

# TPS7A26 500mA、18V、超低 $I_Q$ 、低ドロップアウト、パワー・グッド出力付きのリニア電圧レギュレータ

## 1 特長

- 非常に低い  $I_Q$ : 2.0 $\mu$ A
- 入力電圧: 2.4V~18V
- 出力電圧オプションを選択可能
  - 固定: 1.25V~5.5V
  - 可変: 1.24V~17.4V
- 温度範囲全体で 1% の精度
- 低ドロップアウト: 590mA で 500mV (最大値)
- オープン・ドレインのパワー・グッド出力
- アクティブなオーバーシュート・プルダウン保護
- サーマル・シャットダウンおよび過電流保護機能
- 動作時の接合部温度: -40°C~+125°C
- 1 $\mu$ F の出力コンデンサで安定動作
- パッケージ: 6 ピン WSON

## 2 アプリケーション

- ホーム/ビルディング・オートメーション
- マルチセルのパワー・バンク
- スマート・グリッドおよび計量
- 携帯用電動工具
- モータ・ドライブ
- 白物家電
- 携帯型家電機器

## 3 概要

TPS7A26 低ドロップアウト (LDO) リニア電圧レギュレータは、2.4V~18V の入力電圧範囲に対応し、静止電流 ( $I_Q$ ) が非常に低いことが特長です。これらの特長は、現代の家電製品がますます厳しくなるエネルギー要件を満たすために役立つほか、携帯電源ソリューションでのバッテリー駆動時間も延長できます。

TPS7A26 には、固定電圧バージョンと可変電圧バージョンがあります。出力電圧をより柔軟にしたい場合や、高い出力電圧が必要な場合は、可変電圧バージョンで帰還抵抗を使用し、出力電圧を 1.24V~17.4V の範囲に設定できます。どちらのバージョンも 1% の出力レギュレーション精度を持ち、マイクロコントローラ (MCU) 基準電圧で高精度のレギュレーションに使用できます。

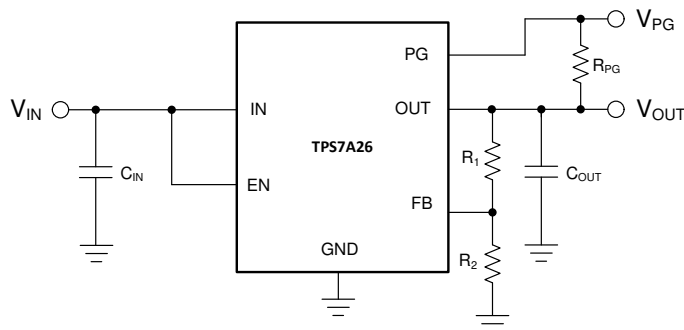
オープン・ドレインのパワー・グッド (PG) 出力により MCU をリセットできます。また、他のオープン・ドレイン PG との間で配線の OR またはレベル・シフトを行い、システム全体の PG やリセットに使用することもできます。

### 製品情報<sup>(1)</sup>

型番	パッケージ	本体サイズ(公称)
TPS7A26	WSON (6)	2.00mm x 2.00mm

(1) 利用可能なすべてのパッケージについては、このデータシートの末尾にあるパッケージ・オプションについての付録を参照してください。

### 代表的なアプリケーション回路



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## 4 改訂履歴

### Revision A (March 2019) から Revision B に変更

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•	ドキュメントに固定電圧バージョンを 追加 .....	1
•	可変電圧バージョンの出力電圧を 0.24V~17.45V から 1.24V~17.4V に 変更 .....	1
•	「概要」セクションから固定電圧バージョンの記述を 削除 .....	1
•	「概要」セクションに TPS7A25 への言及を 追加 .....	3
•	追加 <i>Active to Overshoot Pulldown Circuitry</i> title .....	16

### 2019年12月発行のものから更新

**Page**

•	ステータスを「事前情報」から「量産データ」に 変更 .....	1
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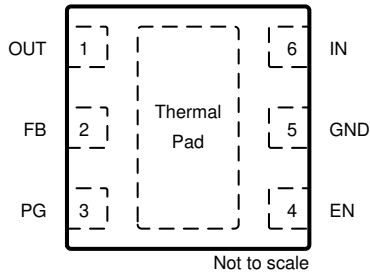
## 5 概要（続き）

TPS7A26 LDO は、500mA の電流で最大ドロップアウト電圧が 590mV 未満なので、標準のリニア・レギュレータよりも効率的に動作します。この最大ドロップアウト電圧により、5.7V の入力電圧 ( $V_{IN}$ ) から 5.0V の出力電圧 ( $V_{OUT}$ ) で、87.7% の効率を実現できます。

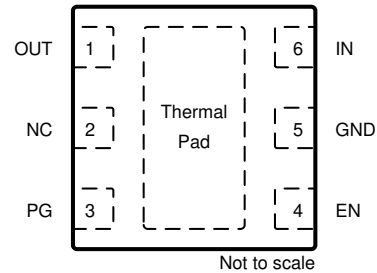
低消費電力用途には、[TPS7A25](#) をご検討ください。

## 6 Pin Configuration and Functions

TPS7A26: DRV Package (Adjustable)  
6-Pin WSON  
Top View



TPS7A26: DRV Package (Fixed)  
6-Pin WSON  
Top View



### Pin Functions

NAME	PIN		I/O	DESCRIPTION
	DRV (Adjustable)	DRV (Fixed)		
EN	4	4	Input	Enable pin. Drive EN greater than $V_{EN(HI)}$ to enable the regulator. Drive EN less than $V_{EN(LOW)}$ to put the regulator into low-current shutdown. Do not float this pin. If not used, connect EN to IN.
FB	2	—	Input	Feedback pin. Input to the control-loop error amplifier. This pin is used to set the output voltage of the device with the use of external resistors. For adjustable-voltage version devices only.
GND	5	5	—	Ground pin.
IN	6	6	Input	Input pin. For best transient response and to minimize input impedance, use the recommended value or larger capacitor from IN to ground as listed in the <a href="#">Recommended Operating Conditions</a> table. Place the input capacitor as close to the IN and GND pins of the device as possible.
NC	—	2	—	No internal connection. For fixed-voltage version devices only. This pin can be floated but the device has better thermal performance with this pin tied to GND.
OUT	1	1	Output	Output pin. A capacitor is required from OUT to ground for stability. For best transient response, use the nominal recommended value or larger capacitor from OUT to ground. Follow the recommended capacitor value as listed in the <a href="#">Recommended Operating Conditions</a> table. Place the output capacitor as close to the OUT and GND pins of the device as possible.
PG	3	3	Output	Power-good pin; open-collector output. Pullup this pin externally to the OUT pin or another voltage rail. The PG pin goes high when $V_{OUT} > V_{IT(PG,RISING)}$ , as discussed in the <a href="#">Electrical Characteristics</a> table. The PG pin is driven low when $V_{OUT} < V_{IT(PG,FALLING)}$ , as discussed in the <a href="#">Electrical Characteristics</a> table. This pin can be floated but the device has better thermal performance with this pin tied to GND.
Thermal pad	Pad	Pad	—	Exposed pad of the package. Connect this pad to ground or leave floating. Connect the thermal pad to a large-area ground plane for best thermal performance.

## 7 Specifications

### 7.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		MIN	MAX	UNIT
Voltage <sup>(2)</sup>	V <sub>IN</sub>	-0.3	20	V
	V <sub>OUT</sub> <sup>(3)</sup>	-0.3	V <sub>IN</sub> + 0.3	
	V <sub>FB</sub>	-0.3	5.5	
	V <sub>EN</sub>	-0.3	20	
	V <sub>PG</sub>	-0.3	20	
Current	Maximum output	Internally limited		A
Temperature	Operating junction, T <sub>J</sub>	-50	150	°C
	Storage, T <sub>stg</sub>	-65	150	

- (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 voltages with respect to GND.
- (3) V<sub>IN</sub> + 0.3 V or 20 V (whichever is smaller).

### 7.2 ESD Ratings

			VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	±1500	V
		Charged device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup>	±1000	

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

### 7.3 Recommended Operating Conditions

		MIN	NOM	MAX	UNIT
V <sub>IN</sub>	Input voltage	2.4		18	V
V <sub>OUT</sub>	Output voltage (adjustable version)	1.24		18-V <sub>DO</sub>	V
V <sub>OUT</sub>	Output voltage (fixed version)	1.25		5.5	V
I <sub>OUT</sub>	Output current	0		500	mA
V <sub>EN</sub>	Enable voltage	0		18	V
V <sub>PG</sub> <sup>(1)</sup>	Power-good voltage	0		18	V
C <sub>IN</sub> <sup>(2)</sup>	Input capacitor		1		μF
C <sub>OUT</sub> <sup>(2)</sup>	Output capacitor	1	2.2	100	μF
T <sub>J</sub>	Operating junction temperature	-40		125	°C

- (1) Select pullup resistor to limit PG pin sink current when PG output is driven low. See *Power Good* section for details.
- (2) All capacitor values are assumed to derate to 50% of the nominal capacitor value.

### 7.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		TPS7A26	UNIT
		DRV (WSON)	
		6 PINS	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	73.3	°C/W
R <sub>θJC(top)</sub>	Junction-to-case (top) thermal resistance	90.6	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	38.3	°C/W
Ψ <sub>JT</sub>	Junction-to-top characterization parameter	3.7	°C/W
Ψ <sub>JB</sub>	Junction-to-board characterization parameter	38.4	°C/W
R <sub>θJC(bot)</sub>	Junction-to-case (bottom) thermal resistance	14.3	°C/W

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

## 7.5 Electrical Characteristics

specified at  $T_J = -40^\circ\text{C}$  to  $+125^\circ\text{C}$ ,  $V_{IN} = V_{OUT(nom)} + 0.8\text{ V}$  or  $V_{IN} = 2.4\text{ V}$  (whichever is greater), FB tied to OUT,  $I_{OUT} = 1\text{ mA}$ ,  $V_{EN} = 2\text{ V}$ , and  $C_{IN} = 1\text{ }\mu\text{F}$ ,  $C_{OUT} = 2.2\text{ }\mu\text{F}$  (unless otherwise noted); typical values are at  $T_J = 25^\circ\text{C}$

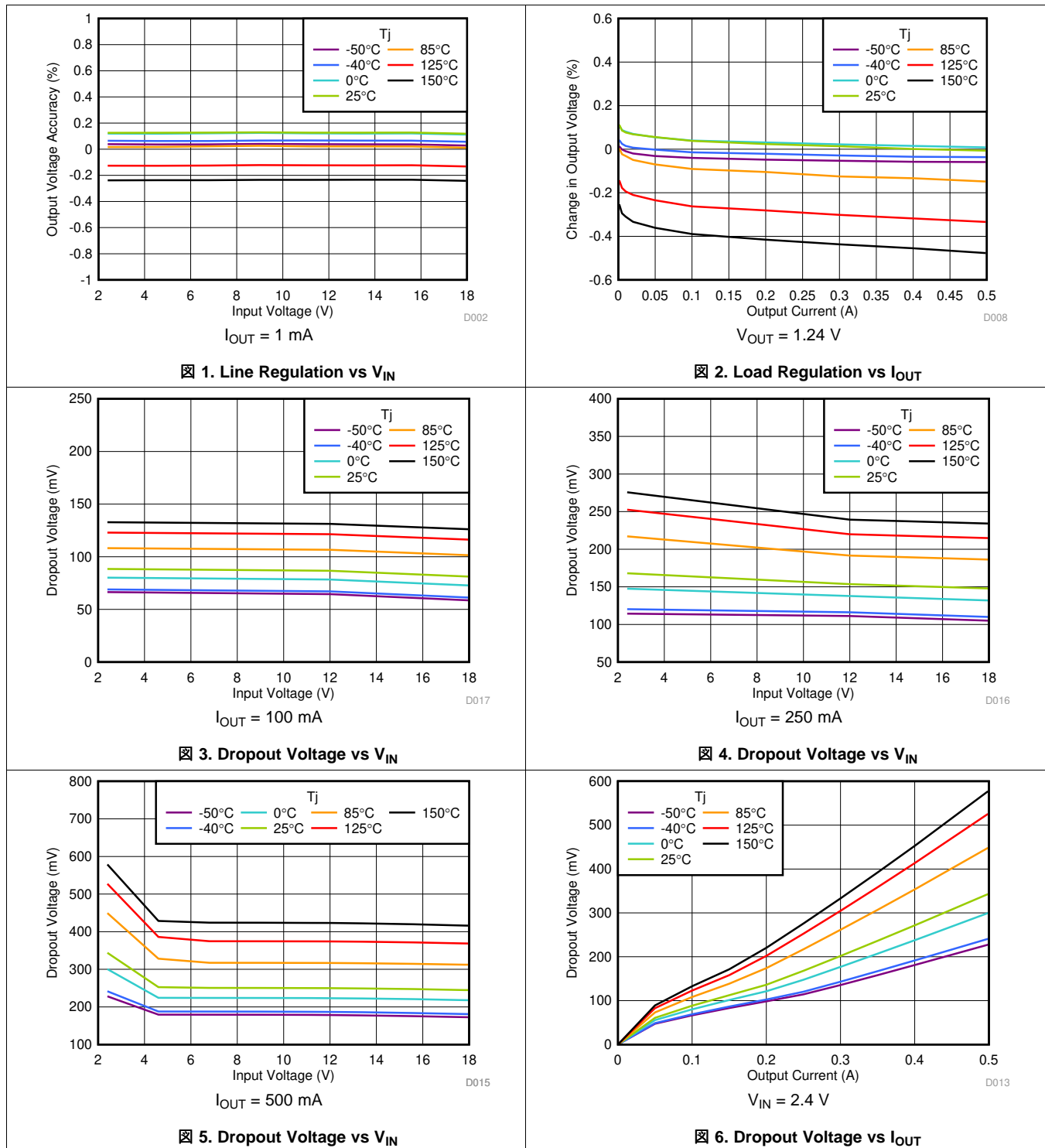
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{UVLO(RISING)}$	UVLO threshold rising	$V_{IN}$ rising	1.95	2.15	2.35	V
$V_{UVLO(HYS)}$	UVLO hysteresis			70		mV
$V_{UVLO(FALLING)}$	UVLO threshold falling	$V_{IN}$ falling	1.85	2.09	2.25	V
$V_{FB}$	Feedback voltage	Adjustable version only		1.24		V
$V_{OUT}$	Output voltage accuracy	Adjustable version, $V_{OUT} = V_{FB}$	1.228	1.24	1.252	V
$V_{OUT}$	Output voltage accuracy for fixed output options	Fixed output versions	-1		1	%
$\Delta V_{OUT(\Delta V_{IN})}$	Line regulation <sup>(1)</sup>	$(V_{OUT(nom)} + 0.8\text{ V or } 2.4\text{ V}) \leq V_{IN} \leq 18\text{ V}$	-0.1		0.1	%
$\Delta V_{OUT(\Delta I_{OUT})}$	Load regulation	$1\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$	-0.5		0.5	%
$V_{DO}$	Dropout voltage <sup>(2)</sup>	$I_{OUT} = 100\text{ mA}$		92	145	mV
		$I_{OUT} = 250\text{ mA}$		173	280	
		$I_{OUT} = 500\text{ mA}$		355	590	
$I_{CL}$	Output current limit	$V_{OUT} = 0.9 \times V_{OUT(nom)}$	525	717	970	mA
$I_{GND}$	Ground pin current	$I_{OUT} = 0\text{ mA}$		2	4.5	$\mu\text{A}$
		$I_{OUT} = 1\text{ mA}$		15		
$I_{SHUTDOWN}$	Shutdown current	$V_{EN} \leq 0.4\text{ V}$ , $V_{IN} = 2.4\text{ V}$ , $I_{out} = 0\text{ mA}$		325	600	nA
$I_{FB}$	FB pin current			10		nA
$I_{EN}$	EN pin current	$V_{EN} = 18\text{ V}$		10		nA
$V_{EN(HI)}$	Enable pin high-level input voltage	Device enabled	0.9			V
$V_{EN(LOW)}$	Enable pin low-level input voltage	Device disabled			0.4	V
$V_{IT(PG,RISING)}$	PG pin threshold rising	$R_{PULLUP} = 10\text{ k}\Omega$ , $V_{OUT}$ rising, $V_{IN} \geq V_{UVLO(RISING)}$		93	96.5	% $V_{OUT}$
$V_{HYS(PG)}$	PG pin hysteresis	$R_{PULLUP} = 10\text{ k}\Omega$ , $V_{OUT}$ falling, $V_{IN} \geq V_{UVLO(RISING)}$		3		% $V_{OUT}$
$V_{IT(PG,FALLING)}$	PG pin threshold falling	$R_{PULLUP} = 10\text{ k}\Omega$ , $V_{OUT}$ falling, $V_{IN} \geq V_{UVLO(RISING)}$	84	90		% $V_{OUT}$
$V_{OL(PG)}$	PG pin low level output voltage	$V_{OUT} < V_{IT(PG,FALLING)}$ , $I_{PG-SINK} = 500\text{ }\mu\text{A}$			0.4	V
$I_{LKG(PG)}$	PG pin leakage current	$V_{OUT} > V_{IT(PG,RISING)}$ , $V_{PG} = 18\text{ V}$		5	300	nA
PSRR	Power-supply rejection ratio	$f = 10\text{ Hz}$		75		dB
		$f = 100\text{ Hz}$		62		
		$f = 1\text{ kHz}$		52		
$V_n$	Output noise voltage	$BW = 10\text{ Hz to } 100\text{ kHz}$ , $V_{OUT} = 1.2\text{ V}$		300		$\mu\text{V}_{RMS}$
$T_{SD(shutdown)}$	Thermal shutdown temperature	Shutdown, temperature increasing		165		$^\circ\text{C}$
$T_{SD(reset)}$	Thermal shutdown reset temperature	Reset, temperature decreasing		145		$^\circ\text{C}$

(1)  $V_{out(nom)} + 0.8\text{ V}$  or  $2.4\text{ V}$  (whichever is greater).

(2)  $V_{DO}$  is measured with  $V_{IN} = 0.97 \times V_{OUT(nom)}$  for fixed output voltage versions.  $V_{DO}$  is not measured for fixed output voltage versions when  $V_{OUT} \leq 2.5\text{ V}$ . For the adjustable output device,  $V_{DO}$  is measured with  $V_{FB} = 0.97 \times V_{FB(nom)}$ .

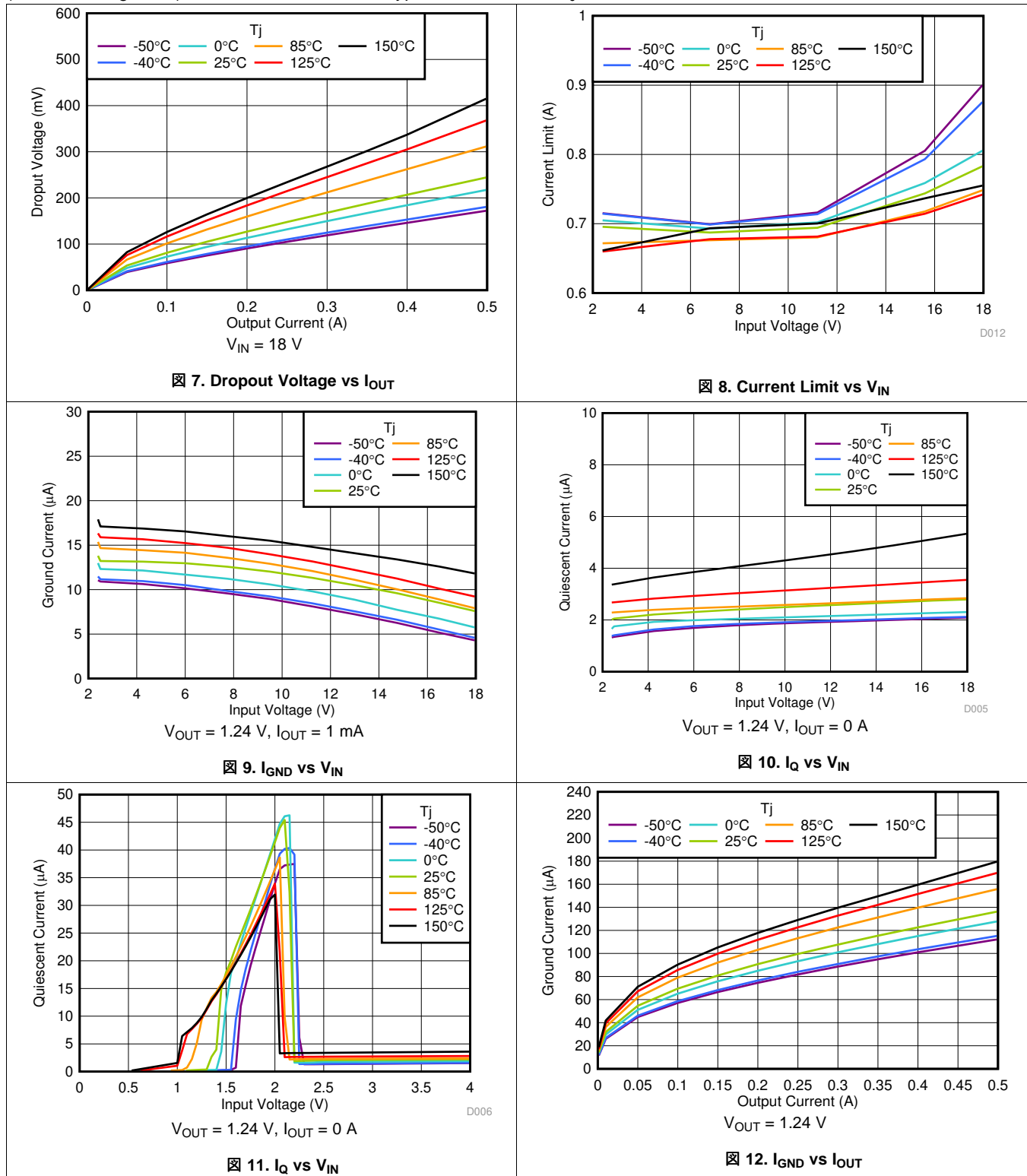
### 7.6 Typical Characteristics

at operating temperature  $T_J = 25^\circ\text{C}$ ,  $I_{OUT} = 1\text{ mA}$ ,  $V_{EN} = 0.9\text{ V}$ ,  $C_{IN} = 2.2\ \mu\text{F}$ ,  $C_{OUT} = 2.2\ \mu\text{F}$ , and  $V_{IN} = V_{OUT(\text{typ})} + 0.8\text{ V}$  or  $2.4\text{ V}$  (whichever is greater), unless otherwise noted; typical values are at  $T_J = 25^\circ\text{C}$



**Typical Characteristics (continued)**

at operating temperature  $T_J = 25^\circ\text{C}$ ,  $I_{OUT} = 1\text{ mA}$ ,  $V_{EN} = 0.9\text{ V}$ ,  $C_{IN} = 2.2\ \mu\text{F}$ ,  $C_{OUT} = 2.2\ \mu\text{F}$ , and  $V_{IN} = V_{OUT(\text{typ})} + 0.8\text{ V}$  or  $2.4\text{ V}$  (whichever is greater), unless otherwise noted; typical values are at  $T_J = 25^\circ\text{C}$





Typical Characteristics (continued)

at operating temperature  $T_J = 25^\circ\text{C}$ ,  $I_{OUT} = 1\text{ mA}$ ,  $V_{EN} = 0.9\text{ V}$ ,  $C_{IN} = 2.2\ \mu\text{F}$ ,  $C_{OUT} = 2.2\ \mu\text{F}$ , and  $V_{IN} = V_{OUT(\text{typ})} + 0.8\text{ V}$  or  $2.4\text{ V}$  (whichever is greater), unless otherwise noted; typical values are at  $T_J = 25^\circ\text{C}$

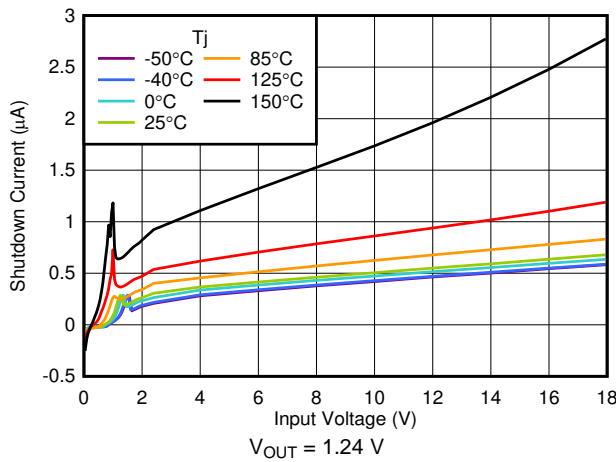


Figure 13. Shutdown Current vs  $V_{IN}$

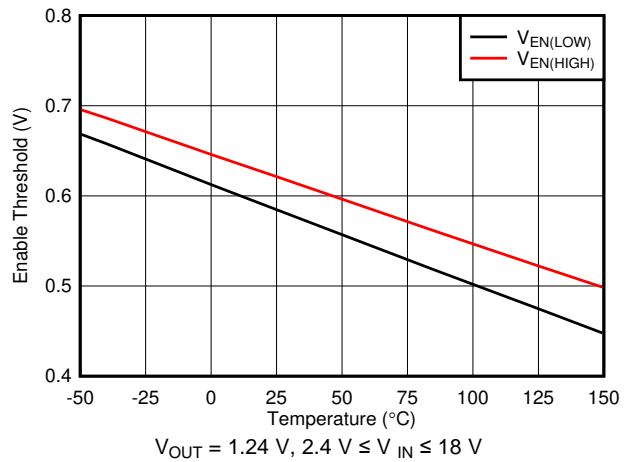


Figure 14.  $V_{EN}$  vs Temperature

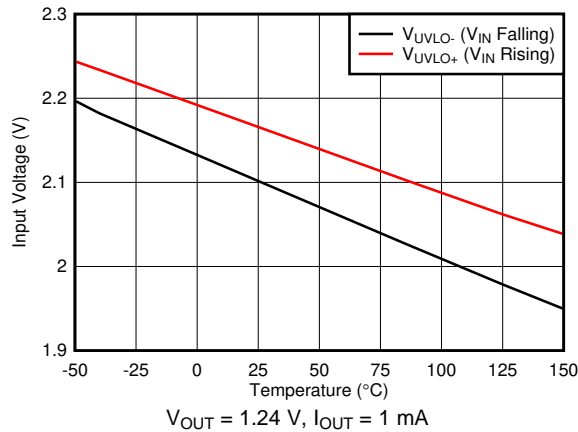


Figure 15. UVLO Thresholds vs Temperature

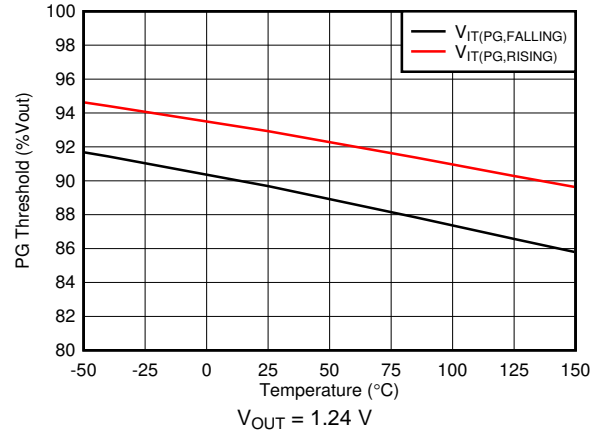


Figure 16. PG Thresholds vs Temperature

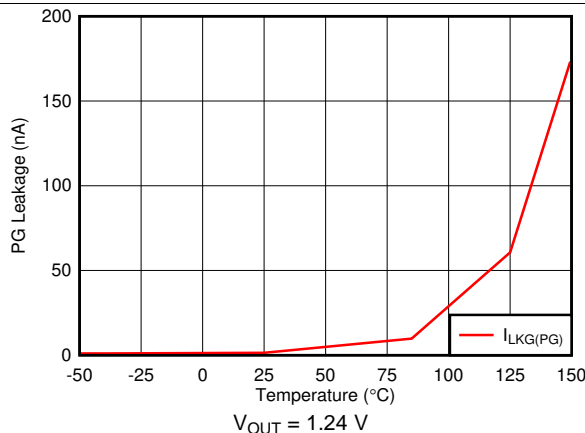


Figure 17. PG Leakage Current vs Temperature

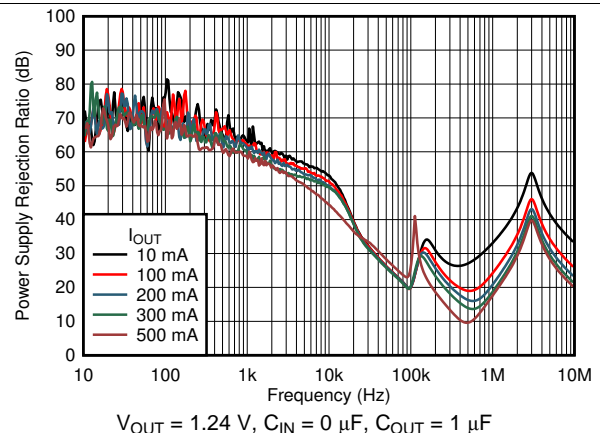
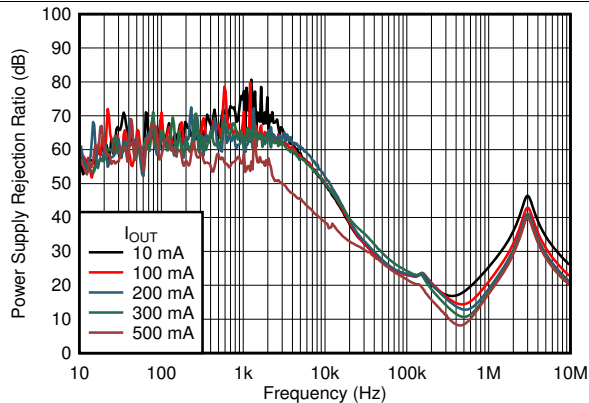


Figure 18. PSRR vs Frequency and  $I_{OUT}$

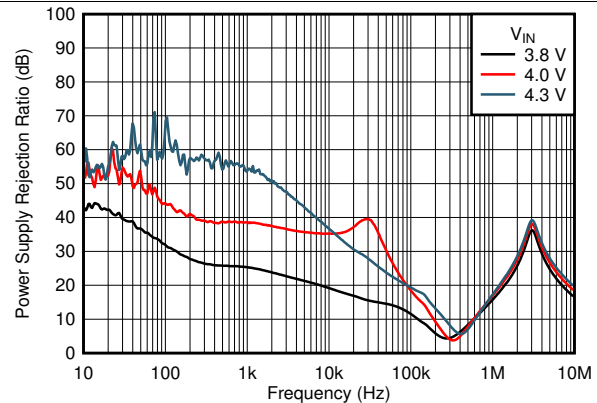
### Typical Characteristics (continued)

at operating temperature  $T_J = 25^\circ\text{C}$ ,  $I_{OUT} = 1\text{ mA}$ ,  $V_{EN} = 0.9\text{ V}$ ,  $C_{IN} = 2.2\ \mu\text{F}$ ,  $C_{OUT} = 2.2\ \mu\text{F}$ , and  $V_{IN} = V_{OUT(\text{typ})} + 0.8\text{ V}$  or  $2.4\text{ V}$  (whichever is greater), unless otherwise noted; typical values are at  $T_J = 25^\circ\text{C}$



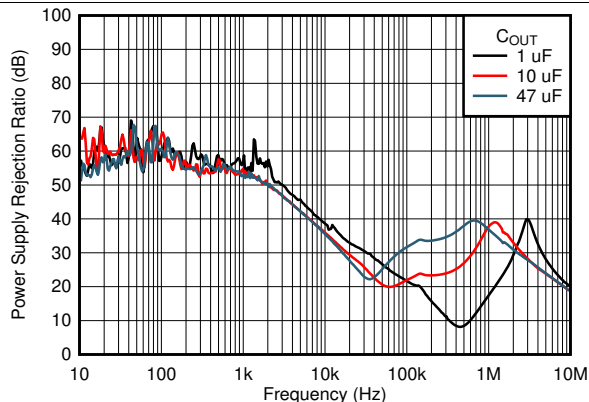
$V_{OUT} = 3.3\text{ V}$ ,  $V_{IN} = 4.3\text{ V}$ ,  
 $C_{IN} = 0\ \mu\text{F}$ ,  $C_{OUT} = 1\ \mu\text{F}$ ,  $C_{FF} = 10\text{ nF}$

19. PSRR vs Frequency and  $I_{OUT}$



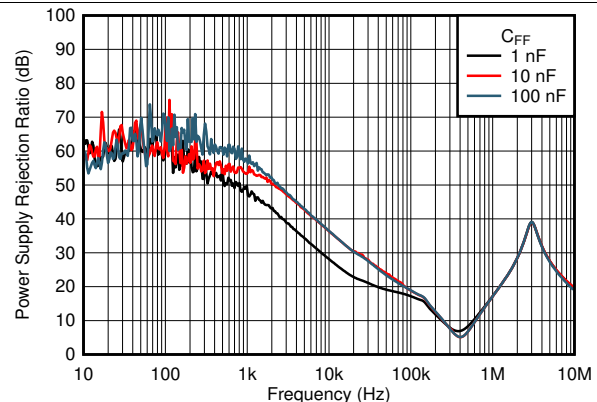
$V_{OUT} = 3.3\text{ V}$ ,  $I_{OUT} = 0.5\text{ A}$ ,  
 $C_{IN} = 0\ \mu\text{F}$ ,  $C_{OUT} = 1\ \mu\text{F}$ ,  $C_{FF} = 10\text{ nF}$

20. PSRR vs Frequency and  $V_{IN}$



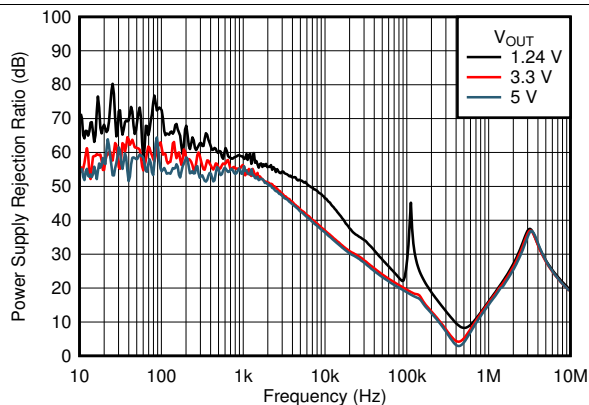
$V_{OUT} = 3.3\text{ V}$ ,  $V_{IN} = 4.3\text{ V}$ ,  $I_{OUT} = 0.5\text{ A}$ ,  
 $C_{IN} = 0\ \mu\text{F}$ ,  $C_{FF} = 10\text{ nF}$

21. PSRR vs Frequency and  $C_{OUT}$



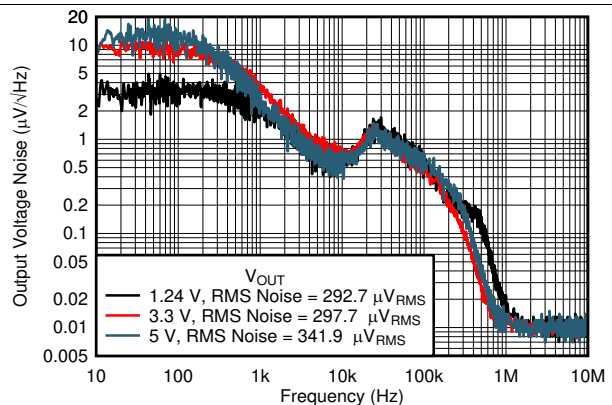
$V_{OUT} = 3.3\text{ V}$ ,  $V_{IN} = 4.3\text{ V}$ ,  $I_{OUT} = 0.5\text{ A}$ ,  
 $C_{IN} = 0\ \mu\text{F}$ ,  $C_{OUT} = 1\ \mu\text{F}$

22. PSRR vs Frequency and  $C_{FF}$



$V_{IN} = V_{OUT} + 1\text{ V}$  or  $2.4\text{ V}$  (whichever is greater),  $I_{OUT} = 0.5\text{ A}$ ,  
 $C_{IN} = 0\ \mu\text{F}$ ,  $C_{OUT} = 1\ \mu\text{F}$ ,  $C_{FF} = 10\text{ nF}$

23. PSRR vs Frequency and  $V_{OUT}$

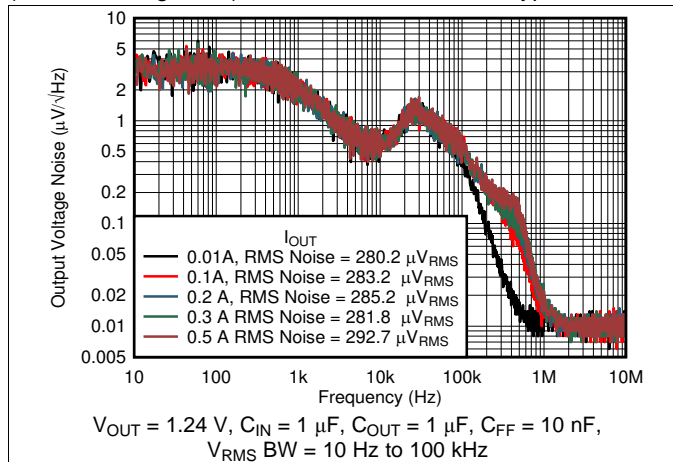


$V_{IN} = V_{OUT} + 1\text{ V}$  or  $2.4\text{ V}$  (whichever is greater),  
 $I_{OUT} = 0.5\text{ A}$ ,  $C_{IN} = 1\ \mu\text{F}$ ,  $C_{OUT} = 1\ \mu\text{F}$ ,  $C_{FF} = 10\text{ nF}$ ,  
 $V_{RMS}\text{ BW} = 10\text{ Hz to }100\text{ kHz}$

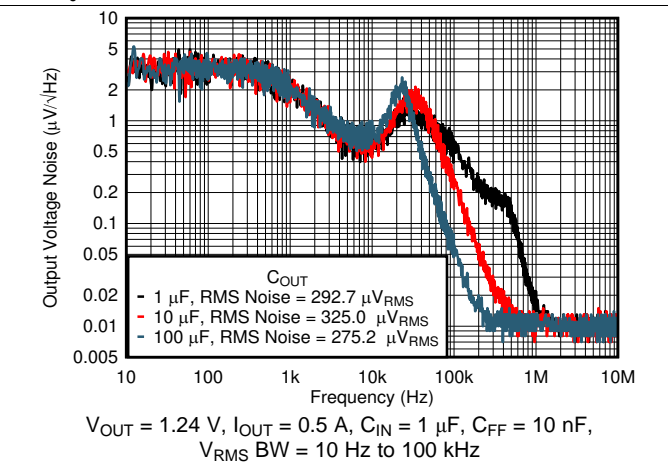
24. Output Noise ( $V_n$ ) vs Frequency and  $V_{OUT}$

Typical Characteristics (continued)

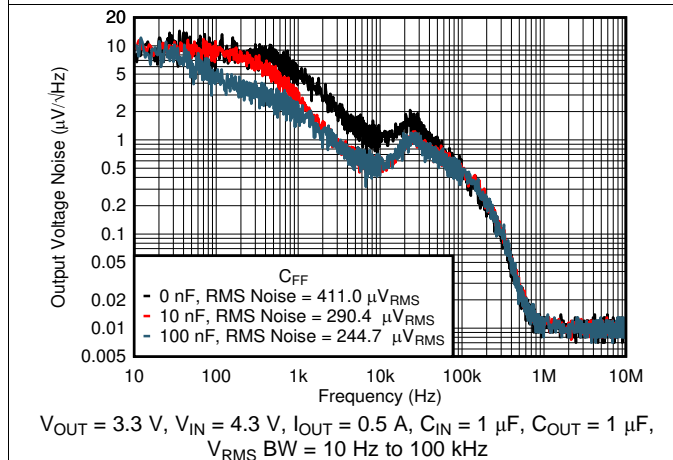
at operating temperature  $T_J = 25^\circ\text{C}$ ,  $I_{OUT} = 1\text{ mA}$ ,  $V_{EN} = 0.9\text{ V}$ ,  $C_{IN} = 2.2\text{ }\mu\text{F}$ ,  $C_{OUT} = 2.2\text{ }\mu\text{F}$ , and  $V_{IN} = V_{OUT(\text{typ})} + 0.8\text{ V}$  or  $2.4\text{ V}$  (whichever is greater), unless otherwise noted; typical values are at  $T_J = 25^\circ\text{C}$



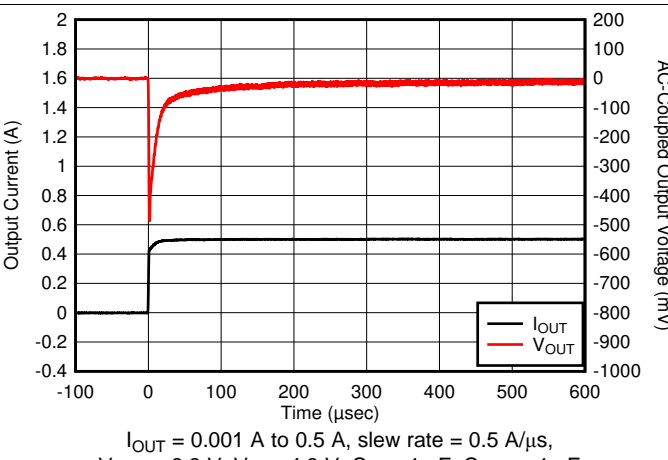
25. Output Noise ( $V_n$ ) vs Frequency and  $I_{OUT}$



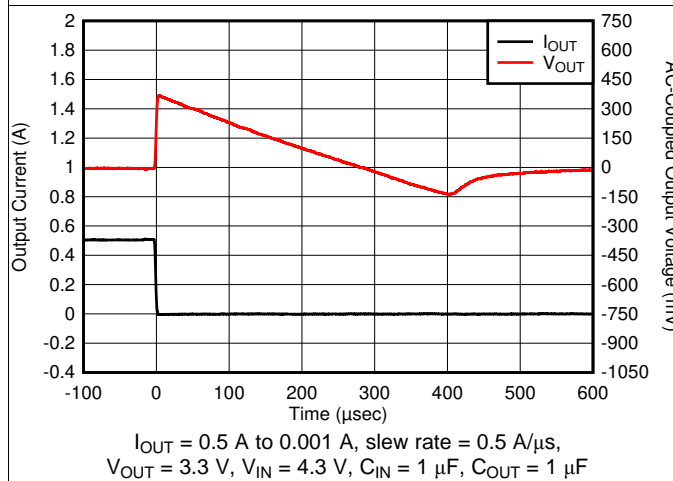
26. Output Noise ( $V_n$ ) vs Frequency and  $C_{OUT}$



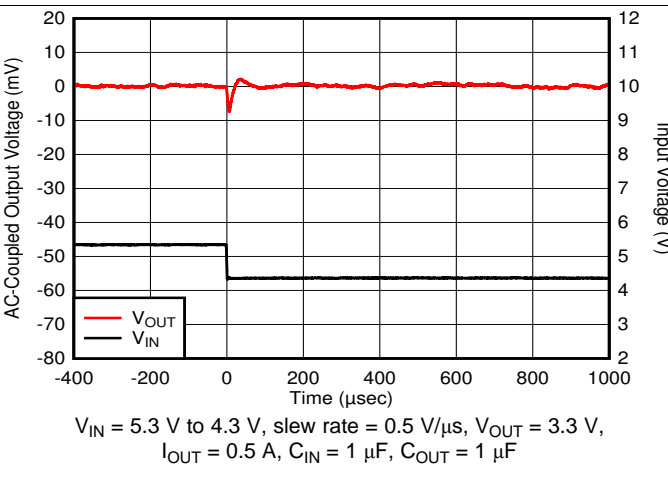
27. Output Noise ( $V_n$ ) vs Frequency and  $C_{FF}$



28. Load Transient



29. Load Transient



30. Line Transient

### Typical Characteristics (continued)

at operating temperature  $T_J = 25^\circ\text{C}$ ,  $I_{OUT} = 1\text{ mA}$ ,  $V_{EN} = 0.9\text{ V}$ ,  $C_{IN} = 2.2\text{ }\mu\text{F}$ ,  $C_{OUT} = 2.2\text{ }\mu\text{F}$ , and  $V_{IN} = V_{OUT(\text{typ})} + 0.8\text{ V}$  or  $2.4\text{ V}$  (whichever is greater), unless otherwise noted; typical values are at  $T_J = 25^\circ\text{C}$

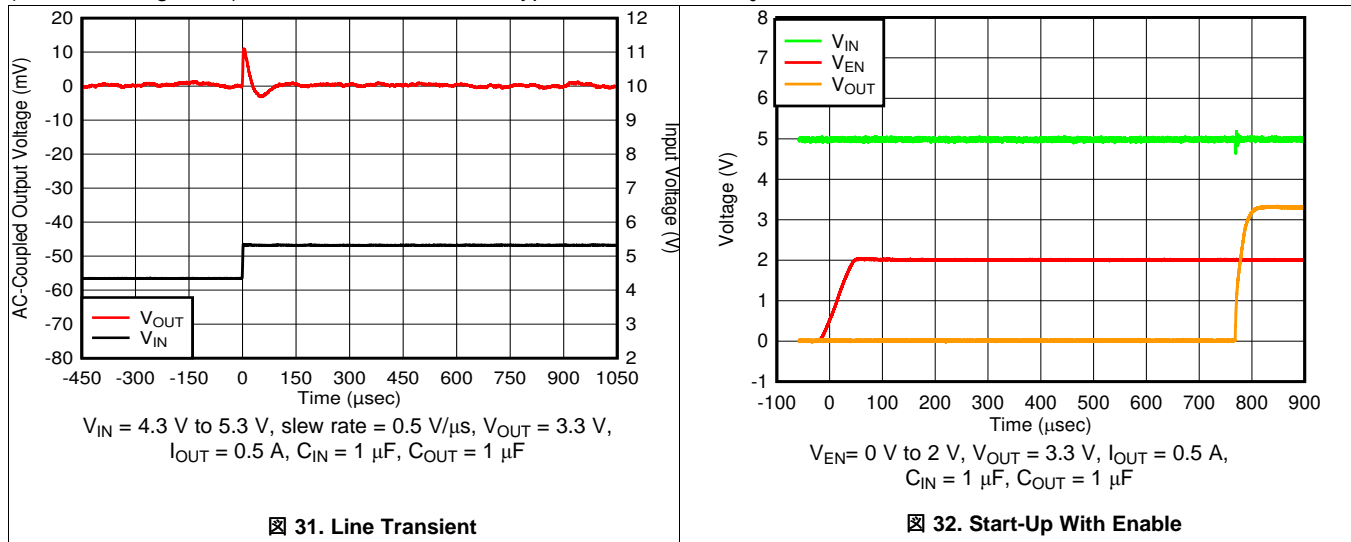


Figure 31. Line Transient

Figure 32. Start-Up With Enable

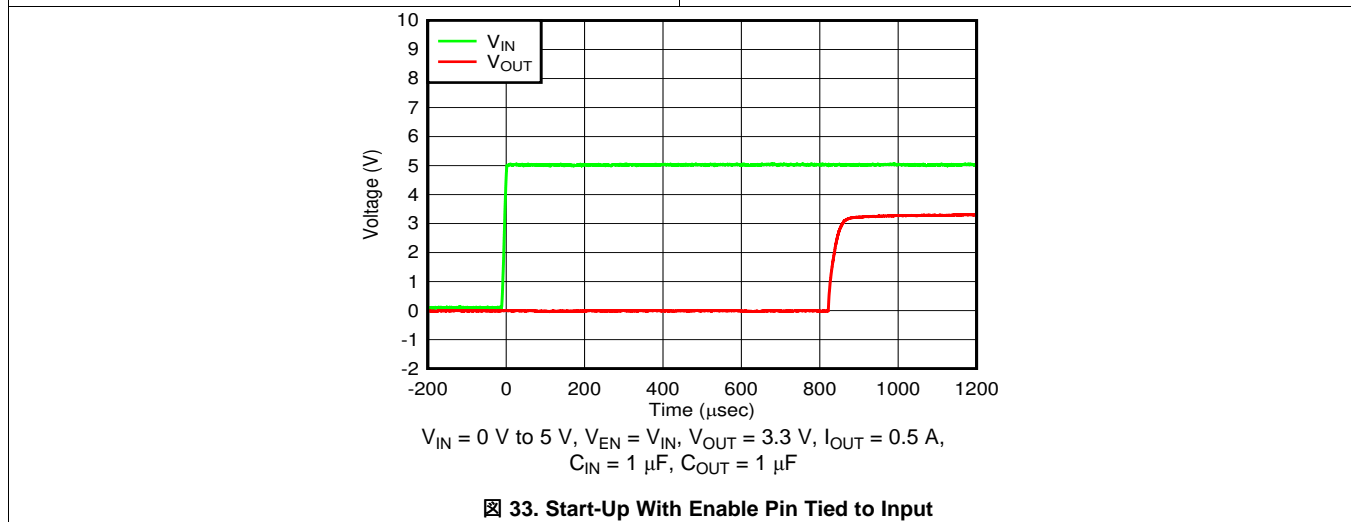


Figure 33. Start-Up With Enable Pin Tied to Input

## 8 Detailed Description

### 8.1 Overview

The TPS7A26 is an 18-V, low quiescent current, low-dropout (LDO) linear regulator. The low  $I_Q$  performance makes the TPS7A26 an excellent choice for battery-powered or line-power applications that are expected to meet increasingly stringent standby-power standards.

The 1% accuracy over temperature and power-good indication make this device an excellent choice for meeting a wide range of microcontroller power requirements.

For increased reliability, the TPS7A26 also incorporates overcurrent, overshoot pulldown, and thermal shutdown protection. The operating junction temperature is  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ , and adds margin for applications concerned with higher working ambient temperatures.

The TPS7A26 is available in a thermally enhanced WSON package.

### 8.2 Functional Block Diagram

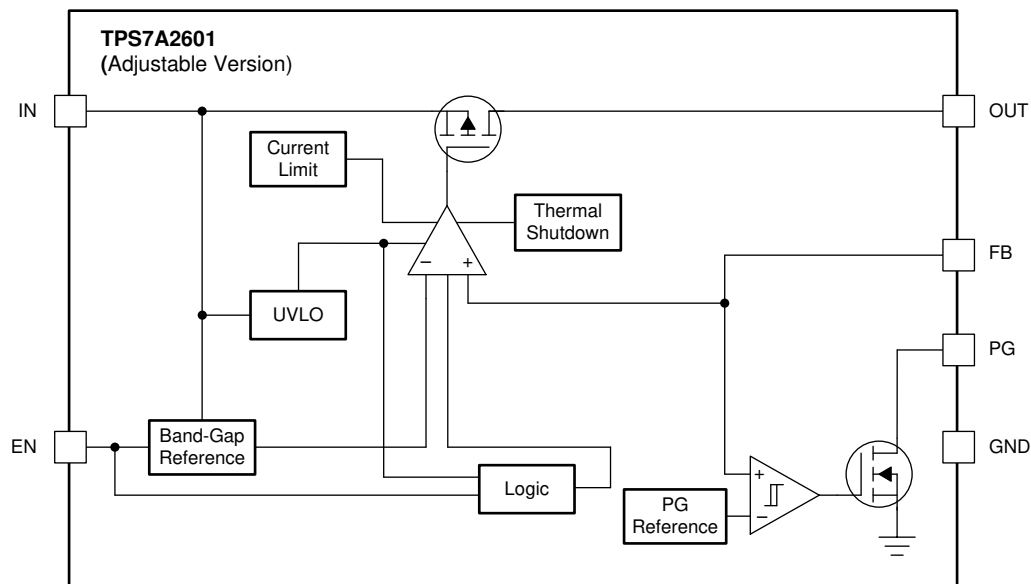
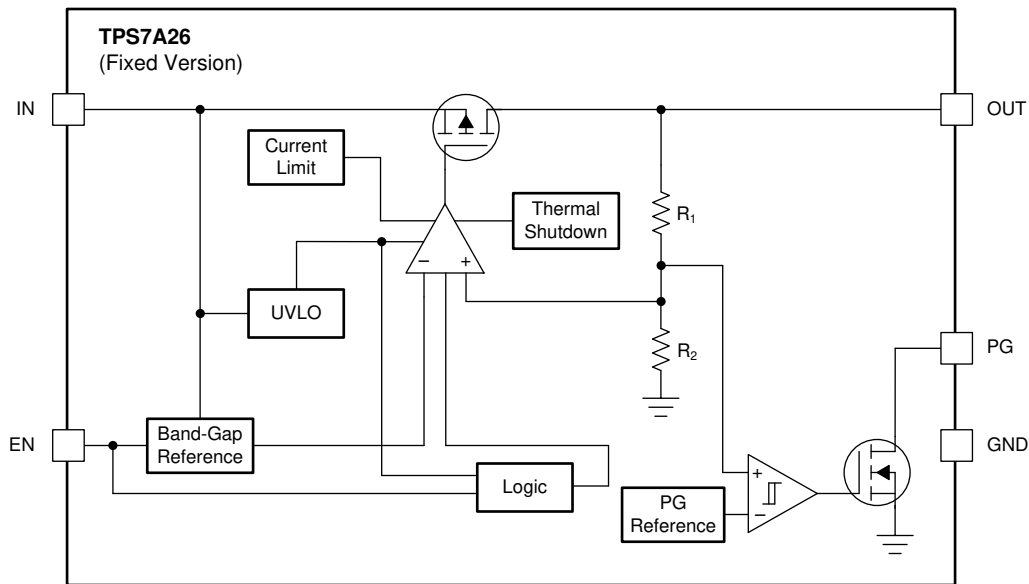


图 34. Adjustable Version

**Functional Block Diagram (continued)**

**图 35. Fixed Version**
**8.3 Feature Description**
**8.3.1 Output Enable**

The enable pin for the device is an active-high pin. The output voltage is enabled when the voltage of the enable pin is greater than the high-level input voltage of the EN pin and disabled when the enable pin voltage is less than the low-level input voltage of the EN pin. If independent control of the output voltage is not needed, connect the enable pin to the input of the device.

**8.3.2 Dropout Voltage**

Dropout voltage ( $V_{DO}$ ) is defined as the input voltage minus the output voltage ( $V_{IN} - V_{OUT}$ ) at the rated output current ( $I_{RATED}$ ), where the pass transistor is fully on.  $I_{RATED}$  is the maximum  $I_{OUT}$  listed in the *Recommended Operating Conditions* table. The pass transistor is in the ohmic or triode region of operation, and acts as a switch. The dropout voltage indirectly specifies a minimum input voltage greater than the nominal programmed output voltage at which the output voltage is expected to stay in regulation. If the input voltage falls to less than the nominal output regulation, then the output voltage falls as well.

## Feature Description (continued)

For a CMOS regulator, the dropout voltage is determined by the drain-source on-state resistance ( $R_{DS(ON)}$ ) of the pass transistor. Therefore, if the linear regulator operates at less than the rated current, the dropout voltage for that current scales accordingly. Use [Equation 1](#) to calculate the  $R_{DS(ON)}$  of the device.

$$R_{DS(ON)} = \frac{V_{DO}}{I_{RATED}} \quad (1)$$

### 8.3.3 Current Limit

The device has an internal current limit circuit that protects the regulator during transient high-load current faults or shorting events. The current limit is a brickwall scheme. In a high-load current fault, the brickwall scheme limits the output current to the current limit ( $I_{CL}$ ).  $I_{CL}$  is listed in the *Electrical Characteristics* table.

The output voltage is not regulated when the device is in current limit. When a current limit event occurs, the device begins to heat up because of the increase in power dissipation. When the device is in brickwall current limit, the pass transistor dissipates power  $[(V_{IN} - V_{OUT}) \times I_{CL}]$ . If thermal shutdown is triggered, the device turns off. After the device cools down, the internal thermal shutdown circuit turns the device back on. If the output current fault condition continues, the device cycles between current limit and thermal shutdown. For more information on current limits, see the [Know Your Limits application report](#).

[Figure 36](#) shows a diagram of the current limit.

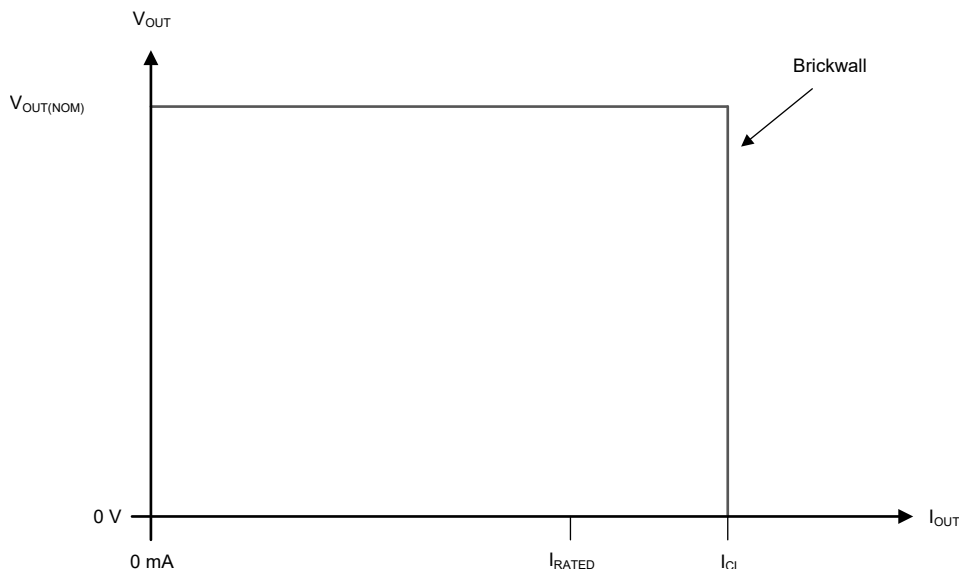


Figure 36. Current Limit

### 8.3.4 Undervoltage Lockout (UVLO)

The device has an independent undervoltage lockout (UVLO) circuit that monitors the input voltage, allowing a controlled and consistent turn on and off of the output voltage. To prevent the device from turning off if the input drops during turn on, the UVLO has hysteresis as specified in the *Electrical Characteristics* table.

### 8.3.5 Thermal Shutdown

The device contains a thermal shutdown protection circuit to disable the device when the junction temperature ( $T_J$ ) of the pass transistor rises to  $T_{SD(shutdown)}$  (typical). Thermal shutdown hysteresis assures that the device resets (turns on) when the temperature falls to  $T_{SD(reset)}$  (typical).

The thermal time-constant of the semiconductor die is fairly short, thus the device may cycle on and off when thermal shutdown is reached until power dissipation is reduced. Power dissipation during startup can be high from large  $V_{IN} - V_{OUT}$  voltage drops across the device or from high inrush currents charging large output capacitors. Under some conditions, the thermal shutdown protection disables the device before startup completes.

## Feature Description (continued)

When the thermal limit is triggered with load currents near the value of the current limit, the output may oscillate prior to the output switching off.

For reliable operation, limit the junction temperature to the maximum listed in the *Recommended Operating Conditions* table. Operation above this maximum temperature causes the device to exceed its operational specifications. Although the internal protection circuitry of the device is designed to protect against thermal overall conditions, this circuitry is not intended to replace proper heat sinking. Continuously running the device into thermal shutdown or above the maximum recommended junction temperature reduces long-term reliability.

### 8.3.6 Power Good

The power-good (PG) pin is an open-drain output and can be connected to a regulated supply through an external pullup resistor. The maximum pullup voltage is listed as  $V_{PG}$  in the *Recommended Operating Conditions* table. For the PG pin to have a valid output, the voltage on the IN pin must be greater than  $V_{UVLO(RISING)}$ , as listed in the *Electrical Characteristics* table. When the  $V_{OUT}$  exceeds  $V_{IT(PG,RISING)}$ , the PG output is high impedance and the PG pin voltage pulls up to the connected regulated supply. When the regulated output falls below  $V_{IT(PG,FALLING)}$ , the open-drain output turns on and pulls the PG output low after a short deglitch time. If output voltage monitoring is not needed, the PG pin can be left floating or connected to ground.

By connecting a pullup resistor to an external supply, any downstream device can receive power-good (PG) as a logic signal that can be used for sequencing. Make sure that the external pullup supply voltage results in a valid logic signal for the receiving device.

The recommended maximum PG pin sink current ( $I_{PG-SINK}$ ) and the leakage current into the PG pin ( $I_{LKG(PG)}$ ) are listed in the *Electrical Characteristics* table.

The PG pullup voltage ( $V_{PG\_PULLUP}$ ), the desired minimum power-good output voltage ( $V_{PG(MIN)}$ ), and  $I_{LKG(PG)}$  limit the maximum PG pin pullup resistor value ( $R_{PG\_PULLUP}$ ).  $V_{PG\_PULLUP}$ , the PG pin low-level output voltage ( $V_{OL(PG)}$ ), and  $I_{PG-SINK}$  limit the minimum  $R_{PG\_PULLUP}$ . Maximum and minimum values for  $R_{PG\_PULLUP}$  can be calculated from the following equations:

$$R_{PG\_PULLUP(MAX)} = (V_{PG\_PULLUP} - V_{PG(MIN)}) / I_{LKG(PG)_MAX} \quad (2)$$

$$R_{PG\_PULLUP(MIN)} = (V_{PG\_PULLUP} - V_{OL(PG)}) / I_{PG-SINK} \quad (3)$$

For example, if the PG pin is connected to a pullup resistor with a 3.3-V external supply, from [Equation 2](#),  $R_{PG\_PULLUP(MAX)}$  is 11 M $\Omega$ . From [Equation 3](#),  $R_{PG\_PULLUP(MIN)}$  is 5.8 k $\Omega$ .

### 8.3.7 Active Overshoot Pulldown Circuitry

This device has pulldown circuitry connected to  $V_{OUT}$ . This circuitry is a 100- $\mu$ A current sink, in series with a 5.5-k $\Omega$  resistor, controlled by  $V_{EN}$ . When  $V_{EN}$  is below  $V_{EN(LOW)}$ , the pulldown circuitry is disabled and the LDO output is in high-impedance mode.

If the output voltage is more than 60 mV above nominal voltage when  $V_{EN} \geq V_{EN(LOW)}$ , the pulldown circuitry turns on and the output is pulled down until the output voltage is within 60 mV from the nominal voltage. This feature helps reduce overshoot during the transient response.



## 8.4 Device Functional Modes

### 8.4.1 Device Functional Mode Comparison

The *Device Functional Mode Comparison* table shows the conditions that lead to the different modes of operation. See the *Electrical Characteristics* table for parameter values.

**Table 1. Device Functional Mode Comparison**

OPERATING MODE	PARAMETER			
	$V_{IN}$	$V_{EN}$	$I_{OUT}$	$T_J$
Normal operation	$V_{IN} > V_{OUT(nom)} + V_{DO}$ and $V_{IN} > V_{IN(min)}$	$V_{EN} > V_{EN(HI)}$	$I_{OUT} < I_{OUT(max)}$	$T_J < T_{SD(shutdown)}$
Dropout operation	$V_{IN(min)} < V_{IN} < V_{OUT(nom)} + V_{DO}$	$V_{EN} > V_{EN(HI)}$	$I_{OUT} < I_{OUT(max)}$	$T_J < T_{SD(shutdown)}$
Disabled (any true condition disables the device)	$V_{IN} < V_{UVLO}$	$V_{EN} < V_{EN(LOW)}$	Not applicable	$T_J > T_{SD(shutdown)}$

### 8.4.2 Normal Operation

The device regulates to the nominal output voltage when the following conditions are met:

- The input voltage is greater than the nominal output voltage plus the dropout voltage ( $V_{OUT(nom)} + V_{DO}$ )
- The output current is less than the current limit ( $I_{OUT} < I_{CL}$ )
- The device junction temperature is less than the thermal shutdown temperature ( $T_J < T_{SD}$ )
- The enable voltage has previously exceeded the enable rising threshold voltage and has not yet decreased to less than the enable falling threshold

### 8.4.3 Dropout Operation

If the input voltage is lower than the nominal output voltage plus the specified dropout voltage, but all other conditions are met for normal operation, the device operates in dropout mode. In this mode, the output voltage tracks the input voltage. During this mode, the transient performance of the device becomes significantly degraded because the pass transistor is in the ohmic or triode region, and acts as a switch. Line or load transients in dropout can result in large output-voltage deviations.

When the device is in a steady dropout state (defined as when the device is in dropout,  $V_{IN} < V_{OUT(NOM)} + V_{DO}$ , directly after being in a normal regulation state, but *not* during startup), the pass transistor is driven into the ohmic or triode region. When the input voltage returns to a value greater than or equal to the nominal output voltage plus the dropout voltage ( $V_{OUT(NOM)} + V_{DO}$ ), the output voltage can overshoot for a short period of time while the device pulls the pass transistor back into the linear region.

### 8.4.4 Disabled

The output of the device can be shutdown by forcing the voltage of the enable pin to less than the maximum EN pin low-level input voltage (see the *Electrical Characteristics* table). When disabled, the pass transistor is turned off and internal circuits are shutdown.

## 9 Application and Implementation

### 注

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.

### 9.1 Application Information

#### 9.1.1 Adjustable Device Feedback Resistors

The adjustable-version device requires external feedback divider resistors to set the output voltage.  $V_{OUT}$  is set using the feedback divider resistors,  $R_1$  and  $R_2$ , according to the following equation:

$$V_{OUT} = V_{FB} \times (1 + R_1 / R_2) \quad (4)$$

To ignore the FB pin current error term in the  $V_{OUT}$  equation, set the feedback divider current to 100x the FB pin current listed in the *Electrical Characteristics* table. This setting provides the maximum feedback divider series resistance, as shown in the following equation:

$$R_1 + R_2 \leq V_{OUT} / (I_{FB} \times 100) \quad (5)$$

#### 9.1.2 Recommended Capacitor Types

The device is designed to be stable using low equivalent series resistance (ESR) capacitors at the input and output. Multilayer ceramic capacitors have become the industry standard for these types of applications and are recommended, but must be used with good judgment. Ceramic capacitors that employ X7R-, X5R-, and C0G-rated dielectric materials provide relatively good capacitive stability across temperature, whereas the use of Y5V-rated capacitors is discouraged because of large variations in capacitance.

Regardless of the ceramic capacitor type selected, the effective capacitance varies with operating voltage and temperature. As a rule of thumb, expect the effective capacitance to decrease by as much as 50%. The input and output capacitors recommended in the *Recommended Operating Conditions* table account for an effective capacitance of approximately 50% of the nominal value.

#### 9.1.3 Input and Output Capacitor Requirements

Although an input capacitor is not required for stability, good analog design practice is to connect a capacitor from IN to GND. This capacitor counteracts reactive input sources and improves transient response, input ripple, and PSRR. An input capacitor is recommended if the source impedance is more than 0.5  $\Omega$ . A higher value capacitor may be necessary if large, fast load transient or line transients are anticipated or if the device is located several inches from the input power source.

Dynamic performance of the device is improved with the use of an output capacitor. Use an output capacitor within the range specified in the *Recommended Operating Conditions* table for stability.

The effective output capacitance value is recommended to not exceed 50  $\mu$ F.

#### 9.1.4 Reverse Current

Excessive reverse current can damage this device. Reverse current flows through the intrinsic body diode of the pass transistor instead of the normal conducting channel. At high magnitudes, this current flow degrades the long-term reliability of the device.

Conditions where reverse current can occur are outlined in this section, all of which can exceed the absolute maximum rating of  $V_{OUT} \leq V_{IN} + 0.3$  V.

- If the device has a large  $C_{OUT}$  and the input supply collapses with little or no load current
- The output is biased when the input supply is not established
- The output is biased above the input supply

## Application Information (continued)

If reverse current flow is expected in the application, external protection is recommended to protect the device. Reverse current is not limited in the device, so external limiting is required if extended reverse voltage operation is anticipated.

Figure 37 shows one approach for protecting the device.

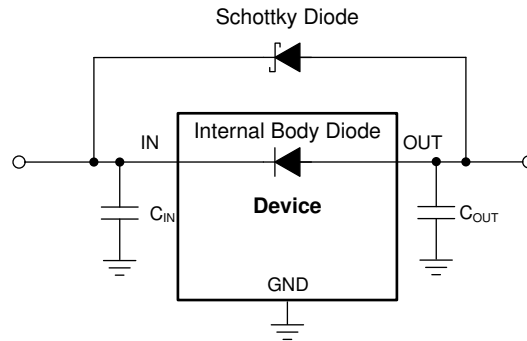


Figure 37. Example Circuit for Reverse Current Protection Using a Schottky Diode

Figure 38 shows another, more commonly used, approach in high input voltage applications.

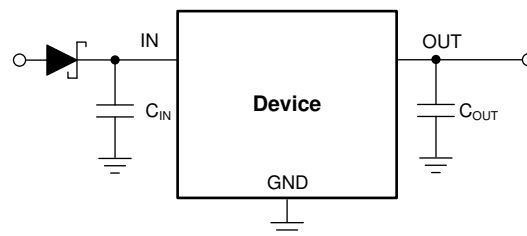


Figure 38. Reverse Current Prevention Using A Diode Before the LDO

### 9.1.5 Feed-Forward Capacitor ( $C_{FF}$ )

For the adjustable-voltage version device, a feed-forward capacitor ( $C_{FF}$ ) can be connected from the OUT pin to the FB pin.  $C_{FF}$  improves transient, noise, and PSRR performance, but is not required for regulator stability. Recommended  $C_{FF}$  values are listed in the *Recommended Operating Conditions* table. A higher capacitance  $C_{FF}$  can be used; however, the startup time increases. For a detailed description of  $C_{FF}$  tradeoffs, see the *Pros and Cons of Using a Feedforward Capacitor with a Low-Dropout Regulator* application report.

### 9.1.6 Power Dissipation ( $P_D$ )

Circuit reliability requires consideration of the device power dissipation, location of the circuit on the printed circuit board (PCB), and correct sizing of the thermal plane. The PCB area around the regulator must have few or no other heat-generating devices that cause added thermal stress.

To first-order approximation, power dissipation in the regulator depends on the input-to-output voltage difference and load conditions. Equation 6 calculates power dissipation ( $P_D$ ).

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} \quad (6)$$

#### NOTE

Power dissipation can be minimized, and therefore greater efficiency can be achieved, by correct selection of the system voltage rails. For the lowest power dissipation use the minimum input voltage required for correct output regulation.

## Application Information (continued)

For devices with a thermal pad, the primary heat conduction path for the device package is through the thermal pad to the PCB. Solder the thermal pad to a copper pad area under the device. This pad area must contain an array of plated vias that conduct heat to additional copper planes for increased heat dissipation.

The maximum power dissipation determines the maximum allowable ambient temperature ( $T_A$ ) for the device. According to [Equation 7](#), power dissipation and junction temperature are most often related by the junction-to-ambient thermal resistance ( $R_{\theta JA}$ ) of the combined PCB and device package and the temperature of the ambient air ( $T_A$ ).

$$T_J = T_A + (R_{\theta JA} \times P_D) \quad (7)$$

Thermal resistance ( $R_{\theta JA}$ ) is highly dependent on the heat-spreading capability built into the particular PCB design, and therefore varies according to the total copper area, copper weight, and location of the planes. The junction-to-ambient thermal resistance listed in the *Thermal Information* table is determined by the JEDEC standard PCB and copper-spreading area, and is used as a relative measure of package thermal performance.

### 9.1.7 Estimating Junction Temperature

The JEDEC standard now recommends the use of psi ( $\Psi$ ) thermal metrics to estimate the junction temperatures of the linear regulator when in-circuit on a typical PCB board application. These metrics are not thermal resistance parameters and instead offer a practical and relative way to estimate junction temperature. These psi metrics are determined to be significantly independent of the copper area available for heat-spreading. The *Thermal Information* table lists the primary thermal metrics, which are the junction-to-top characterization parameter ( $\Psi_{JT}$ ) and junction-to-board characterization parameter ( $\Psi_{JB}$ ). These parameters provide two methods for calculating the junction temperature ( $T_J$ ). As described in , use the junction-to-top characterization parameter ( $\Psi_{JT}$ ) with the temperature at the center-top of device package ( $T_T$ ) to calculate the junction temperature. As described in , use the junction-to-board characterization parameter ( $\Psi_{JB}$ ) with the PCB surface temperature 1 mm from the device package ( $T_B$ ) to calculate the junction temperature.

For detailed information on the thermal metrics and how to use them, see the [Semiconductor and IC Package Thermal Metrics application report](#).

## Application Information (continued)

### 9.1.8 Special Consideration for Line Transient

During a line transient, the response of this LDO to a very large or fast input voltage change can cause a brief shutdown lasting up to a few hundred microseconds from the voltage transition. This shutdown can be avoided by reducing the voltage step size, increasing the transition time, or a combination of both. [Figure 39](#) provides a boundary to follow to avoid this behavior. If necessary, reduce slew rate and the voltage step size to stay below the curve.

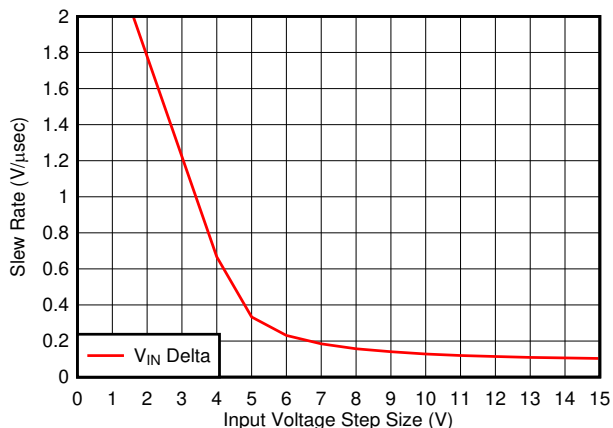


Figure 39. Recommended Input Voltage Step and Slew Rate in a Line transient

## 9.2 Typical Application

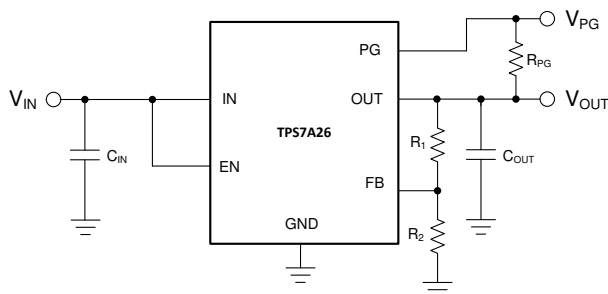


Figure 40. Generating a 5-V Rail From a Multicell Power Bank

### 9.2.1 Design Requirements

Table 2 summarizes the design requirements for Figure 40.

Table 2. Design Parameters

PARAMETER	DESIGN VALUES
$V_{IN}$	7.2 V
$V_{OUT}$	5 V $\pm$ 1%
$I_{(IN)}$ (no load)	< 5 $\mu$ A
$I_{OUT}$ (max)	330 mA
$T_A$	70°C (max)

## 9.2.2 Detailed Design Procedure

Select a 5-V output, fixed or adjustable device to generate the 5-V rail. The fixed-version LDO has internal feedback divider resistors, and thus has lower quiescent current. The adjustable-version LDO requires external feedback divider resistors, and is described in the [Selecting Feedback Divider Resistors](#) section.

### 9.2.2.1 Transient Response

As with any regulator, increasing the output capacitor value reduces over- and undershoot magnitude, but increases transient response duration.

### 9.2.2.2 Selecting Feedback Divider Resistors

For this design example,  $V_{OUT}$  is set to 5 V. The following equations set the output voltage:

$$V_{OUT} = V_{FB} \times (1 + R_1 / R_2) \quad (8)$$

$$R_1 + R_2 \leq V_{OUT} / (I_{FB} \times 100) \quad (9)$$

For improved output accuracy, use [Equation 9](#) and  $I_{FB(TYP)} = 10$  nA as listed in the [Electrical Characteristics](#) table to calculate the upper limit for series feedback resistance,  $R_1 + R_2 \leq 5$  M $\Omega$ .

The control-loop error amplifier drives the FB pin to the same voltage as the internal reference ( $V_{FB} = 1.24$  V as listed in the [Electrical Characteristics](#) table). Use [Equation 8](#) to determine the ratio of  $R_1 / R_2 = 3.03$ . Use this ratio and solve [Equation 9](#) for  $R_2$ . Now calculate the upper limit for  $R_2 \leq 1.24$  M $\Omega$ . Select a standard value resistor of  $R_2 = 1.18$  M $\Omega$ .

Reference [Equation 8](#) and solve for  $R_1$ :

$$R_1 = (V_{OUT} / V_{FB} - 1) \times R_2 \quad (10)$$

From [Equation 10](#),  $R_1 = 3.64$  M $\Omega$  can be determined. Select a standard resistor value for  $R_1 = 3.6$  M $\Omega$ . From [Equation 8](#), select  $V_{OUT} = 5.023$  V.

### 9.2.2.3 Thermal Dissipation

Junction temperature can be determined using the junction-to-ambient thermal resistance ( $R_{\theta JA}$ ) and the total power dissipation ( $P_D$ ). Use [Equation 11](#) to calculate the power dissipation. Multiply  $P_D$  by  $R_{\theta JA}$  and add the ambient temperature ( $T_A$ ), as [Equation 12](#) shows, to calculate the junction temperature ( $T_J$ ).

$$P_D = (I_{GND} + I_{OUT}) \times (V_{IN} - V_{OUT}) \quad (11)$$

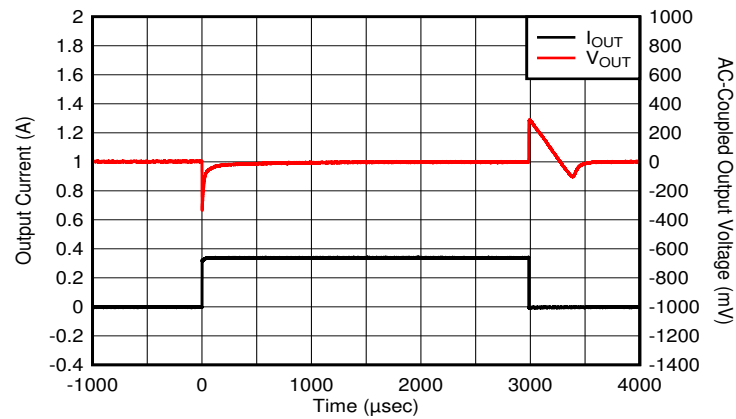
$$T_J = R_{\theta JA} \times P_D + T_A \quad (12)$$

[Equation 13](#) calculates the maximum ambient temperature. [Equation 14](#) calculates the maximum ambient temperature for typical design applications.

$$T_{A(MAX)} = T_{J(MAX)} - (R_{\theta JA} \times P_D) \quad (13)$$

$$T_{A(MAX)} = 125^\circ\text{C} - [73.3^\circ\text{C/W} \times (7.2\text{ V} - 5\text{ V}) \times 0.33\text{ A}] = 71.8^\circ\text{C} \quad (14)$$

### 9.2.3 Application Curve



$I_{OUT} = 1 \text{ mA to } 0.33 \text{ A}$ , slew rate =  $0.5 \text{ A}/\mu\text{s}$ ,  
 $V_{OUT} = 5 \text{ V}$ ,  $V_{IN} = 7.2 \text{ V}$ ,  $C_{IN} = 1 \mu\text{F}$ ,  $C_{OUT} = 1 \mu\text{F}$ ,  $C_{FF} = 0 \mu\text{F}$

⊠ 41. TPS7A26 Load Transient 1 mA to 330 mA)

## 10 Power Supply Recommendations

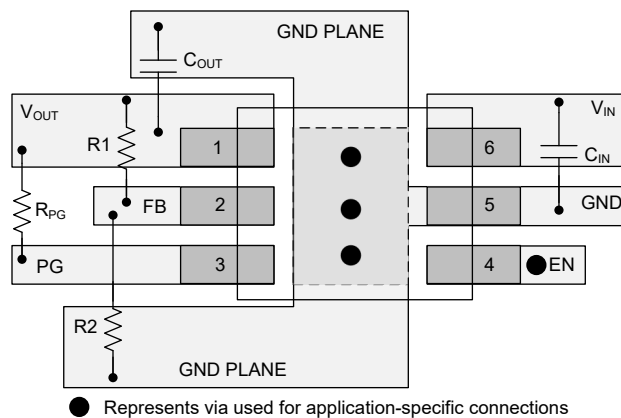
The device is designed to operate with an input supply range of 2.4 V to 18 V. If the input supply is noisy, additional input capacitors with low ESR can help improve output noise performance.

## 11 Layout

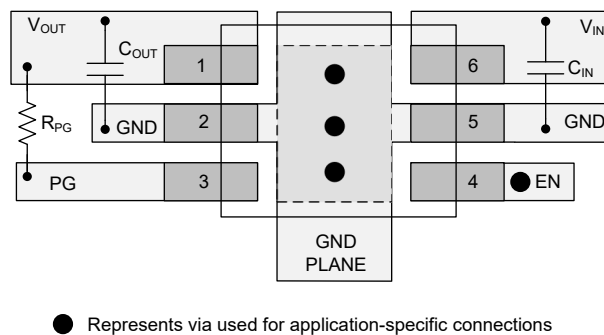
### 11.1 Layout Guidelines

- Place input and output capacitors as close to the device pins as possible
- Use copper planes for device connections to optimize thermal performance
- Place thermal vias around the device and under the DRV thermal pad to distribute heat

### 11.2 Layout Examples



☒ 42. Adjustable Version Layout Example



☒ 43. Fixed Version Layout Example



## 12 デバイスおよびドキュメントのサポート

### 12.1 デバイス・サポート

#### 12.1.1 デバイスの項目表記

**表 3. デバイスの項目表記<sup>(1)</sup>**

製品名	V <sub>OUT</sub>
TPS7A26xx(x)yyyz	<p><b>xx(x)</b>は公称出力電圧です。出力電圧の分解能が100mVの場合、注文番号に2桁が使用されます。分解能が50mVの場合、3桁が使用されます(例: 28 = 2.8V、125 = 1.25V)。01は、可変出力バージョンを示します。</p> <p><b>yyy</b>はパッケージ指定子です。</p> <p><b>z</b>はパッケージ数量です。Rは数量の大きいリール、Tは数量の小さいリールです。</p>

(1) 最新のパッケージおよび注文情報については、このドキュメントの最後にあるパッケージ・オプションの付録を参照するか、[www.ti.com](http://www.ti.com)のデバイス製品フォルダをご覧ください。

### 12.2 ドキュメントのサポート

#### 12.2.1 関連資料

- テキサス・インスツルメンツ、『[TPS7A25 300mA、18V、超低 IQ、低ドロップアウト、パワー・グッド出力付きのリニア電圧レギュレータ](#)』データシート
- テキサス・インスツルメンツ、『[Know Your Limits](#)』アプリケーション・レポート (英語)
- テキサス・インスツルメンツ、『[Pros and Cons of Using a Feedforward Capacitor with a Low-Dropout Regulator](#)』アプリケーション・レポート (英語)

#### 12.3 ドキュメントの更新通知を受け取る方法

ドキュメントの更新についての通知を受け取るには、[ti.com](http://ti.com)のデバイス製品フォルダを開いてください。右上の「アラートを受け取る」をクリックして登録すると、変更されたすべての製品情報に関するダイジェストを毎週受け取れます。変更の詳細については、修正されたドキュメントに含まれている改訂履歴をご覧ください。

#### 12.4 コミュニティ・リソース

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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#### 12.5 商標

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#### 12.6 静電気放電に関する注意事項



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静電気放電はわずかな性能の低下から完全なデバイスの故障に至るまで、様々な損傷を与えます。高精度の集積回路は、損傷に対して敏感であり、極めてわずかなパラメータの変化により、デバイスに規定された仕様に適合しなくなる場合があります。

#### 12.7 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

## 13 メカニカル、パッケージ、および注文情報

以降のページには、メカニカル、パッケージ、および注文に関する情報が記載されています。この情報は、そのデバイスについて利用可能な最新のデータです。このデータは予告なく変更されることがあり、ドキュメントが改訂される場合もあります。本データシートのブラウザ版を使用されている場合は、画面左側の説明をご覧ください。

**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
TPS7A2601DRVR	ACTIVE	WSON	DRV	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	7A26	<a href="#">Samples</a>
TPS7A2601DRVT	ACTIVE	WSON	DRV	6	250	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	7A26	<a href="#">Samples</a>
TPS7A26125DRVR	ACTIVE	WSON	DRV	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1X9P	<a href="#">Samples</a>
TPS7A2618DRVR	ACTIVE	WSON	DRV	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1X8P	<a href="#">Samples</a>
TPS7A2625DRVR	ACTIVE	WSON	DRV	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1X7P	<a href="#">Samples</a>
TPS7A2633DRVR	ACTIVE	WSON	DRV	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1WRP	<a href="#">Samples</a>
TPS7A2650DRVR	ACTIVE	WSON	DRV	6	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1WPP	<a href="#">Samples</a>

(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".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(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.

<sup>(6)</sup> 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 AND REEL INFORMATION**

**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
TPS7A2601DRVR	WSON	DRV	6	3000	178.0	8.4	2.25	2.25	1.0	4.0	8.0	Q2
TPS7A2601DRVT	WSON	DRV	6	250	178.0	8.4	2.25	2.25	1.0	4.0	8.0	Q2
TPS7A26125DRVR	WSON	DRV	6	3000	178.0	8.4	2.25	2.25	1.0	4.0	8.0	Q2
TPS7A2618DRVR	WSON	DRV	6	3000	178.0	8.4	2.25	2.25	1.0	4.0	8.0	Q2
TPS7A2625DRVR	WSON	DRV	6	3000	178.0	8.4	2.25	2.25	1.0	4.0	8.0	Q2
TPS7A2633DRVR	WSON	DRV	6	3000	178.0	8.4	2.25	2.25	1.0	4.0	8.0	Q2
TPS7A2650DRVR	WSON	DRV	6	3000	178.0	8.4	2.25	2.25	1.0	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)
TPS7A2601DRVR	WSON	DRV	6	3000	205.0	200.0	33.0
TPS7A2601DRVT	WSON	DRV	6	250	205.0	200.0	33.0
TPS7A26125DRVR	WSON	DRV	6	3000	205.0	200.0	33.0
TPS7A2618DRVR	WSON	DRV	6	3000	205.0	200.0	33.0
TPS7A2625DRVR	WSON	DRV	6	3000	205.0	200.0	33.0
TPS7A2633DRVR	WSON	DRV	6	3000	205.0	200.0	33.0
TPS7A2650DRVR	WSON	DRV	6	3000	205.0	200.0	33.0

## GENERIC PACKAGE VIEW

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.

4206925/F



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NOTES:

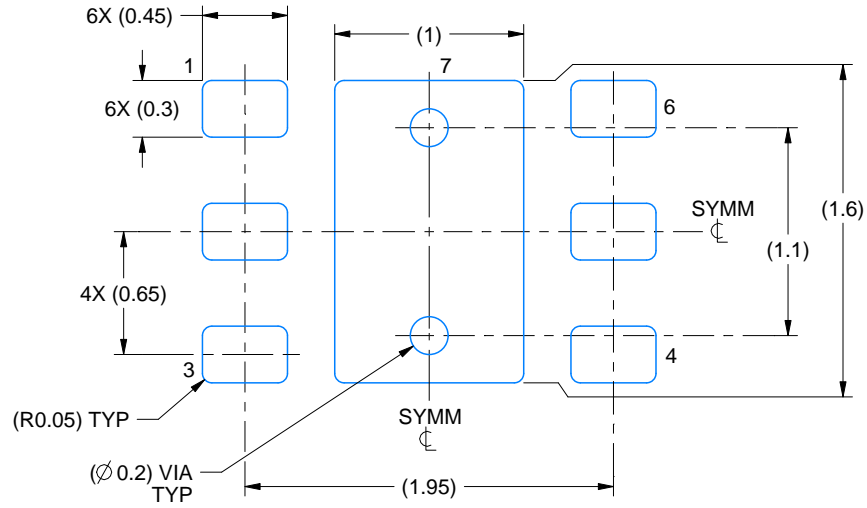
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

# EXAMPLE BOARD LAYOUT

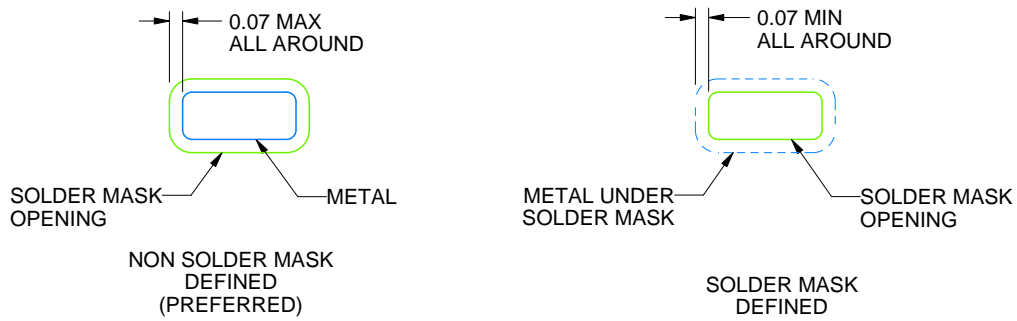
DRV0006A

WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE  
SCALE:25X



SOLDER MASK DETAILS

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NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 ([www.ti.com/lit/sluea271](http://www.ti.com/lit/sluea271)).
5. Vias are optional depending on application, refer to device data sheet. If some or all are implemented, recommended via locations are shown.



# EXAMPLE STENCIL DESIGN

DRV0006A

WSON - 0.8 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD #7  
88% PRINTED SOLDER COVERAGE BY AREA UNDER PACKAGE  
SCALE:30X

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NOTES: (continued)

6. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

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