikes and provides a stable system rail for the device. At least a 10μF or larger input capacitor is recommended for operation. In applications in which the power source (e.g. certain battery chemistries) shows an internal resistance characteristic, a larger input capacitor might be used to buffer the supply voltage for the TPS61291. The recommended typical output capacitor value is 22 μF and can vary as outlined in the output filter selection Table 2.

8.2.3 Application Curves



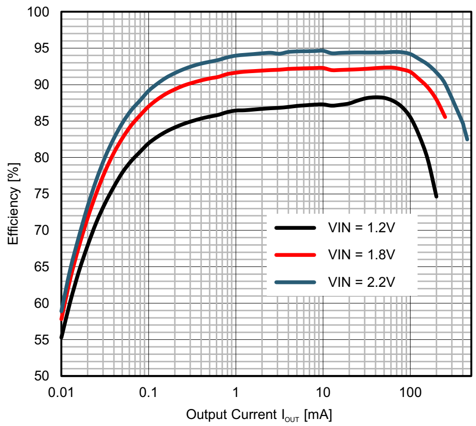
EN/BYP = high L = 3.3µH VSEL = GND

Figure 10. Efficiency vs I_{OUT}, V_{OUT} = 3.3V



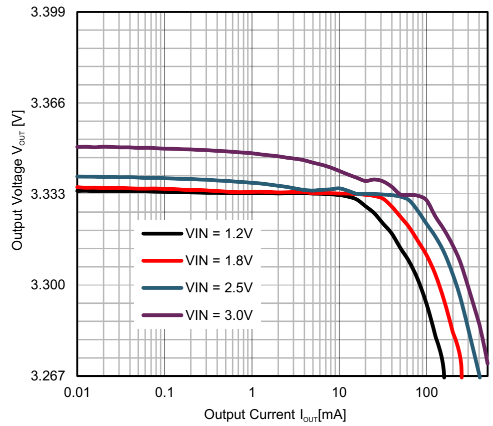
EN/BYP = high L = 3.3µH VSEL = VOUT

Figure 11. Efficiency vs I_{OUT}, V_{OUT} = 3.0V



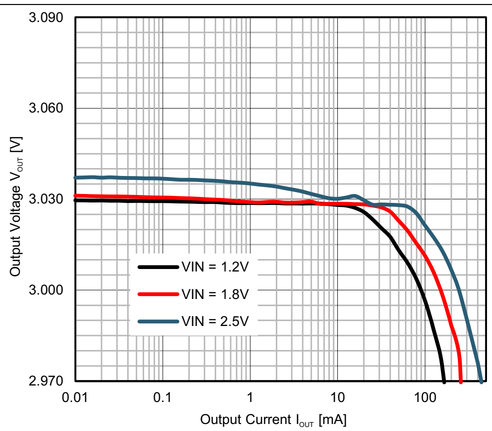
EN/BYP = high L = 3.3µH VSEL = open

Figure 12. Efficiency vs I_{OUT}, V_{OUT} = 2.5V



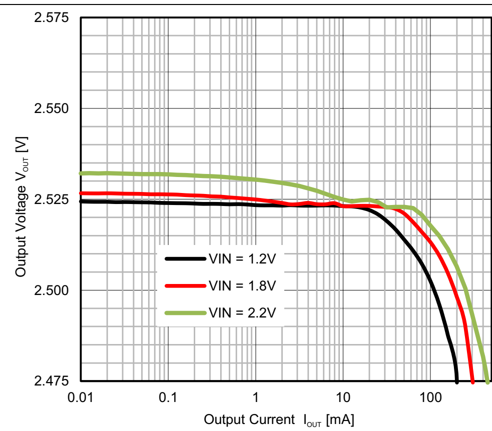
EN/BYP = high L = 3.3µH VSEL = GND

Figure 13. Output Voltage vs Output Current VOUT = 3.3V



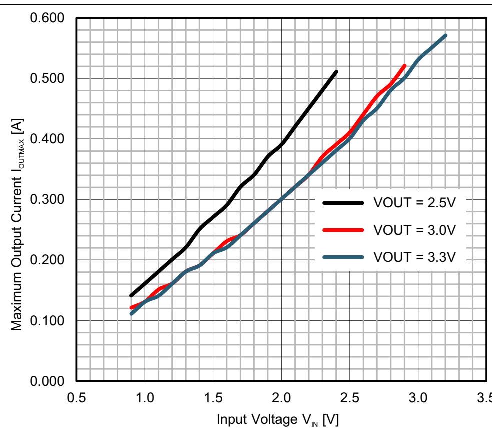
EN/BYP = high L = 3.3µH VSEL = VOUT

Figure 14. Output Voltage vs Output Current VOUT = 3.0V



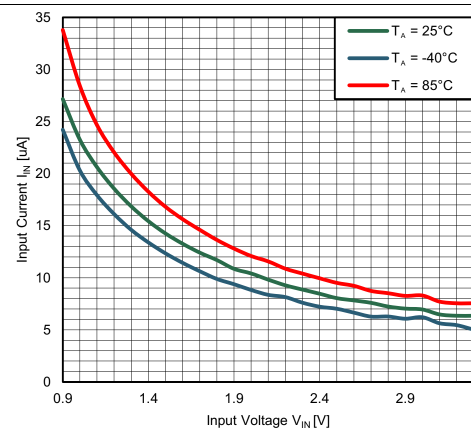
EN/BYP = high L = 3.3µH VSEL = open

Figure 15. Output Voltage vs Output Current VOUT = 2.5V



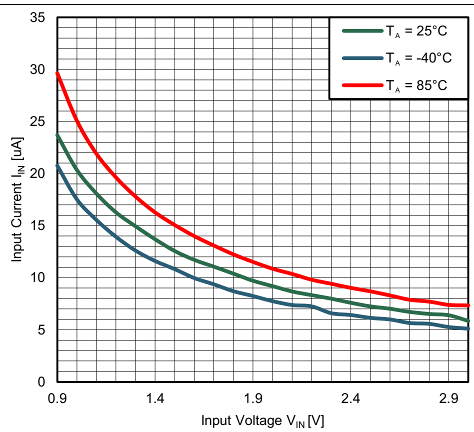
EN/BYP = high
L = 3.3µH
I_{SW} = 1000mA (typical)
Boost mode operation

Figure 16. Maximum Output Current



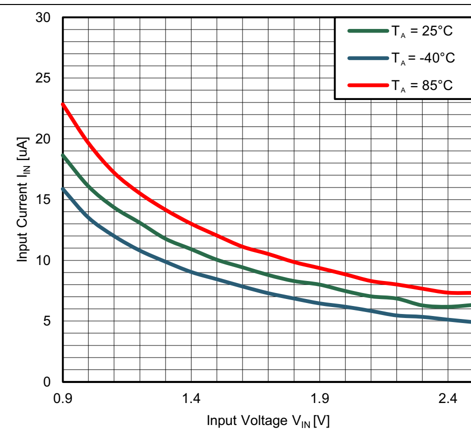
V_{OUT} = 3.3 V
I_{OUT} = 0 mA
L = 3.3 µH
C_{OUT} = 22 µF
Device switching

Figure 17. Supply Current vs. V_{IN}, V_{OUT} = 3.3V, I_{OUT} = 0mA



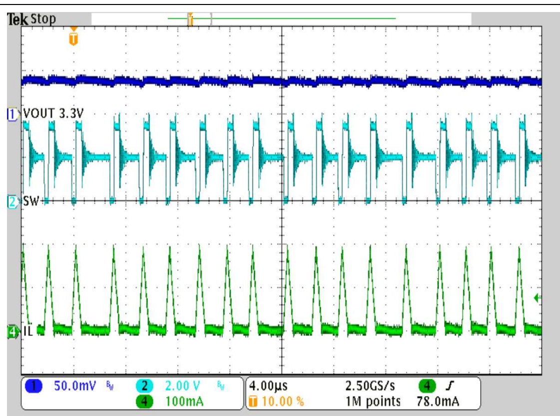
V_{OUT} = 3.0 V
I_{OUT} = 0 mA
L = 3.3 µH
C_{OUT} = 22 µF
Device switching

Figure 18. Supply Current vs. V_{IN}, V_{OUT} = 3.0V, I_{OUT} = 0mA



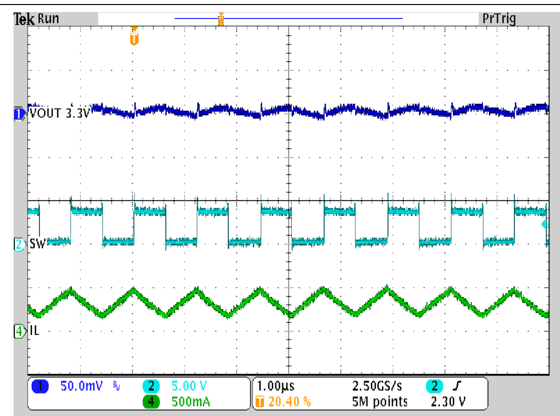
V_{OUT} = 2.5 V
I_{OUT} = 0 mA
L = 3.3 µH
C_{OUT} = 22 µF
Device switching

Figure 19. Supply Current vs. V_{IN}, V_{OUT} = 2.5V, I_{OUT} = 0mA



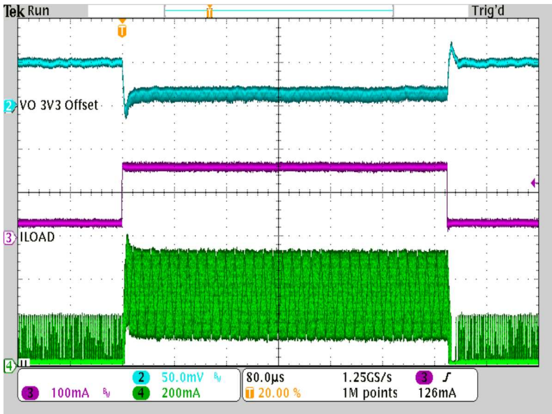
V_{IN} = 2.0 V
V_{OUT} = 3.3 V
L = 3.3 µH
I_{OUT} = 15mA
C_{OUT} = 22 µF
VSEL = GND
EN/BYP = high

Figure 20. Discontinuous Conduction Mode Operation, V_{OUT} = 3.3V



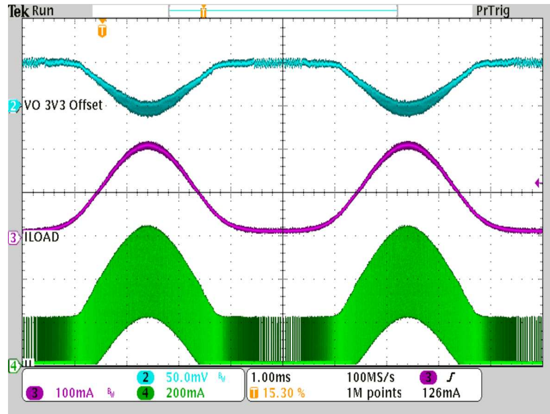
V_{IN} = 1.8 V
V_{OUT} = 3.3 V
VSEL = GND
L = 3.3 µH
C_{OUT} = 22 µF
I_{OUT} = 150 mA
EN/BYP = high

Figure 21. Continuous Conduction Mode Operation, V_{OUT} = 3.3V



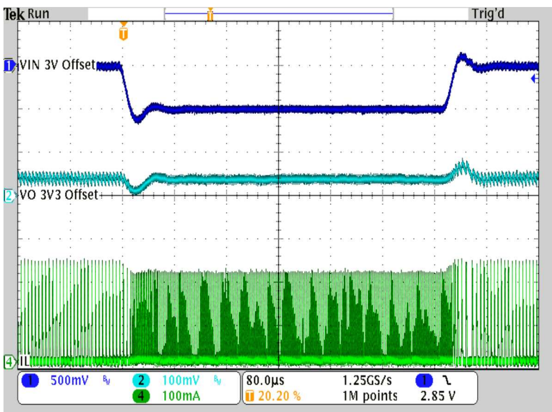
V_{IN} = 1.8V L = 3.3µH C_{OUT} = 22 µF
V_{OUT} = 3.3V VSEL = GND
ILOAD 20mA /150mA

Figure 22. Load Transient Response



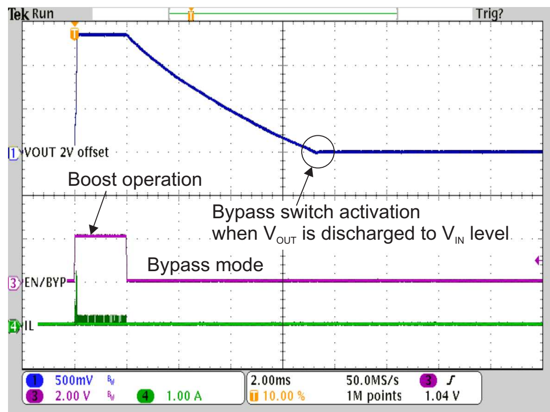
V_{IN} = 1.8V L = 3.3µH C_{OUT} = 22 µF
V_{OUT} = 3.3V VSEL = GND
ILOAD 1mA/200mA

Figure 23. AC Load Sweep



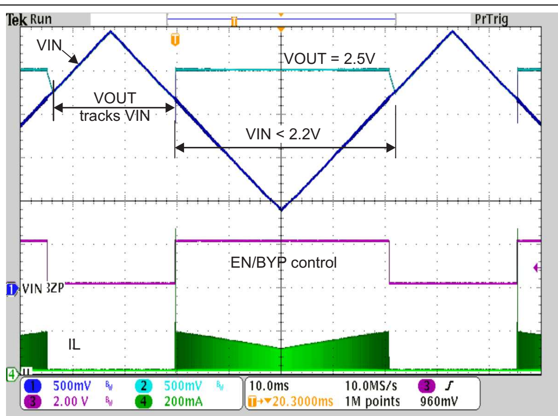
V_{IN} = 2.5V/3V L = 3.3µH C_{OUT} = 22 µF
V_{OUT} = 3.3V VSEL = GND Load =100Ω

Figure 24. Line Transient Response



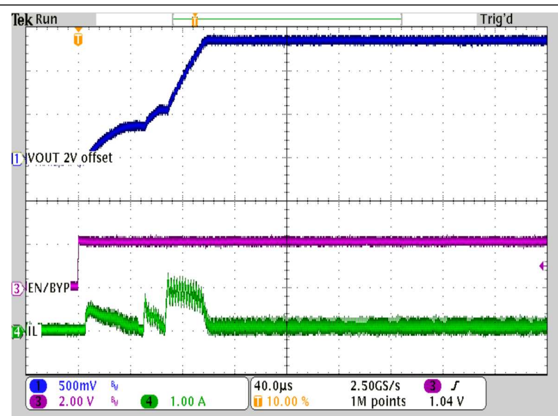
V_{IN} = 2.0V L = 3.3µH C_{OUT} = 22 µF
V_{OUT} = 3.3V VSEL = GND R_{LOAD} = 1kΩ

Figure 25. Boost Mode / Bypass Mode Transition



V_{IN} = 0.9V to 3V VSEL = Open ILOAD = 5mA
V_{OUT} = 2.5V EN/BYP externally controlled
Bypass / Boost mode operation

Figure 26. Bypass / Boost Mode Operation



V_{IN} = 2.0V L = 3.3µH C_{OUT} = 22 µF
V_{OUT} = 3.3V VSEL = GND R_{LOAD} = 100Ω

Figure 27. Startup in Boost Mode

9 Power Supply Recommendations

The input power supply needs to have a current rating according to the supply voltage, output voltage and output current of the TPS61291.

10 Layout

10.1 Layout Guidelines

As for all switching power supplies, the layout is an important step in the design. Care must be taken in board layout to get the specified performance. If the layout is not carefully done, the regulator could show poor line and/or load regulation, stability issues as well as EMI problems. It is critical to provide a low inductance, low impedance ground path. Therefore, use wide and short traces for the main current paths. In a boost converter, the ripple current on the output is larger than the ripple current on the input. The output capacitor needs to be placed as close as possible between the VOUT and the GND pins. The input capacitor should be placed as close as possible to the VIN and GND pins. Place the inductor close by the IC and connect it with short and thick traces to the IC. Avoid current loops to minimize radiated noise and stray fields. The exposed thermal pad of the package and the GND pin must be connected. See Figure 28 for the recommended PCB layout.

10.2 Layout Example

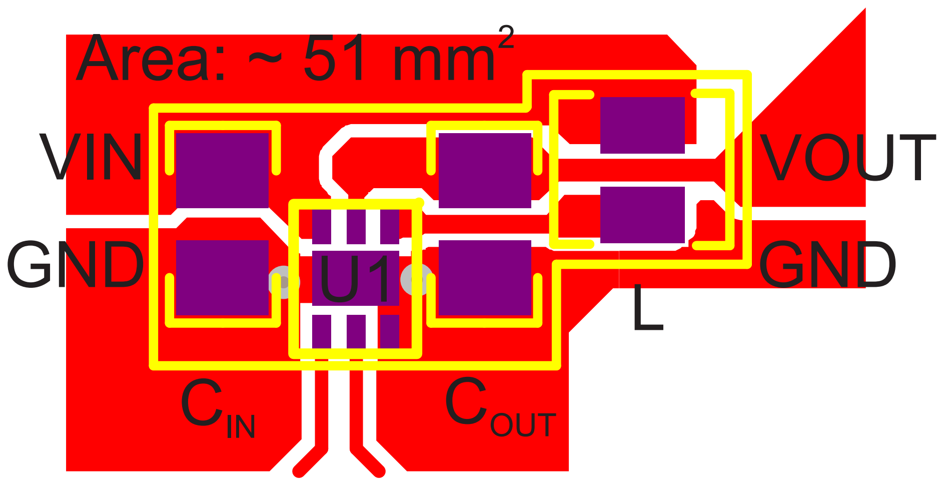


Figure 28. Recommended PCB Layout

11 器件和文档支持

11.1 器件支持

11.1.1 第三方产品免责声明

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11.2 文档支持

11.2.1 相关文档

《TPS61291EVM-569 用户指南》，SLVUA29

11.3 商标

11.4 静电放电警告

这些装置包含有限的内置 ESD 保护。 存储或装卸时，应将导线一起截短或将装置放置于导电泡棉中，以防止 MOS 门极遭受静电损伤。

11.5 术语表

SLYZ022 — *TI 术语表*。

这份术语表列出并解释术语、首字母缩略词和定义。

12 机械封装和可订购信息

以下页中包括机械封装和可订购信息。 这些信息是针对指定器件可提供的最新数据。 这些数据会在无通知且不对本文档进行修订的情况下发生改变。 欲获得该数据表的浏览器版本，请查阅左侧的导航栏。

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PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TPS61291DRVR	ACTIVE	WSON	DRV	6	3000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	PC4I	Samples
TPS61291DRVT	ACTIVE	WSON	DRV	6	250	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	PC4I	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI 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. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
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(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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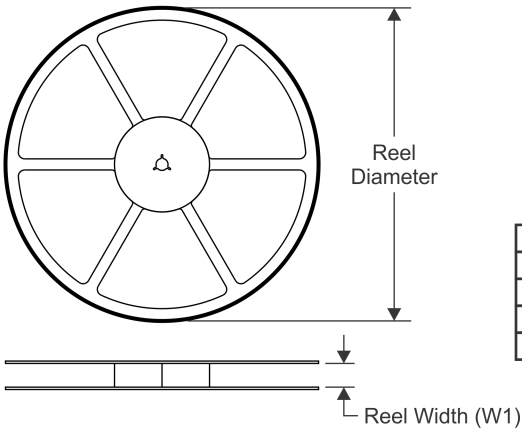
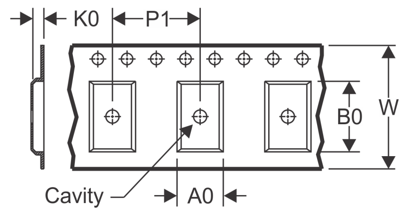
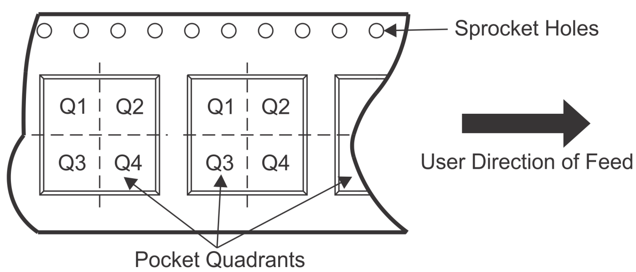


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

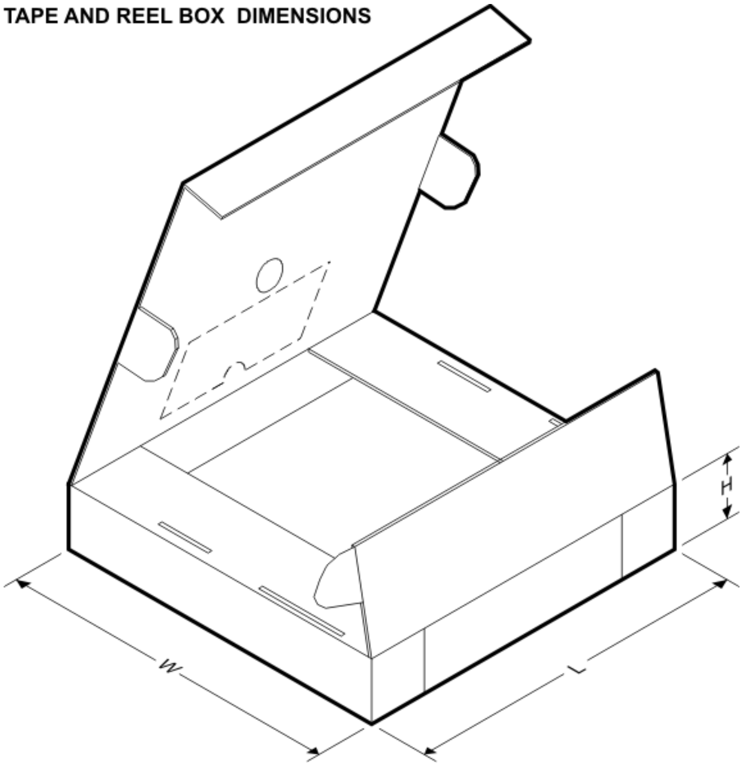
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TPS61291DRVR	WSON	DRV	6	3000	180.0	8.4	2.3	2.3	1.15	4.0	8.0	Q2
TPS61291DRVT	WSON	DRV	6	250	180.0	8.4	2.3	2.3	1.15	4.0	8.0	Q2

TAPE AND REEL BOX DIMENSIONS

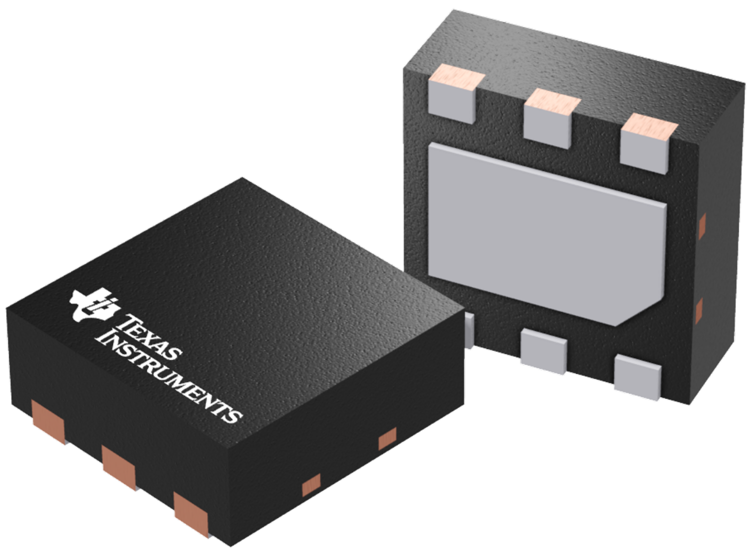


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS61291DRVR	WSON	DRV	6	3000	210.0	185.0	35.0
TPS61291DRVT	WSON	DRV	6	250	210.0	185.0	35.0

DRV 6 WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.