TPS7A05 1µAの超低I_Q、200mA、小型パッケージの低ドロップアウト・レギュレータ

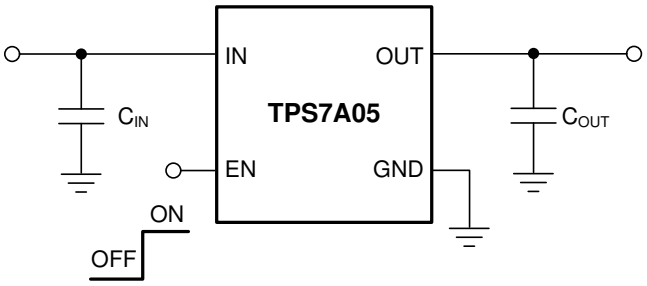
1 特長

- 非常に低いI_Q: 1µA (標準値)、3µA (最大値)
  - I_{GND}: 200mAで6µA (標準値)
- 優れた過度応答
- パッケージ:
  - 1.0mm×1.0mm X2SON (4)
  - 0.65mm×0.65mm DSBGA (4)
  - SOT-23 (5)
  - SOT-23 (3)
- 入力電圧範囲: 1.4V～5.5V
- 出力精度：標準値 1%、最大値 3%
- 固定出力電圧で供給
  - 0.8V～3.3V
- 非常に低いドロップアウト
  - 200mA で 235mV (最大値) ($3.3V_{OUT}$)
- アクティブ出力放電
- フォールドバック電流制限
- 0.47µF 以上のコンデンサで安定

2 アプリケーション

- ウェアラブル電子機器
- ウルトラブック、タブレット、電子書籍リーダー
- 常時オンの電源
- セット・トップ・ボックス
- ゲーム・コントローラ、リモート・コントロール、玩具、ドローン
- ワイヤレス・ハンドセットおよびスマートフォン
- 携帯型およびバッテリ駆動の機器

代表的なアプリケーション回路



3 概要

TPS7A05は超小型、低静止電流、低ドロップアウトのレギュレータ(LDO)で、非常に優れた過渡性能で 200mA を供給できます。このデバイスは出力範囲が0.8V～3.3V で、標準精度が1%です。

TPS7A05はI_Qが非常に低く(1µA)、静止時消費電流も非常に低いため、バッテリ駆動のアプリケーションで動作時間を延長できます。このデバイスは充電可能なリチウムイオン電池、Li-SOCl2やLi-MnO2などのリチウム一次電池に加えて、2または3セルのアルカリ電池でも動作します。

TPS7A05にはアクティブ・プルダウン回路があり、ディセーブル時に出力負荷を迅速に放電します。

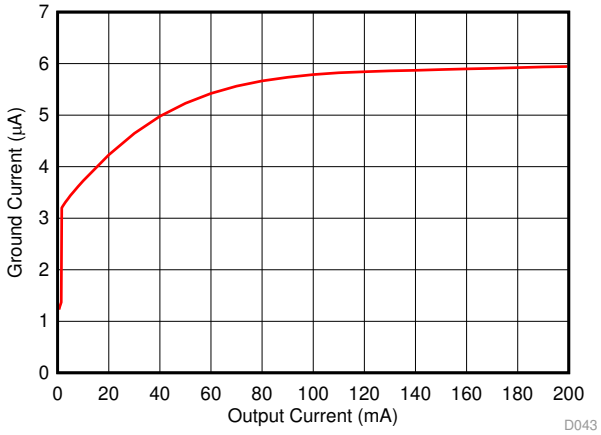
TPS7A05 は T_J = -40℃～+125℃で完全に動作が規定されており、標準の X2SON (DQN)、SOT-23 (DBV および DBZ)、DSBGA (YKA) パッケージで供給されます。

製品情報(1)

型番	パッケージ	本体サイズ(公称)
TPS7A05	X2SON (4)	1.00mm×1.00mm
	DSBGA (4)	0.65mm×0.65mm
	SOT-23 (5)	2.90mm×1.60mm
	SOT-23 (3)	2.90mm×1.60mm

(1) 提供されているすべてのパッケージについては、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。

グランド電流と出力電流との関係



英語版のTI製品についての情報を翻訳したこの資料は、製品の概要を確認する目的で便宜的に提供しているものです。該当する正式な英語版の最新情報は、www.ti.comで閲覧でき、その内容が常に優先されます。TIでは翻訳の正確性および妥当性につきましては一切保証いたしません。実際の設計などの前には、必ず最新版の英語版をご参照くださいますようお願いいたします。

目次

1 特長 ... 1
2 アプリケーション ... 1
3 概要 ... 1
4 改訂履歴 ... 2
5 **Pin Configuration and Functions** ... 4
6 **Specifications** ... 6
6.1 Absolute Maximum Ratings ... 6
6.2 ESD Ratings ... 6
6.3 Recommended Operating Conditions ... 6
6.4 Thermal Information ... 6
6.5 Electrical Characteristics ... 7
6.6 Switching Characteristics ... 9
6.7 Typical Characteristics ... 10
7 **Detailed Description** ... 18
7.1 Overview ... 18
7.2 Functional Block Diagram ... 18
7.3 Feature Description ... 19
7.4 Device Functional Modes ... 21
8 **Application and Implementation** ... 22
8.1 Application Information ... 22
8.2 Typical Application ... 27
9 **Power Supply Recommendations** ... 27
10 **Layout** ... 28
10.1 Layout Guidelines ... 28
10.2 Layout Example ... 28
11 デバイスおよびドキュメントのサポート ... 29
11.1 デバイス・サポート ... 29
11.2 ドキュメントのサポート ... 29
11.3 ドキュメントの更新通知を受け取る方法 ... 29
11.4 コミュニティ・リソース ... 29
11.5 商標 ... 29
11.6 静電気放電に関する注意事項 ... 29
11.7 Glossary ... 29
12 メカニカル、パッケージ、および注文情報 ... 30

4 改訂履歴

Revision C (April 2019) から **Revision D** に変更 — **Page**

- DBZ パッケージを APL から量産データに 変更 ... 1
- Added DBZ package to *Load Regulation* parameter in *Electrical Characteristics* table ... 7
- Added DBZ package to *Dropout voltage* parameter in *Electrical Characteristics* table ... 8
- 追加 condition statement to I_Q *vs* V_{IN} *and Temperature* figure ... 10

Revision B (August 2018) から **Revision C** に変更 — **Page**

- ドキュメントに DBZ パッケージを APL リリースとして 追加 ... 1

Revision A (May 2018) から **Revision B** に変更 — **Page**

- ドキュメントのタイトルで「*1mm×1mm*」を「*小型*」に 変更 ... 1
- YKA (DSBGA)パッケージのステータスを量産データに 変更 ... 1
- Added Accuracy for 1.825 V in *Electrical Characteristics* table ... 7
- Changed Output current limit in *Electrical Characteristics* table ... 7
- Added Output current limit for +85°C in *Electrical Characteristics* table ... 7
- Changed Short-circuit current limit in *Electrical Characteristics* table ... 7
- Added Dropout voltage for 1.825 V in *Electrical Characteristics* table ... 8
- 変更 y-axis scaling and added conditions for I_{OUT} *Transient 0 mA to 100 mA* figure ... 10
- 変更 y-axis scaling and added conditions for I_{OUT} *Transient 0 mA to 200 mA* figure ... 11
- 追加 I_{OUT} *Transient 0 mA to 50 mA* figure to I_{OUT} *Transient 3 µA to 3 mA* figure ... 11
- 追加 slew rate condition to V_{IN} *Transient* figures (I_{OUT} = 100 mA and I_{OUT} = 200 mA) ... 12
- 追加 V_{IN} *Transient* figures (I_{OUT} = 150 mA and I_{OUT} = 20 mA) ... 13
- 追加 V_{IN} condition to *PSRR vs Frequency and* I_{OUT} figure (V_{OUT} = 1.8 V) ... 16

Copyright © 2018–2019, Texas Instruments Incorporated

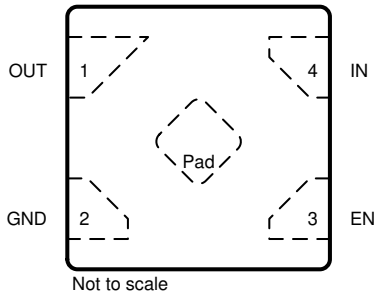
2018年2月発行のものから更新 **Page**

- 量産用にリリース..... 1

Copyright © 2018–2019, Texas Instruments Incorporated

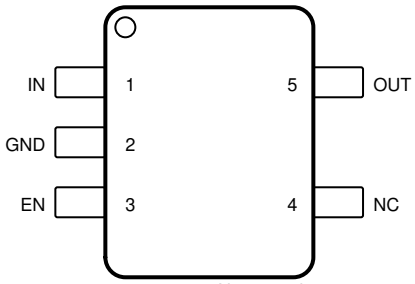
5 Pin Configuration and Functions

DQN Package
1-mm × 1-mm, 4-Pin X2SON
Top View



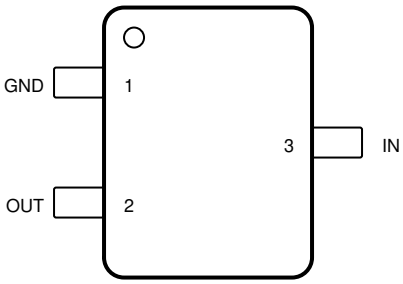
Not to scale

DBV Package
5-Pin SOT-23
Top View



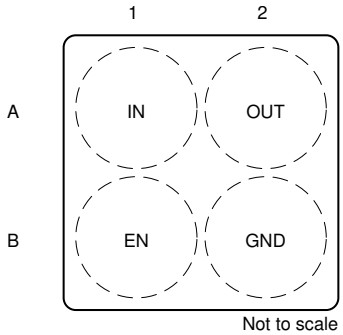
Not to scale

DBZ Package
3-Pin SOT-23
Top View



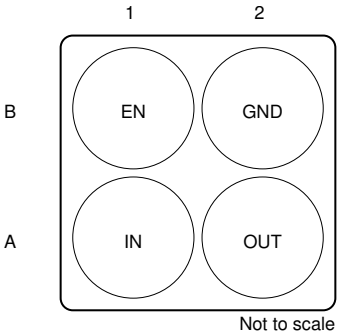
Not to scale

YKA Package
4-Pin DSBGA, 0.35-mm Pitch
Top View



Not to scale

YKA Package
4-Pin DSBGA, 0.35-mm Pitch
Bottom View



Not to scale

Copyright © 2018–2019, Texas Instruments Incorporated

Pin Functions

PIN					I/O	DESCRIPTION
NAME	DQN	DBV	DBZ	YKA		
IN	4	1	3	A1	Input	Input pin. For best transient response and to minimize input impedance, use the recommended value or larger ceramic capacitor from IN to ground as listed in the *Recommended Operating Conditions* table. Place the input capacitor as close to input of the device as possible.
EN	3	3	—	B1	Input	Enable pin. Driving this pin to logic high enables the device; driving this pin to logic low disables the device. If enable functionality is not required, this pin must be connected to IN. V_{EN} must not exceed V_{IN}.
GND	2	2	1	B2	—	Ground pin. This pin must be connected to ground on the board.
OUT	1	5	2	A2	Output	Regulated output pin. A capacitor is required from OUT to ground for stability. For best transient response, use the nominal recommended value or larger ceramic capacitor from OUT to ground. Follow the recommended capacitor value as listed in the *Recommended Operating Conditions* table. Place the output capacitor as close to output of the device as possible.
NC	—	4	—	—	—	No connect pin. This pin is not internally connected. Connect to ground or leave floating.
Thermal pad	Pad	—	—	—	—	Connect the thermal pad to a large-area ground plane. This pad is not an electrical connection to the device ground.

Copyright © 2018–2019, Texas Instruments Incorporated

6 Specifications

6.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT
Voltage(2)	IN	–0.3	6.0	V
	EN	–0.3	V_{IN} + 0.3	
	OUT	–0.3	V_{IN} + 0.3 or 3.6(3)	
Current	Maximum output current	Internally limited		A
Temperature	Operating junction temperature, T_J	–40	125	°C
	Storage temperature, T_{stg}	–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_{IN} + 0.3 V or 3.6 V (whichever is smaller)

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±1000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101(2)	±500	

(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

		MIN	NOM	MAX	UNIT
V_{IN}	Input supply voltage	1.4		5.5	V
V_{EN}	Enable supply voltage	0		V_{IN}	V
V_{OUT}	Nominal output voltage range	0.8		3.3	V
I_{OUT}	Output current(1)	0		200	mA
C_{IN}	Input capacitor		1		µF
C_{OUT}	Output capacitor	0.47	1	22	µF
T_J	Operating junction temperature	–40		125	°C

(1) Output current of 10 µA minimum required to meet output voltage accuracy specification.

6.4 Thermal Information

THERMAL METRIC(1)		TPS7A05				UNIT
		DBZ (SOT-23)	DBV (SOT-23)	DQN (X2SON)	YKA (DSBGA)	
		3 PINS	5 PINS	4 PINS	4 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	267.3	185.6	144.1	198.0	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	103.5	104.3	137.9	2.1	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	98.0	54.5	83.5	66.9	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	9.2	31.0	5.3	0.9	°C/W
Y_{JB}	Junction-to-board characterization parameter	97.4	54.5	83.8	76.0	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	n/a	n/a	71.8	n/a	°C/W

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

Copyright © 2018–2019, Texas Instruments Incorporated

6.5 Electrical Characteristics

specified at T_J = –40°C to +125°C, V_{IN} = $V_{OUT(nom)}$ + 0.5 V or 1.4 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, C_{IN} = 1 µF, and C_{OUT} = 1 µF (unless otherwise noted); typical values are at T_J = 25°C.

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
	Nominal accuracy(1)	V_{OUT} ≥ 1.0 V, T_J = 25°C		–1%		1%	
		V_{OUT} < 1.0 V, T_J = 25°C		–10		10	mV
	Accuracy over temperature(1)	V_{OUT} ≥ 1.0 V, T_J = –40°C to +85°C		–2%		2%	
		V_{OUT} ≥ 1.0 V		–3%		3%	
		V_{OUT} < 1.0 V, T_J = –40°C to +85°C		–20		20	mV
		V_{OUT} < 1.0 V		–30		30	
		V_{OUT} = 1.825 V, T_J = +10℃ to +45℃, I_{OUT} = 100 µA		–0.9%		0.9%	
$\Delta V_{OUT(\Delta VIN)}$	Line regulation	$V_{OUT(nom)}$ + 0.5 V ≤ V_{IN} ≤ 5.5 V(2), T_J = –40°C to +85°C			5	16.5	mV
		$V_{OUT(nom)}$ + 0.5 V ≤ V_{IN} ≤ 5.5 V(2)				18	
$\Delta V_{OUT(\Delta IOUT)}$	Load regulation(3)	100 µA ≤ I_{OUT} ≤ 200 mA, V_{IN} = $V_{OUT(nom)}$ + $V_{DO(max)}$ + 0.1 V, T_J = –40°C to +85°C	DBV, DQN, YKA		20	43	mV
			DBZ		27	50	
		100 µA ≤ I_{OUT} ≤ 200 mA, V_{IN} = $V_{OUT(nom)}$ + $V_{DO(max)}$ + 0.1 V	DBV, DQN, YKA			55	
			DBZ			62	
I_{GND}	Ground current	T_J = 25°C, I_{OUT} = 1 µA		0.6	1	1.3	µA
		I_{OUT} = 1 µA, T_J = –40°C to +85°C				2	
		I_{OUT} = 1 µA				3	
I_{SHDN}	Shutdown current	V_{EN} = 0.4 V, 1.4 V ≤ V_{IN} ≤ 5.5 V, T_J = 25°C			100	300	nA
I_{CL}	Output current limit	V_{OUT} = 90% × $V_{OUT(nom)}$, V_{IN} = $V_{OUT(nom)}$ + $V_{DO(max)}$ + 0.5 V		210	450	700	mA
I_{CL}	Output current limit	V_{OUT} = 90% × $V_{OUT(nom)}$, V_{IN} = $V_{OUT(nom)}$ + $V_{DO(max)}$ + 0.5 V, T_J = 0°C to +85°C		250	450	700	mA
I_{SC}	Short-circuit current limit	V_{OUT} = 0 V			65	150	mA

(1) I_{OUT} ≥ 10 µA required to meet accuracy specifications.
(2) V_{IN} = 1.4 V for V_{OUT} ≤ 0.9 V.
(3) Load Regulation is normalized to the output voltage at I_{OUT} = 1 mA.

Copyright © 2018–2019, Texas Instruments Incorporated

Electrical Characteristics (continued)

specified at T_J = –40°C to +125°C, V_{IN} = $V_{OUT(nom)}$ + 0.5 V or 1.4 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, C_{IN} = 1 µF, and C_{OUT} = 1 µF (unless otherwise noted); typical values are at T_J = 25°C.

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{DO}	Dropout voltage(4)	I_{OUT} = 200 mA, T_J = –40°C to +85°C	0.8 V ≤ V_{OUT} < 1.0 V			915	mV
			1.0 V ≤ V_{OUT} < 1.2 V			758	
			1.2 V ≤ V_{OUT} < 1.5 V			609	
			1.5 V ≤ V_{OUT} < 1.8 V			469	
			1.8 V ≤ V_{OUT} < 2.5 V			341	
			2.5 V ≤ V_{OUT} < 3.3 V			275	
			V_{OUT} = 3.3 V			212	
		I_{OUT} = 200 mA	0.8 V ≤ V_{OUT} < 1.0 V			1004	
			1.0 V ≤ V_{OUT} < 1.2 V			837	
			1.2 V ≤ V_{OUT} < 1.5 V			679	
			1.5 V ≤ V_{OUT} < 1.8 V			525	
			1.8 V ≤ V_{OUT} < 2.5 V			382	
			2.5 V ≤ V_{OUT} < 3.3 V			308	
			V_{OUT} = 3.3 V			235	
		I_{OUT} = 200 mA, T_J = –40°C to +85°C, DBZ Package	1.8 V ≤ V_{OUT} < 2.5 V			351	
			2.5 V ≤ V_{OUT} < 3.3 V			285	
			V_{OUT} = 3.3 V			222	
		I_{OUT} = 200 mA, DBZ Package	1.8 V ≤ V_{OUT} < 2.5 V			392	
			2.5 V ≤ V_{OUT} < 3.3 V			318	
			V_{OUT} = 3.3 V			245	
		I_{OUT} = 100 µA, T_J = +10°C to +45°C	V_{OUT} = 1.825 V			20	
PSRR	Power-supply rejection ratio	f = 1 kHz, I_{OUT} = 30 mA			40		dB
		f = 500 kHz, I_{OUT} = 30 mA			30		
		f = 1 MHz, I_{OUT} = 30 mA			40		
V_N	Output voltage noise	BW = 10 Hz to 100 kHz, V_{OUT} = 1.2 V, I_{OUT} = 30 mA			180		$µV_{RMS}$
V_{UVLO}	UVLO threshold	V_{IN} rising		1.21	1.3	1.37	V
$V_{UVLO(HYST)}$	UVLO hysteresis	V_{IN} falling			40		mV
V_{UVLO}	UVLO threshold	V_{IN} falling		1.17		1.33	V
$V_{EN(HI)}$	EN pin logic high voltage			0.9			V
$V_{EN(LO)}$	EN pin logic low voltage					0.4	V
I_{EN}	EN pin current	V_{EN} = V_{IN} = 5.5 V			10		nA
$R_{PULLDOWN}$	Pulldown resistor	V_{IN} = 3.3 V, P version only			120		Ω
T_{sd}	Thermal shutdown temperature	Shutdown, temperature increasing			160		°C
		Reset, temperature decreasing			140		

(4) Dropout is measured by ramping V_{IN} down until V_{OUT} = $V_{OUT(nom)}$ – 5%.

Copyright © 2018–2019, Texas Instruments Incorporated

6.6 Switching Characteristics

specified at T_J = –40 to +125°C, V_{IN} = $V_{OUT(nom)}$ + $V_{DO(max)}$ + 0.5 V, I_{OUT} = 10 mA, C_{IN} = 1 µF, and C_{OUT} = 1 µF (unless otherwise noted); typical values are at T_J = 25°C.

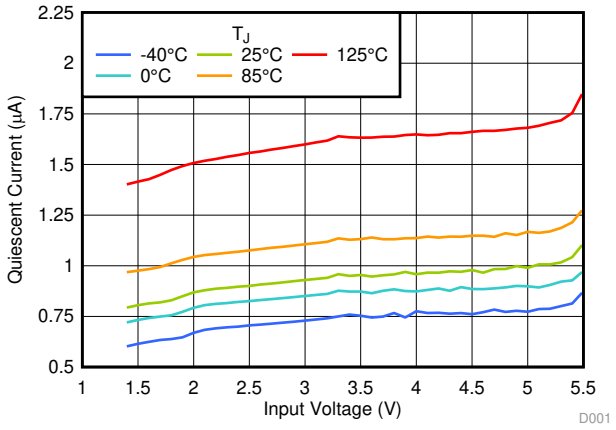
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{STR}	Start-up time(1)	From EN assertion to V_{OUT} = 95% × $V_{OUT(nom)}$, V_{OUT} = 1.8 V		1.5	2.8	ms

(1) See the *Special Considerations When Ramping Down IN and Enable* section for details on minimum ramp down rates to ensure specified start-up time.

Copyright © 2018–2019, Texas Instruments Incorporated

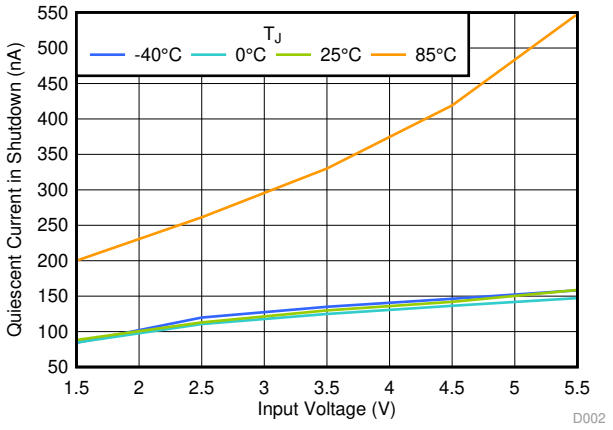
6.7 Typical Characteristics

at operating temperature T_J = 25°C, V_{IN} = $V_{OUT(NOM)}$ + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, C_{IN} = 1 µF, and C_{OUT} = 1 µF (unless otherwise noted)



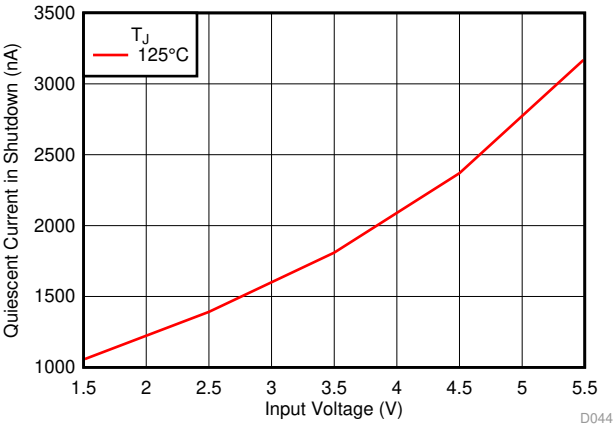
V_{OUT} = 3.3 V, includes I_Q in dropout

図 1. I_Q vs V_{IN} and Temperature



V_{EN} < 0.4 V

図 2. I_{SHDN} vs V_{IN} and Temperature



V_{EN} < 0.4 V

図 3. I_{SHDN} vs V_{IN} and Temperature

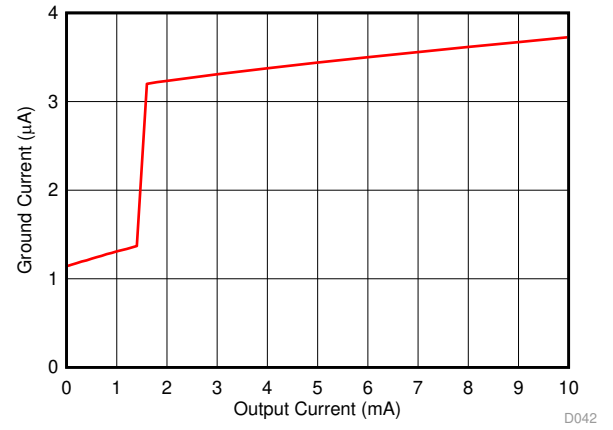


図 4. I_{GND} vs I_{OUT} up to 10 mA

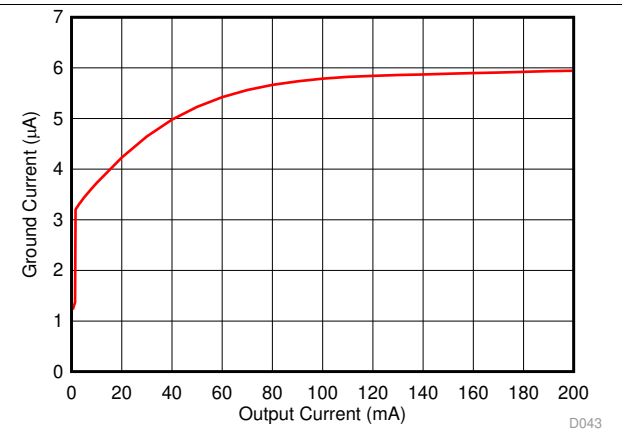
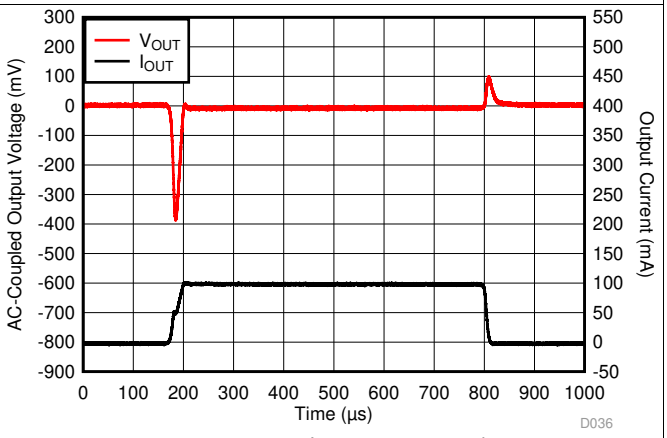


図 5. I_{GND} vs I_{OUT} up to 200 mA



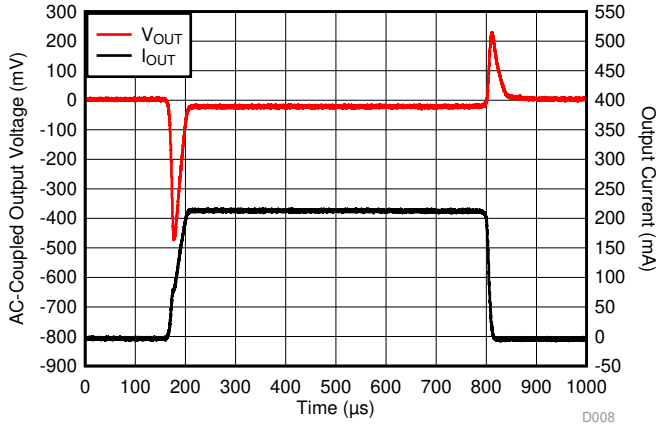
Output current slew rate = 3.3 mA/µs

図 6. I_{OUT} Transient 0 mA to 100 mA

Copyright © 2018–2019, Texas Instruments Incorporated

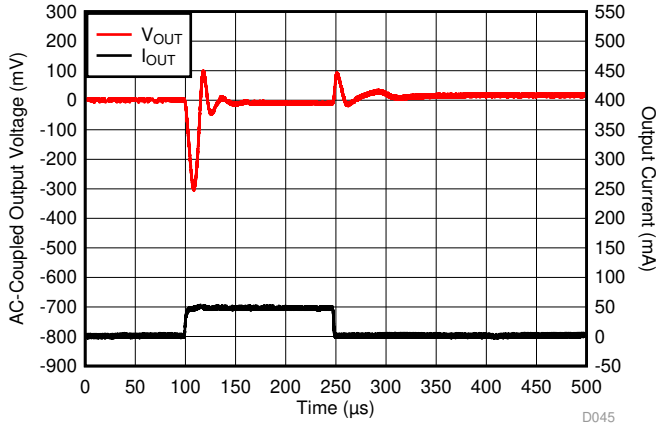
Typical Characteristics (continued)

at operating temperature T_J = 25°C, V_{IN} = $V_{OUT(NOM)}$ + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, C_{IN} = 1 µF, and C_{OUT} = 1 µF (unless otherwise noted)



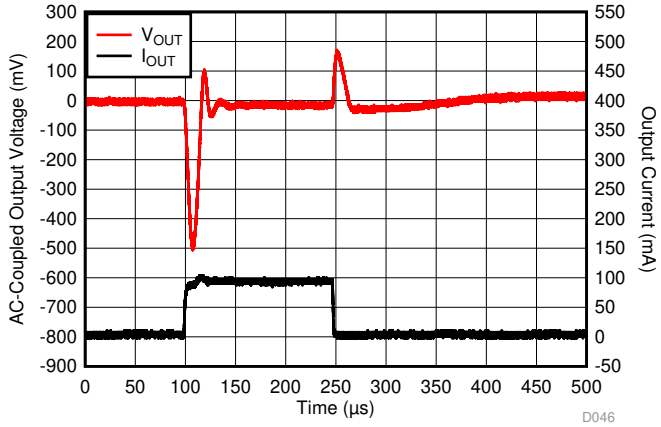
Output current slew rate = 6.6 mA/µs

図 7. I_{OUT} Transient 0 mA to 200 mA



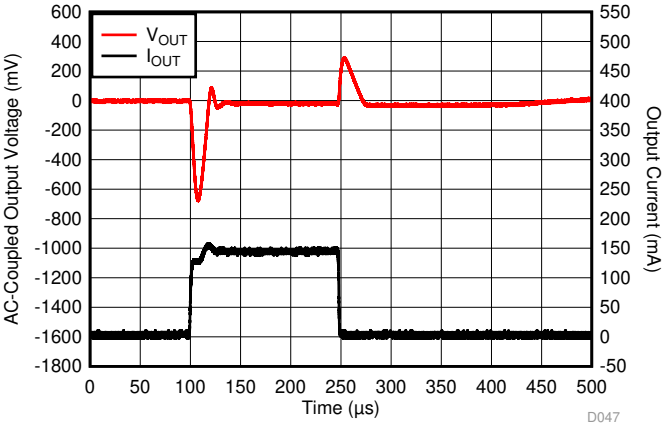
Output current slew rate = 50 mA/µs

図 8. I_{OUT} Transient 0 mA to 50 mA



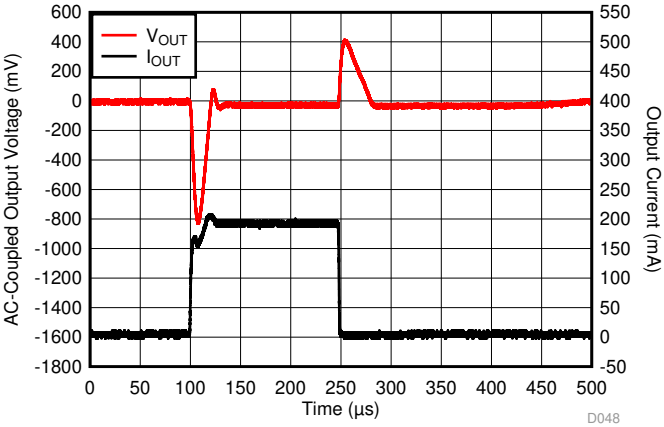
Output current slew rate = 100 mA/µs

図 9. I_{OUT} Transient 0 mA to 100 mA



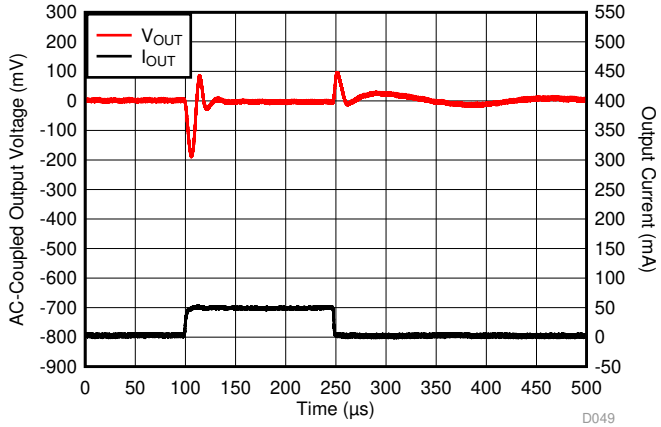
Output current slew rate = 150 mA/µs

図 10. I_{OUT} Transient 0 mA to 150 mA



Output current slew rate = 200 mA/µs

図 11. I_{OUT} Transient 0 mA to 200 mA



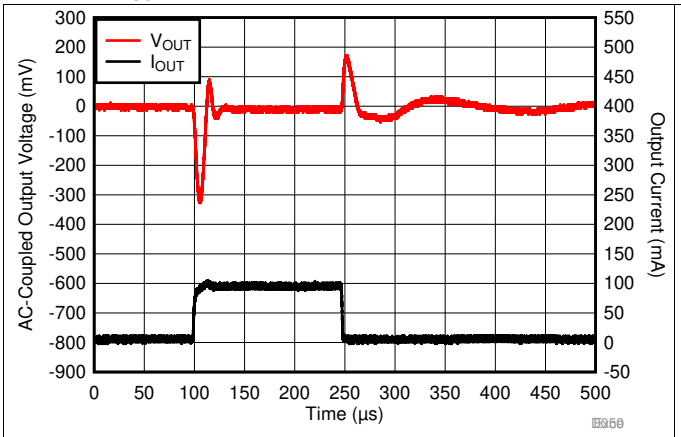
Output current slew rate = 50 mA/µs

図 12. I_{OUT} Transient 1 mA to 50 mA

Copyright © 2018–2019, Texas Instruments Incorporated

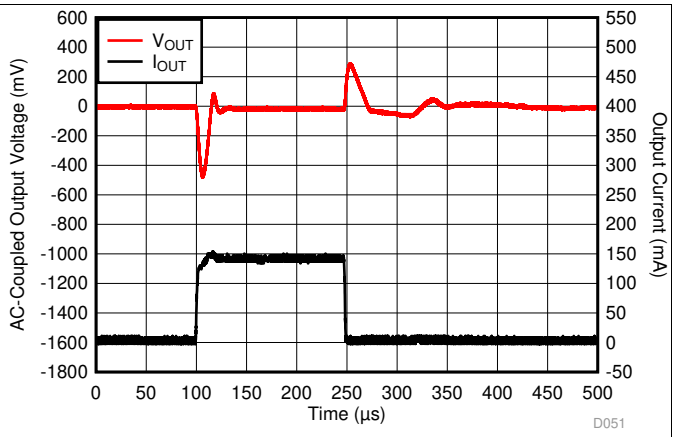
Typical Characteristics (continued)

at operating temperature T_J = 25°C, V_{IN} = $V_{OUT(NOM)}$ + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, C_{IN} = 1 µF, and C_{OUT} = 1 µF (unless otherwise noted)



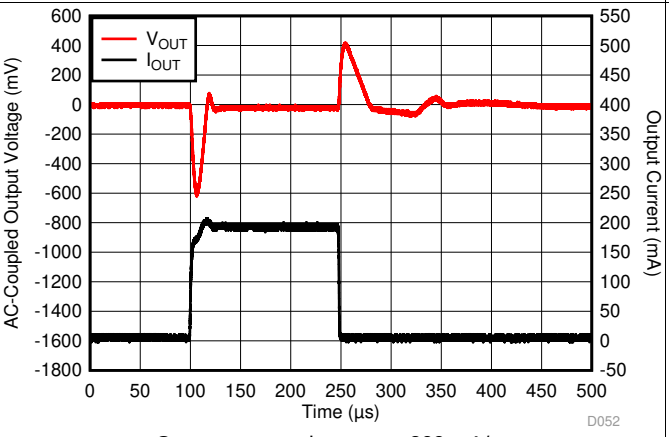
Output current slew rate = 100 mA/µs

図 13. I_{OUT} Transient 1 mA to 100 mA



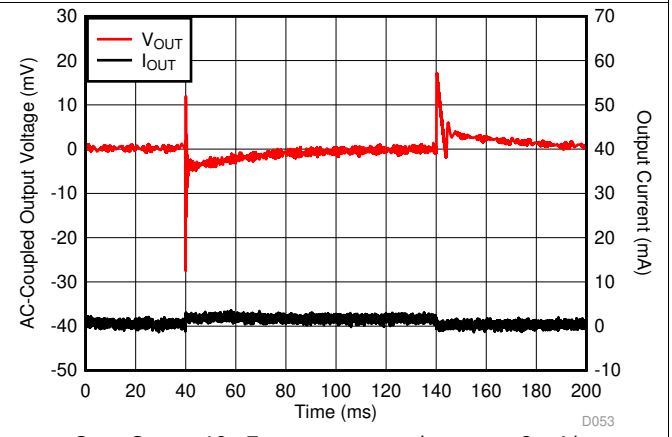
Output current slew rate = 150 mA/µs

図 14. I_{OUT} Transient 1 mA to 150 mA



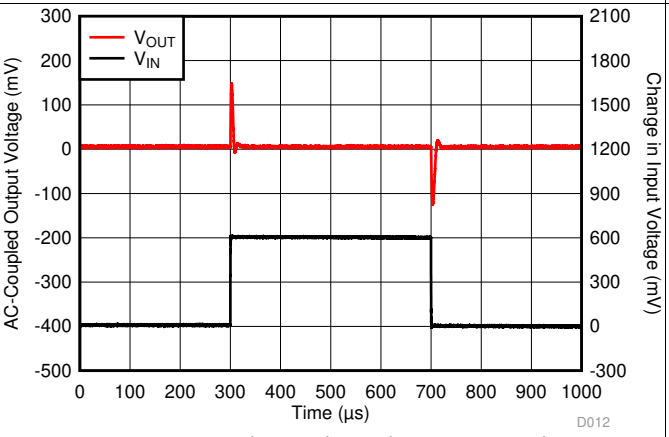
Output current slew rate = 200 mA/µs

図 15. I_{OUT} Transient 1 mA to 200 mA



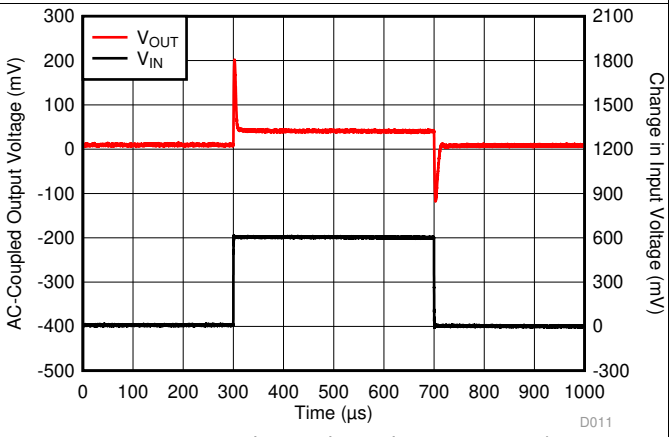
C_{IN} = C_{OUT} = 10 µF, output current slew rate = 3 mA/µs

図 16. I_{OUT} Transient 3 µA to 3 mA



I_{OUT} = 100 mA, input voltage slew rate = 0.6 V/µs

図 17. V_{IN} Transient



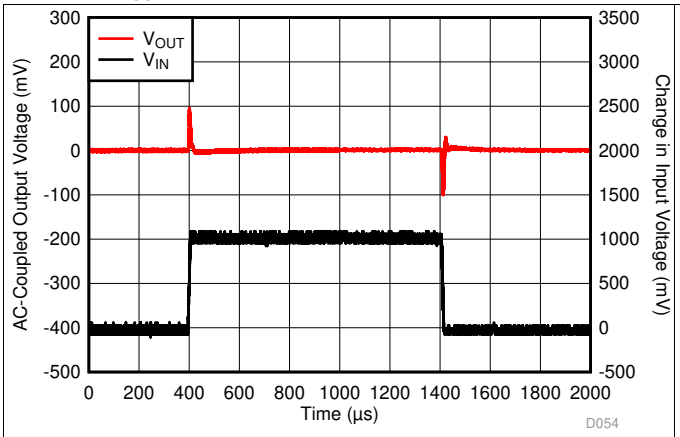
I_{OUT} = 200 mA, input voltage slew rate = 0.6 V/µs

図 18. V_{IN} Transient

Copyright © 2018–2019, Texas Instruments Incorporated

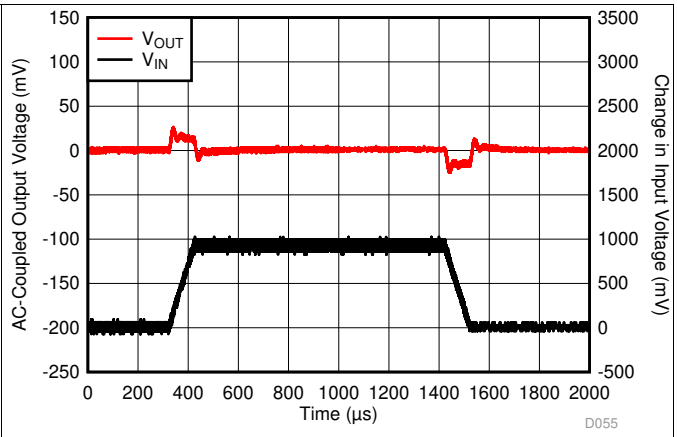
Typical Characteristics (continued)

at operating temperature T_J = 25°C, V_{IN} = $V_{OUT(NOM)}$ + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, C_{IN} = 1 µF, and C_{OUT} = 1 µF (unless otherwise noted)



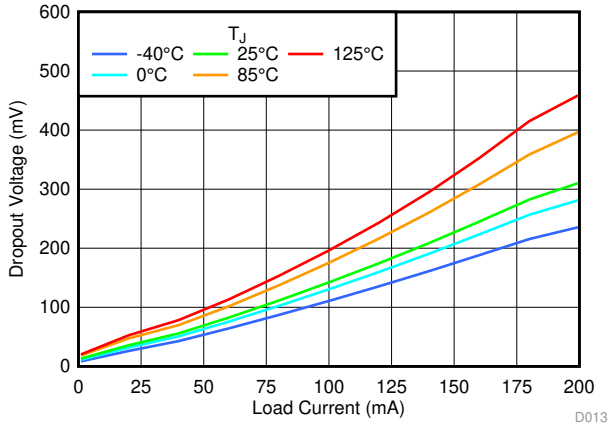
I_{OUT} = 150 mA, input voltage slew rate = 0.1 V/µs

図 19. V_{IN} Transient



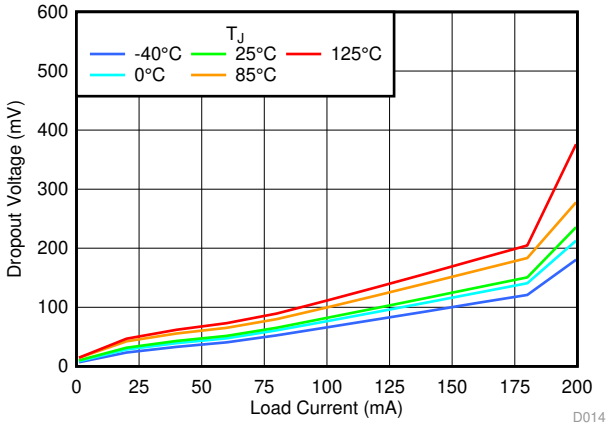
I_{OUT} = 20 mA, input voltage slew rate = 0.01 V/µs

図 20. V_{IN} Transient



V_{OUT} = 1.8 V

図 21. Dropout vs I_{OUT} and Temperature



V_{OUT} = 3.3 V

図 22. Dropout vs I_{OUT} and Temperature

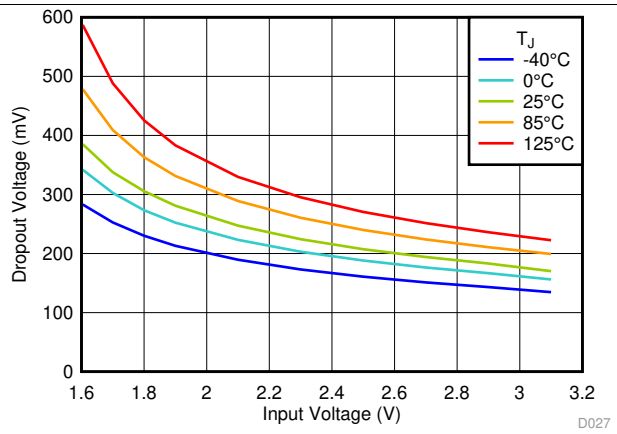
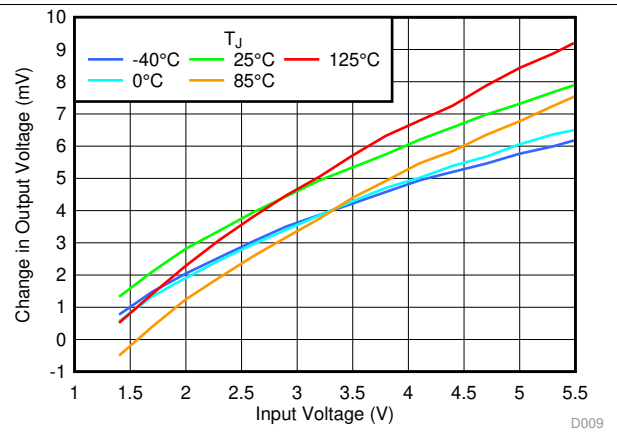


図 23. Dropout vs V_{IN} and Temperature



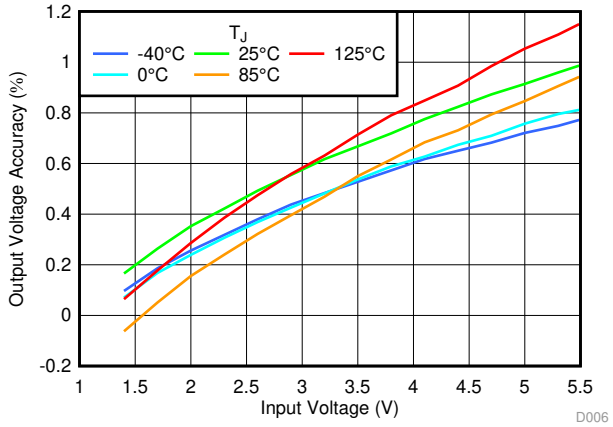
V_{OUT} = 0.8 V

図 24. Line Regulation V_{IN} and Temperature

Copyright © 2018–2019, Texas Instruments Incorporated

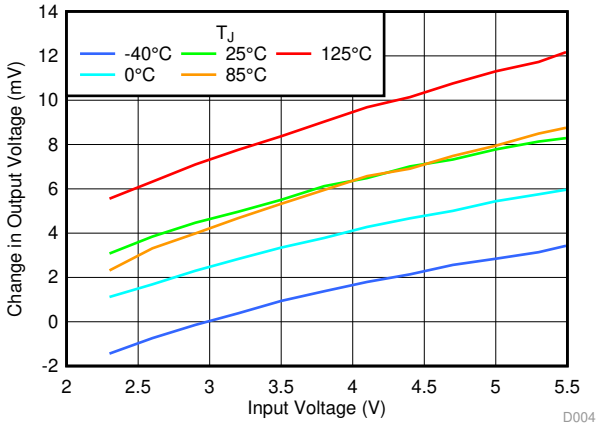
Typical Characteristics (continued)

at operating temperature T_J = 25°C, V_{IN} = $V_{OUT(NOM)}$ + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, C_{IN} = 1 µF, and C_{OUT} = 1 µF (unless otherwise noted)



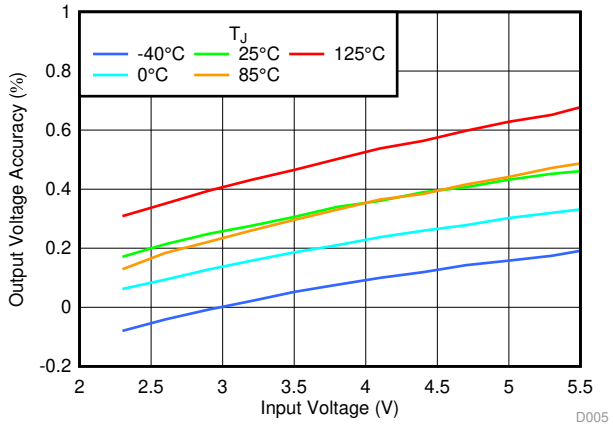
V_{OUT} = 0.8 V

図 25. Output Accuracy V_{IN} and Temperature



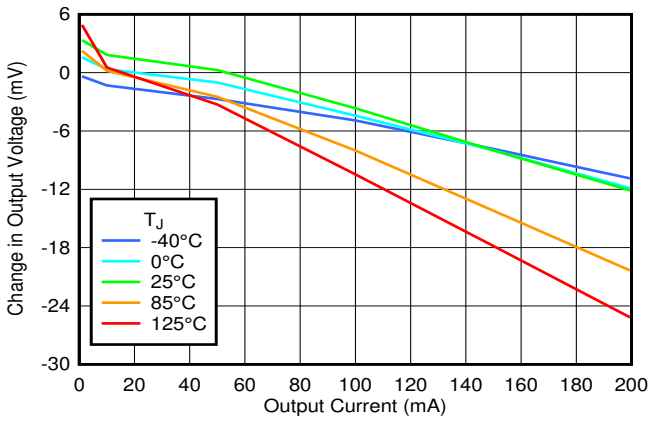
V_{OUT} = 1.8 V

図 26. Line Regulation V_{IN} and Temperature



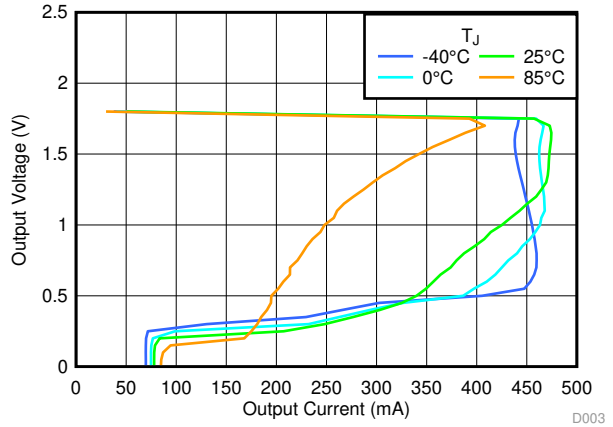
V_{OUT} = 1.8 V

図 27. Output Accuracy V_{IN} and Temperature



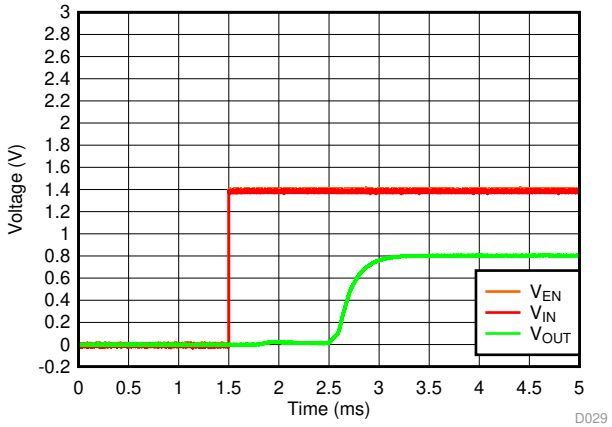
V_{OUT} = 1.8 V

図 28. Load Regulation vs I_{OUT} and Temperature



V_{OUT} = 1.8 V

図 29. Foldback Current Limit vs I_{OUT} and Temperature



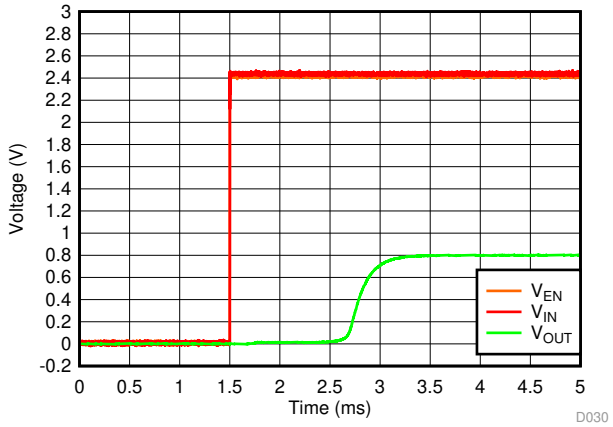
V_{OUT} = 0.8 V, I_{OUT} = 1 mA

図 30. Startup With V_{EN} = V_{IN}

Copyright © 2018–2019, Texas Instruments Incorporated

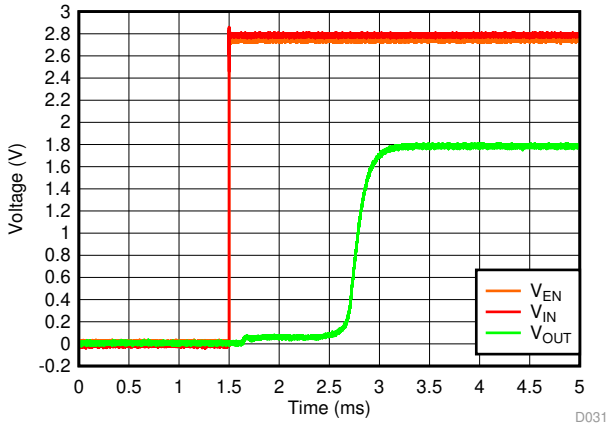
Typical Characteristics (continued)

at operating temperature T_J = 25°C, V_{IN} = $V_{OUT(NOM)}$ + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, C_{IN} = 1 µF, and C_{OUT} = 1 µF (unless otherwise noted)



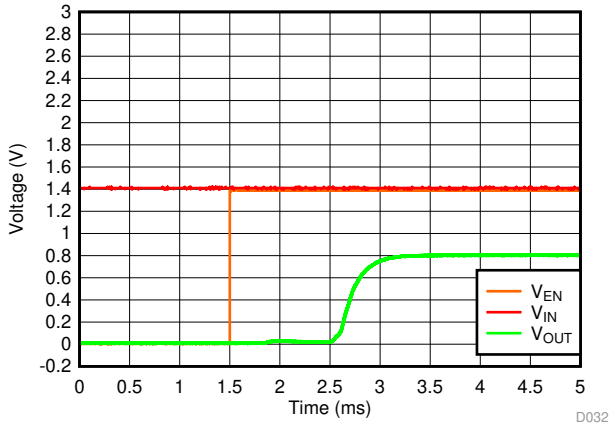
V_{OUT} = 0.8 V, I_{OUT} = 30 mA

図 31. Startup With V_{EN} = V_{IN}



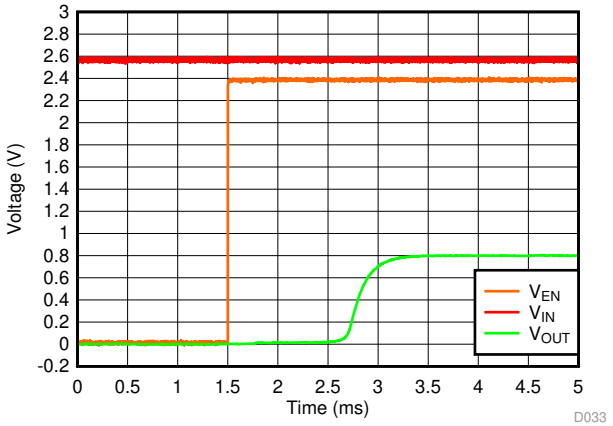
V_{OUT} = 1.8 V, I_{OUT} = 30 mA

図 32. Startup With V_{EN} = V_{IN}



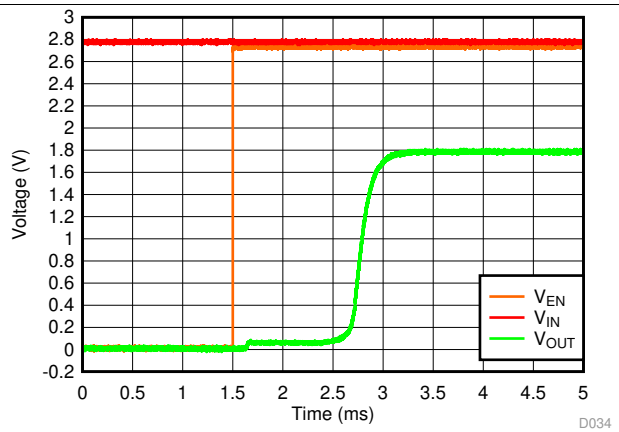
V_{OUT} = 0.8 V, I_{OUT} = 1 mA

図 33. Startup With Separate V_{IN} and V_{EN}



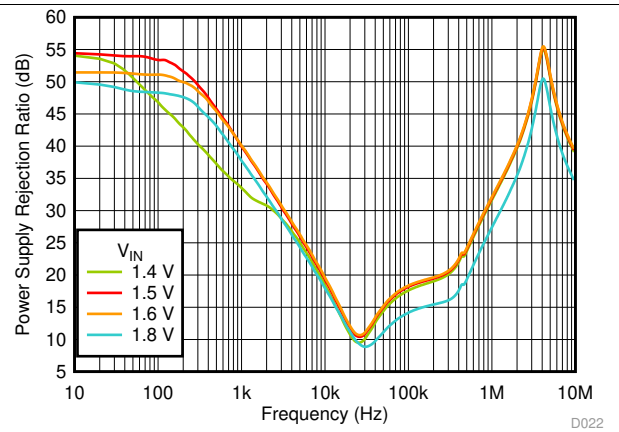
V_{OUT} = 0.8 V, I_{OUT} = 30 mA

図 34. Startup With Separate V_{IN} and V_{EN}



V_{OUT} = 1.8 V, I_{OUT} = 30 mA

図 35. Startup With Separate V_{IN} and V_{EN}



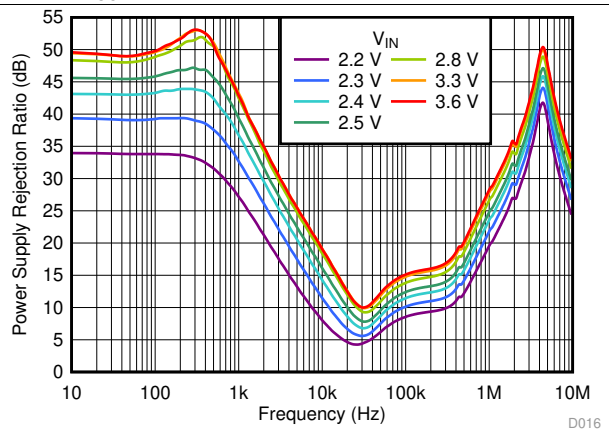
V_{OUT} = 0.8 V, I_{OUT} = 200 mA, C_{OUT} = 1 µF, C_{IN} = 0 µF

図 36. PSRR vs Frequency and V_{IN}

Copyright © 2018–2019, Texas Instruments Incorporated

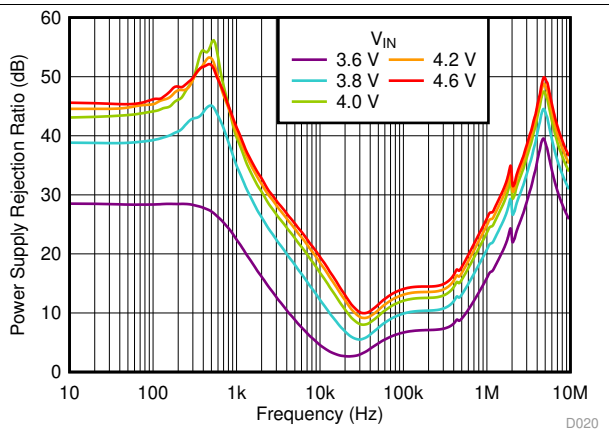
Typical Characteristics (continued)

at operating temperature T_J = 25°C, V_{IN} = $V_{OUT(NOM)}$ + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, C_{IN} = 1 µF, and C_{OUT} = 1 µF (unless otherwise noted)



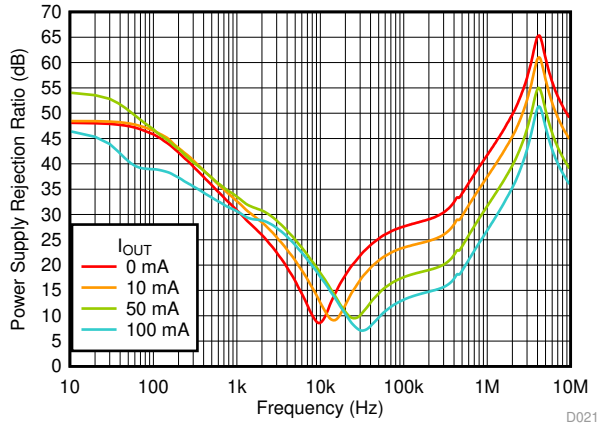
V_{OUT} = 1.8 V, I_{OUT} = 200 mA, C_{OUT} = 1 µF, C_{IN} = 0 µF

図 37. PSRR vs Frequency and V_{IN}



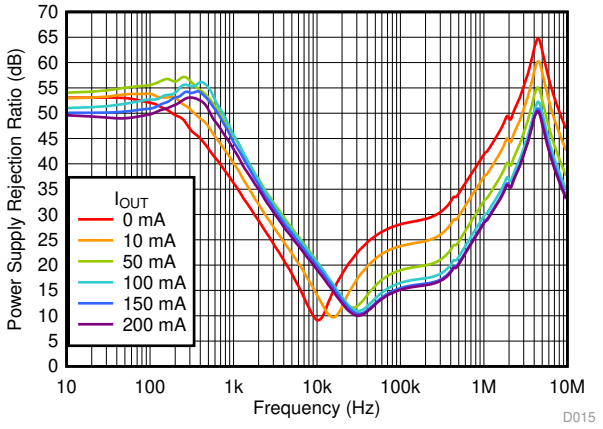
V_{OUT} = 3.3 V, I_{OUT} = 200 mA, C_{OUT} = 1 µF, C_{IN} = 0 µF

図 38. PSRR vs Frequency and V_{IN}



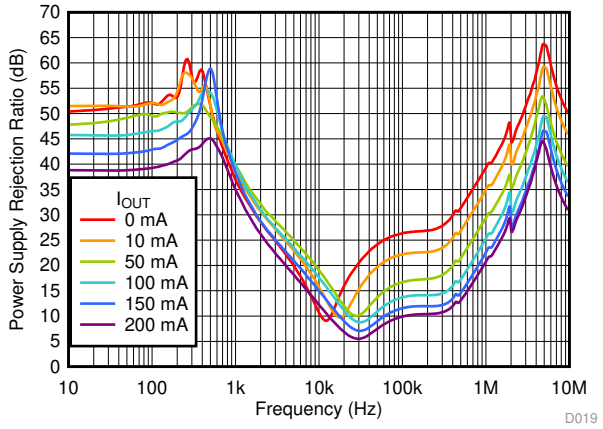
V_{OUT} = 0.8 V, V_{IN} = 1.4 V, C_{OUT} = 1 µF, C_{IN} = 0 µF

図 39. PSRR vs Frequency and I_{OUT}



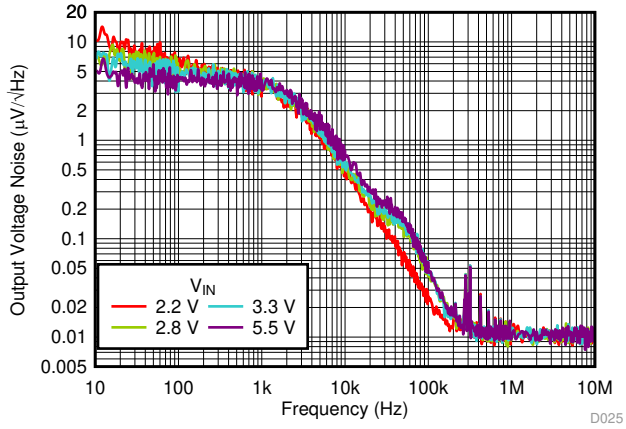
V_{OUT} = 1.8 V, V_{IN} = 2.8 V, C_{OUT} = 1 µF, C_{IN} = 0 µF

図 40. PSRR vs Frequency and I_{OUT}



V_{OUT} = 3.3 V, V_{IN} = 3.8 V, C_{OUT} = 1 µF, C_{IN} = 0 µF

図 41. PSRR vs Frequency and I_{OUT}



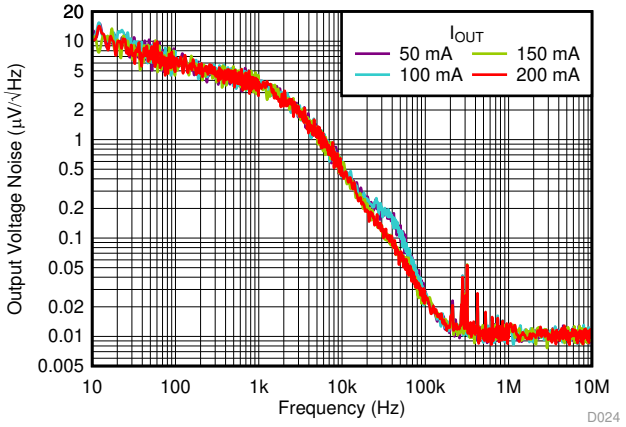
V_{OUT} = 1.8 V, I_{OUT} = 200 mA, C_{OUT} = 1 µF

図 42. Output Noise vs Frequency and V_{IN}

Copyright © 2018–2019, Texas Instruments Incorporated

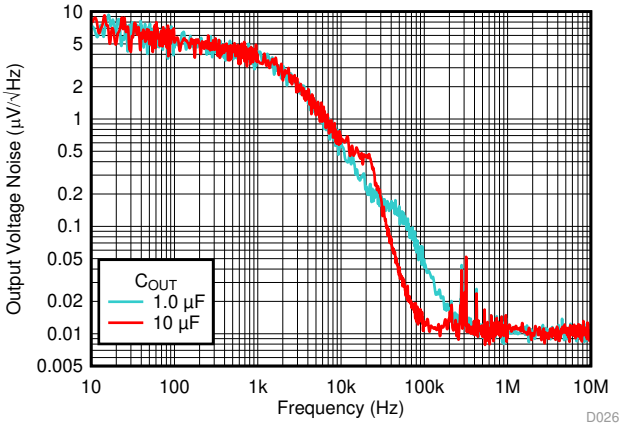
Typical Characteristics (continued)

at operating temperature T_J = 25°C, V_{IN} = $V_{OUT(NOM)}$ + 0.5 V or 2.0 V (whichever is greater), I_{OUT} = 1 mA, V_{EN} = V_{IN}, C_{IN} = 1 µF, and C_{OUT} = 1 µF (unless otherwise noted)



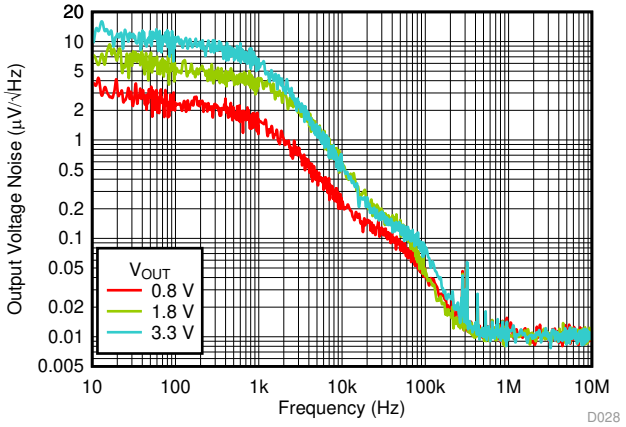
V_{OUT} = 1.8 V, V_{IN} = 2.8 V, C_{OUT} = 1 µF

図 43. Output Noise vs Frequency and I_{OUT}



V_{OUT} = 1.8 V, V_{IN} = 2.8 V, I_{OUT} = 200 mA

図 44. Output Noise vs Frequency and C_{OUT}



V_{IN} = V_{OUT} + 1 V, I_{OUT} = 200 mA, C_{OUT} = 1 µF

図 45. Output Noise vs Frequency and V_{OUT}

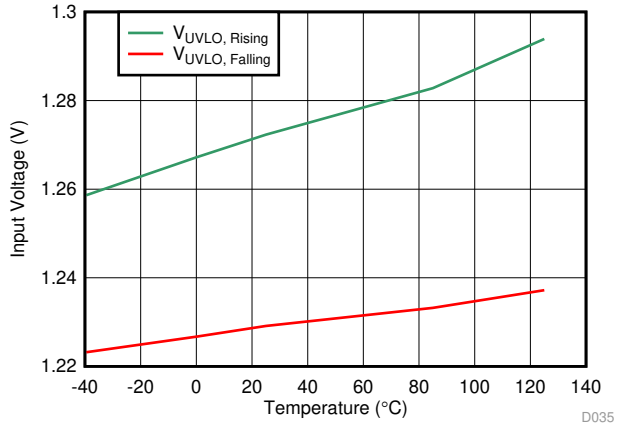


図 46. UVLO V_{IN} Rising and Falling Thresholds vs Temperature

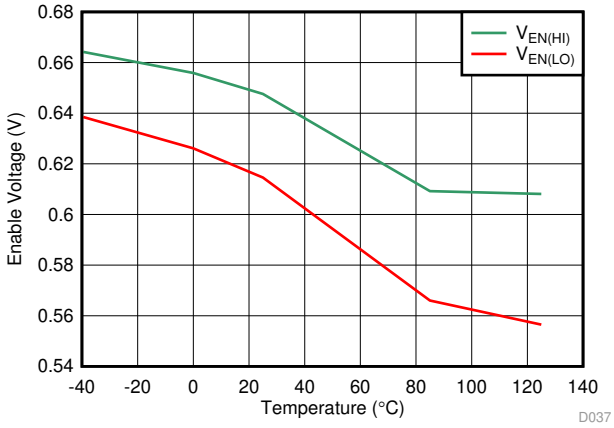


図 47. Enable High and Low Thresholds vs Temperature

Copyright © 2018–2019, Texas Instruments Incorporated

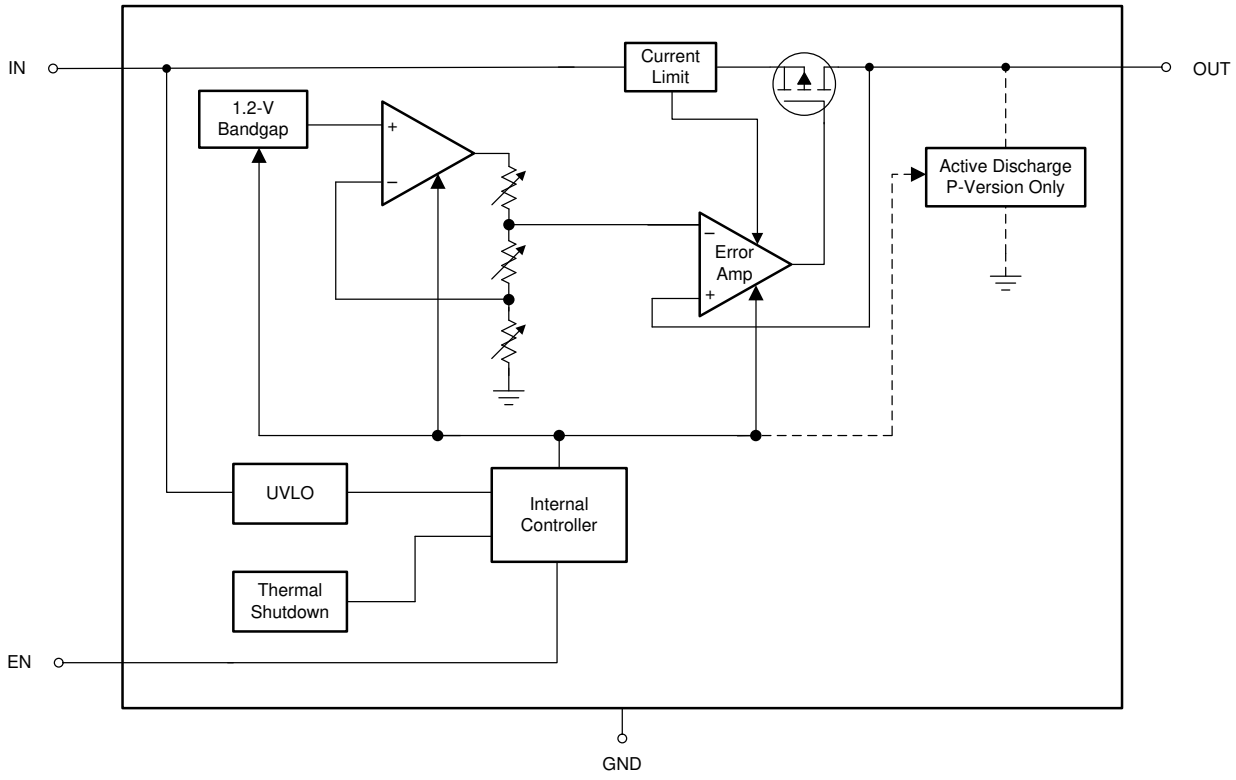
7 Detailed Description

7.1 Overview

The TPS7A05 is a ultra-low I_Q linear voltage regulator that is optimized for excellent transient performance. These characteristics make the TPS7A05 ideal for most battery-powered applications.

This low-dropout regulator (LDO) offers foldback current limit, shutdown, thermal protection, and optional active discharge.

7.2 Functional Block Diagram



Copyright © 2018–2019, Texas Instruments Incorporated

7.3 Feature Description

7.3.1 Excellent Transient Response

The device includes several innovative circuits to ensure excellent transient response. Dynamic biasing increases the I_Q for a short duration during transients to extend the closed-loop bandwidth and improve the device response time during transients.

Adaptive biasing increases the I_Q as the dc load current increases, extending the bandwidth of the control loop. The device response time across the output voltage range is constant because of the use of a buffered reference topology, which keeps the control loop in unity gain at any output voltage.

These features give the device a wide loop bandwidth during transients that ensure excellent transient response while maintaining the device low I_Q in steady-state conditions; see the *Application and Implementation* section for more details.

7.3.2 Active Discharge

Devices with this option have an internal pulldown MOSFET that connects a 120-Ω resistor to ground when the device is disabled to actively discharge the output voltage. The active discharge circuit is activated when the device is disabled, in undervoltage lockout (UVLO), or in thermal shutdown.

The discharge time after disabling depends on the output capacitance (C_{OUT}) and the load resistance (R_L) in parallel with the 120-Ω pulldown resistor. 式 1 calculates the time constant:

$$\tau = \frac{120 \cdot R_L}{120 + R_L} \cdot C_{OUT} \quad (1)$$

Do not rely on the active discharge circuit for discharging a large amount of output capacitance after the input supply has collapsed because reverse current can flow from the output to the input. This reverse current flow can cause damage to the device. Limit reverse current to no more than 5% of the device-rated current.

7.3.3 Low I_Q in Dropout

In most LDOs the I_Q significantly increases when the device is placed into dropout, which is especially true for low I_Q LDOs with adaptive biasing. The TPS7A05 detects when operating in dropout and disables the adaptive biasing, minimizing the I_Q increase.

7.3.4 Undervoltage Lockout (UVLO)

The undervoltage lockout (UVLO) circuit monitors the input voltage (V_{IN}) to prevent the device from turning on before V_{IN} rises above the lockout voltage. The UVLO circuit also disables the output of the device when V_{IN} falls below the lockout voltage. If the device includes the optional active discharge, the output is connected to ground with a 120-Ω pulldown resistor when V_{IN} is below the lockout voltage; see the *Application and Implementation* section for more details.

7.3.5 Enable

The enable pin for the device is active high. The output of the device is turned on when the enable pin voltage is greater than the EN pin logic high voltage, and the output of the device is turned off when the enable pin voltage is less than the EN pin logic low voltage. A voltage less than the EN pin logic low voltage on the enable pin disables all internal circuits.

At the next turn-on, any voltage on the EN pin below the logic low voltage ensures a normal start-up waveform with start-up ramp rate control, provided there is enough time to discharge the output capacitance. If shutdown capability is not required, connect EN to IN. V_{EN} must not exceed V_{IN}.

7.3.6 Internal Foldback Current Limit

The internal foldback current-limit circuit is used to protect the LDO against high-load current faults or shorting events. The foldback mechanism lowers the current limit as the output voltage decreases, and limits power dissipation during short-circuit events while still allowing for the device to operate at its rated output current; see 図 29.

Copyright © 2018–2019, Texas Instruments Incorporated

Feature Description (continued)

A foldback example for this device is that when V_{OUT} is 90% of $V_{OUT(nom)}$ the current limit is I_{CL}(typical); however, if V_{OUT} is forced to 0 V the current limit is I_{SC} (typical).

In many LDOs the foldback current limit can prevent start-up into a constant-current load or a negatively-biased output. The foldback mechanism for this device goes into a brick-wall current limit when V_{OUT} > 500 mV (typ), thus limiting current to I_{CL}(typical) and, when V_{OUT} is approximately 0 V, current is limited to I_{SC} (typical) to ensure normal start-up into a variety of loads.

The foldback current limit is disengaged when I_{OUT} < 1 mA (typical) to reduce I_Q. As such, the current-limit loop takes longer to respond to a current-limit event when I_{OUT} < 1 mA (typ).

Thermal shutdown can activate during a current-limit event because of the high power dissipation typically found in these conditions. To ensure proper operation of the current limit, minimize the inductances to the input and load. Continuous operation in current limit is not recommended.

7.3.7 Thermal Shutdown

The device contains a thermal shutdown protection circuit to disable the device when thermal junction temperature (T_J) of the main pass-FET rises to $T_{sd(Shutdown)}$ (typical). Thermal shutdown hysteresis assures that the LDO resets again (turns on) when the temperature falls to $T_{sd(Reset)}$ (typical).

The thermal time-constant of the semiconductor die is fairly short, and thus the device may cycle on and off when thermal shutdown is reached until power dissipation is reduced.

For reliable operation, limit the junction temperature to a maximum of 125°C. Operation above 125°C causes the device to exceed its operational specifications. Although the internal protection circuitry of the device is designed to protect against thermal overload conditions, this circuitry is not intended to replace proper heat sinking. Continuously running the device into thermal shutdown or above a junction temperature of 125°C reduces long-term reliability.

A fast start-up when T_J > $T_{sd(Reset)}$ (typical, outside of the specified operating range) causes the device thermal shutdown to assert at $T_{sd(Reset)}$ and prevents the device from turning on until the junction temperature is reduced below $T_{sd(Shutdown)}$.

Copyright © 2018–2019, Texas Instruments Incorporated

7.4 Device Functional Modes

The device has several modes of operation,:

- Normal operation: The device regulates to the nominal output voltage
- Dropout operation: The pass element operates as a resistor and the output voltage is set as $V_{IN} – V_{DO}$
- Shutdown: The output of the device is disabled and the discharge circuit is activated

表 1 shows the conditions that lead to the different modes of operation. See the *Electrical Characteristics* table for parameter values.

表 1. Device Functional Mode Comparison

OPERATING MODE	PARAMETER			
	V_{IN}	V_{EN}	I_{OUT}	T_J
Normal mode	$V_{IN} > V_{OUT(nom)} + V_{DO}$ and $V_{IN} > V_{IN(min)}$	$V_{EN} > V_{EN(HI)}$	$I_{OUT} < I_{OUT(max)}$	$T_J < T_{sd(Shutdown)}$
Dropout mode	$V_{IN(min)} < V_{IN} < V_{OUT(nom)} + V_{DO}$	$V_{EN} > V_{EN(HI)}$	$I_{OUT} < I_{OUT(max)}$	$T_J < T_{sd(Shutdown)}$
Disabled mode (any true condition disables the device)	$V_{IN} < V_{UVLO}$	$V_{EN} < V_{EN(LO)}$	—	$T_J > T_{sd(Shutdown)}$

7.4.1 Normal Mode

The device regulates the output to the nominal output voltage when all normal mode conditions in 表 1 are met.

7.4.2 Dropout Mode

The device is not in regulation, and the output voltage tracks the input voltage minus the voltage drop across the pass transistor of the device. In this mode, the PSRR, noise, and transient performance of the device are significantly degraded.

7.4.3 Disable Mode

In this mode, the pass element is turned off, the internal circuits are shut down, and the output voltage is actively discharged to ground by an internal resistor.

Copyright © 2018–2019, Texas Instruments Incorporated

8 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.

8.1 Application Information

8.1.1 Recommended Capacitor Types

The device is designed to be stable using low equivalent series resistance (ESR) ceramic 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 COG-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, assume 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.

8.1.2 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 Ω. A higher value capacitor may be necessary if large, fast rise-time load 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.

8.1.3 Special Considerations When Ramping Down V_{IN} and Enable

Care must be taken when ramping down voltage on the IN and EN pins to power-down the device when the operating free-air temperature is less than 15°C. The minimum ramp-down time for the IN pin is 10 ms. The minimum ramp-down time for the EN pin is 100 µs. Ramping at faster rates can cause the regulator to exhibit undesired startup behavior on the next power-on.

If V_{IN} is ramped down faster than 10 ms, the next startup may exhibit a partial startup, shutoff, followed by a normal soft-start startup. 図 48 shows this response.

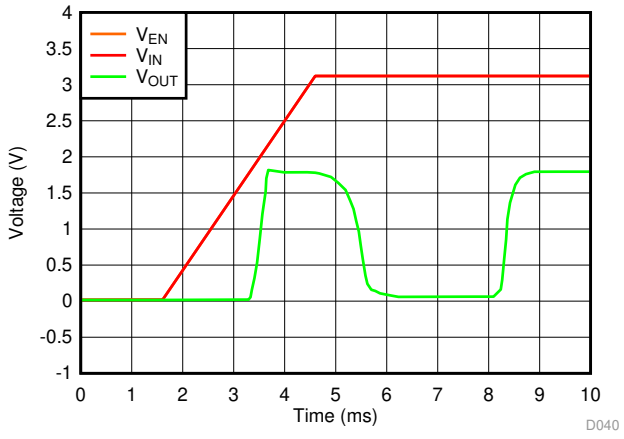


図 48. Partial Startup, Shutdown, Normal Startup With V_{EN} = V_{IN}

Copyright © 2018–2019, Texas Instruments Incorporated

Application Information (continued)

If the EN pin is ramped down faster than 100 µs, the next startup may exhibit a delay time of up to 130 ms before the output ramps up with a normal soft-start startup. 図 49 shows this delay.

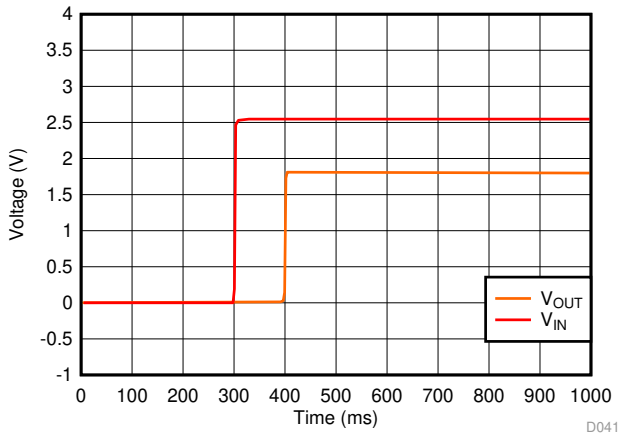


図 49. Long Delay to Startup With $V_{EN} = V_{IN}$

Fast ramp downs of V_{IN} and the EN pin charge internal high-impedance nodes in the device, which take extended time to discharge below 15°C. To avoid these startup behaviors, follow the recommended minimum ramp down times for V_{IN} and the EN pin.

8.1.4 Load Transient Response

The load-step transient response is the output voltage response by the LDO to a step in load current, whereby output voltage regulation is maintained. See 図 6 for typical load transient response. There are two key transitions during a load transient response: the transition from a light to a heavy load and the transition from a heavy to a light load. The regions in 図 50 are broken down as described in this section. Regions A, E, and H are where the output voltage is in steady-state.

During transitions from a light load to a heavy load, the:

- Initial voltage dip is a result of the depletion of the output capacitor charge and parasitic impedance to the output capacitor (region B)
- Recovery from the dip results from the LDO increasing its sourcing current, and leads to output voltage regulation (region C)

During transitions from a heavy load to a light load, the:

- Initial voltage rise results from the LDO sourcing a large current, and leads to the output capacitor charge to increase (region F)
- Recovery from the rise results from the LDO decreasing its sourcing current in combination with the load discharging the output capacitor (region G)

A larger output capacitance reduces the peaks during a load transient but slows down the response time of the device. A larger dc load also reduces the peaks because the amplitude of the transition is lowered and a higher current discharge path is provided for the output capacitor.

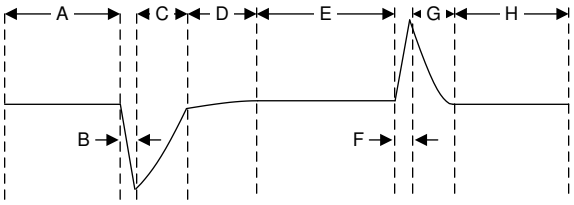


図 50. Load Transient Waveform

Application Information (continued)

8.1.5 Dropout Voltage

The device uses a PMOS pass transistor to achieve low dropout. When (V_{IN} – V_{OUT}) is less than the dropout voltage (V_{DO}), the PMOS pass transistor is in the linear region of operation, and the input-to-output resistance of the device is the drain-to-source resistance of the PMOS pass transistor. V_{DO} scales with the output current and changes with temperature because the PMOS pass transistor functions like a resistor in dropout mode. For a graph of dropout voltage, see 図 22. As with any linear regulator, PSRR and the transient response degrade as (V_{IN} – V_{OUT}) approaches dropout operation. See 図 23 for dropout performance.

8.1.5.1 Behavior When Transitioning From Dropout Into Regulation

Some applications may have transients that place the device into dropout, especially as this device can be powered from a battery with high ESR. A typical application with these conditions is using a stack of two 1.55-V coin-cell batteries with an ESR of 30 Ω to create a 2.5-V rail and experiencing a load transient from 1 µA to 25 mA. This load transient causes the input supply to drop 750 mV, placing the device into dropout.

The load transient saturates the output stage of the error amplifier when the pass element is driven fully on, making the pass element function like a resistor from V_{IN} to V_{OUT}. The error amplifier response time to this load transient is limited because the error amplifier must first recover from saturation and then place the pass element back into active mode. During this time V_{OUT} overshoots because the pass element is functioning as a resistor from V_{IN} to V_{OUT}. This device uses a loop pulldown circuit to help mitigate the overshoot.

If operating under these conditions, applying a higher dc load or increasing the output capacitance reduces the overshoot because these solutions provide a path to dissipate the excess charge.

8.1.5.2 Behavior of Output Resulting From Line Transient When in Dropout

The output deviation resulting from a line transient can be significantly higher when the device is operating in dropout. As explained in the *Dropout Voltage* section, the response time of the error amplifier is limited when in dropout, so the output deviation is larger and can exceed twice the regulated output voltage. Care must be taken in applications where line transients are expected when the device is operating in dropout.

8.1.6 Undervoltage Lockout (UVLO) Operation

The UVLO circuit ensures that the device stays disabled before its input supply reaches the minimum operational voltage range, and ensures that the device shuts down when the input supply collapses. See 図 46 for rising and falling thresholds. 図 51 depicts the UVLO circuit response to various input voltage events. The diagram can be separated into the following parts:

- Region A: The device does not start until the input reaches the UVLO rising threshold
- Region B: Normal operation, regulating device
- Region C: Brownout event above the UVLO falling threshold (UVLO rising threshold – UVLO hystersis). The output may fall out of regulation but the device is still enabled.
- Region D: Normal operation, regulating device
- Region E: Brownout event below the UVLO falling threshold. The device is disabled in most cases and the output falls as a result of the load and active discharge circuit. The device is re-enabled when the UVLO rising threshold is reached by the input voltage and a normal start-up follows.
- Region F: Normal operation followed by the input falling to the UVLO falling threshold
- Region G: The device is disabled as the input voltage falls below the UVLO falling threshold to 0 V. The output falls as a result of the load and active discharge circuit.

Copyright © 2018–2019, Texas Instruments Incorporated

Application Information (continued)

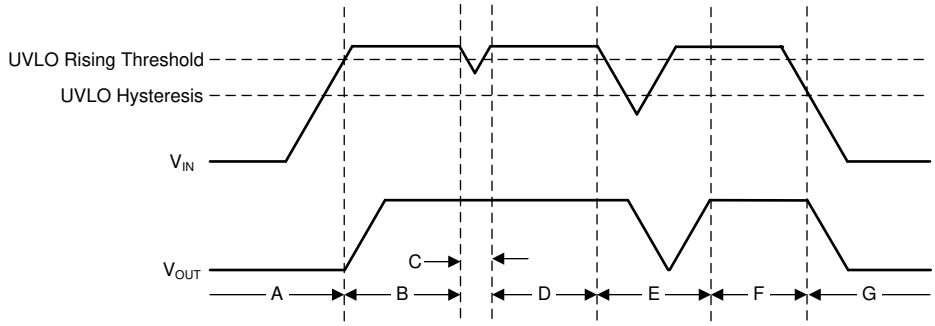


図 51. Typical UVLO Operation

8.1.7 Power Dissipation (P_D)

Circuit reliability demands that proper consideration be given to 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 be as free as possible of other heat-generating devices that cause added thermal stresses.

式 2 calculates the maximum allowable power dissipation for the device in a given package:

$$P_{D\text{-}MAX} = ((T_J - T_A) / R_{\theta JA}) \quad (2)$$

式 3 represents the actual power being dissipated in the device:

$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} \quad (3)$$

An important note is that power dissipation can be minimized, and thus greater efficiency achieved, by proper selection of the system voltage rails. Proper selection allows the minimum input-to-output voltage differential to be obtained. The low dropout of the TPS7A05 allows for maximum efficiency across a wide range of output voltages.

The main heat conduction path for the device depends on the ambient temperature and the thermal resistance across the various interfaces between the die junction and ambient air.

The maximum power dissipation determines the maximum allowable junction temperature (T_J) for the device. According to 式 4, maximum 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). The equation is rearranged in 式 5 for output current.

$$T_J = T_A + (R_{\theta JA} \times P_D) \quad (4)$$

$$I_{OUT} = (T_J - T_A) / [R_{\theta JA} \times (V_{IN} - V_{OUT})] \quad (5)$$

Unfortunately, this 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 $R_{\theta JA}$ recorded in the *Thermal Information* table is determined by the JEDEC standard, PCB, and copper-spreading area, and is only used as a relative measure of package thermal performance. For a well-designed thermal layout, $R_{\theta JA}$ is actually the sum of the DQN package junction-to-case (bottom) thermal resistance ($R_{\theta JC(bot)}$) plus the thermal resistance contribution by the PCB copper.

Copyright © 2018–2019, Texas Instruments Incorporated

Application Information (continued)

8.1.7.1 Estimating Junction Temperature

The JEDEC standard now recommends the use of psi (Ψ) thermal metrics to estimate the junction temperatures of the LDO when in-circuit on a typical PCB board application. These metrics are not strictly speaking thermal resistances, but rather offer practical and relative means of estimating junction temperatures. These psi metrics are determined to be significantly independent of the copper-spreading area. The key thermal metrics (Ψ_{JT} and Ψ_{JB}) are used in accordance with 式 6 and are given in the *Thermal Information* table.

$$\Psi_{JT} : T_J = T_T + \Psi_{JT} \times P_D \text{ and } \Psi_{JB} : T_J = T_B + \Psi_{JB} \times P_D \quad (6)$$

where:

- P_D is the power dissipated as explained in 式 3
- T_T is the temperature at the center-top of the device package, and
- T_B is the PCB surface temperature measured 1 mm from the device package and centered on the package edge

8.1.7.2 Recommended Area for Continuous Operation

The operational area of an LDO is limited by the dropout voltage, output current, junction temperature, and input voltage. The recommended area for continuous operation for a linear regulator is shown in 図 52 and can be separated into the following regions:

- Dropout voltage limits the minimum differential voltage between the input and the output ($V_{IN} – V_{OUT}$) at a given output current level; see the *Dropout Voltage* section for more details.
- The rated output currents limits the maximum recommended output current level. Exceeding this rating causes the device to fall out of specification.
- The rated junction temperature limits the maximum junction temperature of the device. Exceeding this rating causes the device to fall out of specification and reduces long-term reliability.
  - 式 5 provides the shape of the slope. The slope is nonlinear because the maximum rated junction temperature of the LDO is controlled by the power dissipation across the LDO, thus when $V_{IN} – V_{OUT}$ increases the output current must decrease.
- The rated input voltage range governs both the minimum and maximum of $V_{IN} – V_{OUT}$.

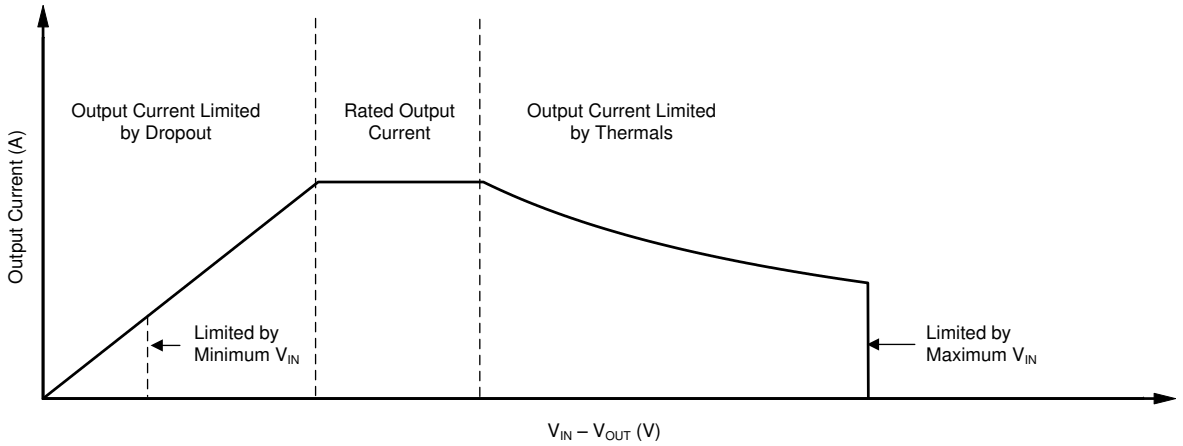


図 52. Region Description for Continuous Operation

Copyright © 2018–2019, Texas Instruments Incorporated

8.2 Typical Application

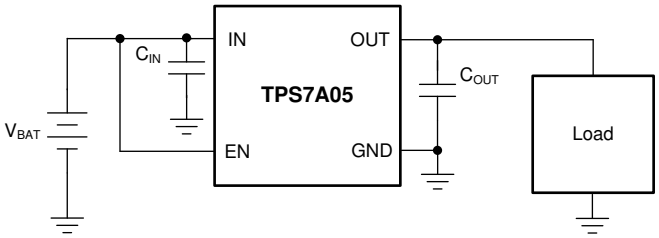


図 53. Operation From the Battery Input Supply

8.2.1 Design Requirements

表 2 summarizes the design requirements for 図 53.

表 2. Design Parameters

PARAMETER	DESIGN REQUIREMENT
Input voltage	3.0 V to 2.0 V (CR2032 battery)
Output voltage	1.0 V, ±2% (T_J from –40 to +85ºC)
Output load	10 mA

8.2.2 Design Considerations

For this design example, the 1.0-V, fixed-version TPS7A0510 device is selected. A single CR2032 coin-cell battery was used, thus a 1.0-µF input capacitor is recommended to minimize transient currents drawn from the battery. A 1.0-µF output capacitor is also recommended for excellent load transient response. The dropout voltage (V_{DO}) is kept within the TPS7A05 dropout voltage specification for the 1.0-V output voltage option to keep the device in regulation under all load and temperature conditions for this design. The very small ground current consumed by the regulator shown in 図 54 allows for long battery life.

8.2.3 Application Curve

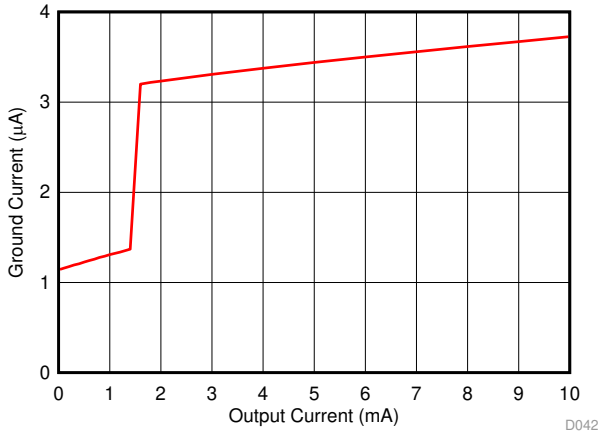


図 54. I_{GND} vs I_{OUT} at 25°C

9 Power Supply Recommendations

This device is designed to operate from an input supply voltage range of 1.4 V to 5.5 V. The input supply must be well regulated and free of spurious noise. To ensure that the output voltage is well regulated and dynamic performance is optimum, the input supply must be at least $V_{OUT(nom)}$ + 0.5 V. A 1 µF or greater input capacitor is recommended to be used to reduce the impedance of the input supply, especially during transients.

Copyright © 2018–2019, Texas Instruments Incorporated

10 Layout

10.1 Layout Guidelines

- Place input and output capacitors as close to the device as possible
- Use copper planes for device connections to optimize thermal performance
- Place thermal vias around the device to distribute heat
- Do not place a thermal via directly beneath the thermal pad of the DQN package. A via can wick solder or solder paste away from the thermal pad joint during the soldering process, leading to a compromised solder joint on the thermal pad.

10.2 Layout Example

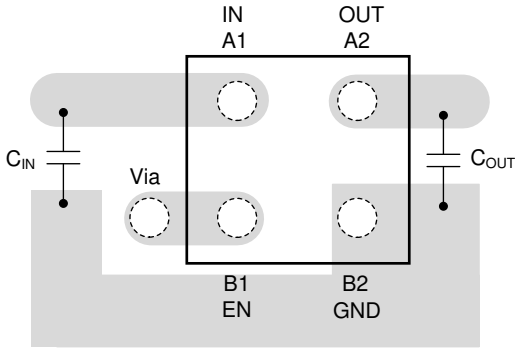


図 55. Layout Example for the YKA Package

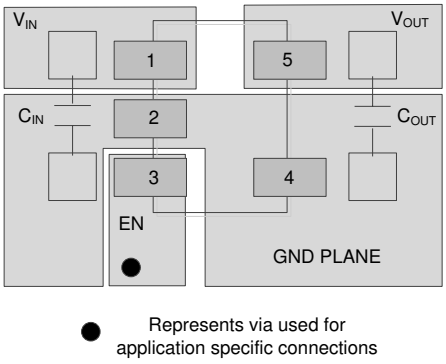


図 56. Layout Example for the DBV Package

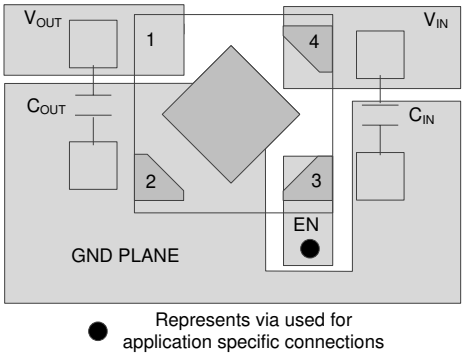


図 57. Layout Example for the DQN Package

Copyright © 2018–2019, Texas Instruments Incorporated

11 デバイスおよびドキュメントのサポート

11.1 デバイス・サポート

11.1.1 SPICEモデル

TPS7A05用のSPICEモデルは、プロダクト・フォルダの「ツールとソフトウェア」から入手できます。

11.1.2 デバイスの項目表記

表 3. デバイスの項目表記(1)(2)

製品名	V_{OUT}
TPS7A05**xx(x)Pyyyz**	**xx(x)**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。それ以外の場合は3桁が使用されます(例: 28 = 2.8V、125 = 1.25V)。 **P**はオプションで、アクティブ出力放電機能を意味します。 **yyy**はパッケージ指定子です。 **z**はパッケージ数量です。Rはリール(3000ピース)、Tはテープ(250ピース)を表します。

(1) 最新のパッケージと発注情報については、このデータシートの末尾にある「パッケージ・オプション」の付録を参照するか、www.ti.comにあるデバイスの製品フォルダをご覧ください。
(2) 出力電圧は、1.0Vから3.3Vまで、50mV刻みで利用できます。詳細と在庫については、工場にお問い合わせください。

11.2 ドキュメントのサポート

11.2.1 関連資料

関連資料については、以下を参照してください。

『汎用低ドロップアウト(LDO)リニア電圧レギュレータMultiPkgLDOEVM-823評価基板』

11.3 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。

11.4 コミュニティ・リソース

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

TI E2E™ Online Community ***TI's Engineer-to-Engineer (E2E) Community.*** Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support ***TI's Design Support*** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

11.5 商標

E2E is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

11.6 静電気放電に関する注意事項

すべての集積回路は、適切なESD保護方法を用いて、取扱いと保存を行うようにして下さい。

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。

11.7 Glossary

SLYZ022 — *TI Glossary*.

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

Copyright © 2018–2019, Texas Instruments Incorporated

12 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。

Copyright © 2018–2019, Texas Instruments Incorporated

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TPS7A0508PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1C6F
TPS7A0508PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1C6F
TPS7A0508PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1C6F
TPS7A0508PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1C6F
TPS7A0508PDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QMW
TPS7A0508PDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QMW
TPS7A0508PDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QMW
TPS7A0508PDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QMW
TPS7A0508PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	6G
TPS7A0508PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	6G
TPS7A0508PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	6G
TPS7A0508PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	6G
TPS7A0508PYKAR	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	3
TPS7A0508PYKAR.A	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	3
TPS7A0510PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IKF
TPS7A0510PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IKF
TPS7A0510PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IKF
TPS7A0510PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IKF
TPS7A0510PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C7
TPS7A0510PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C7
TPS7A0510PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C7
TPS7A0510PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C7
TPS7A0510PYKAR	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	L
TPS7A0510PYKAR.A	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	L
TPS7A0511PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HK
TPS7A0511PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HK
TPS7A0512PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	1ILF
TPS7A0512PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1ILF
TPS7A0512PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1ILF

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TPS7A0512PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1ILF
TPS7A0512PDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QOW
TPS7A0512PDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QOW
TPS7A0512PDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QOW
TPS7A0512PDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QOW
TPS7A0512PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C8
TPS7A0512PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C8
TPS7A0512PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C8
TPS7A0512PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C8
TPS7A0512PYKAR	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	M
TPS7A0512PYKAR.A	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	M
TPS7A0515PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	1IMF
TPS7A0515PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IMF
TPS7A0515PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IMF
TPS7A0515PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IMF
TPS7A0515PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C9
TPS7A0515PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C9
TPS7A0515PDQNR1	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C9
TPS7A0515PDQNR1.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C9
TPS7A0515PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C9
TPS7A0515PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	C9
TPS7A0515PYKAR	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	N
TPS7A0515PYKAR.A	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	N
TPS7A051825PYKAR	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	P
TPS7A051825PYKAR.A	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	P
TPS7A0518PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	1INF
TPS7A0518PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1INF
TPS7A0518PDBVRG4	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1INF
TPS7A0518PDBVRG4.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1INF
TPS7A0518PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1INF
TPS7A0518PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1INF

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TPS7A0518PDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QQW
TPS7A0518PDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QQW
TPS7A0518PDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QQW
TPS7A0518PDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QQW
TPS7A0518PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CA
TPS7A0518PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CA
TPS7A0518PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CA
TPS7A0518PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CA
TPS7A0518PDQNTG4	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CA
TPS7A0518PDQNTG4.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CA
TPS7A0518PYKAR	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	P
TPS7A0518PYKAR.A	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	P
TPS7A0518YKAR	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	N
TPS7A0518YKAR.A	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	N
TPS7A0520PDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1U8W
TPS7A0520PDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1U8W
TPS7A0520PDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1U8W
TPS7A0520PDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1U8W
TPS7A0520PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	G1
TPS7A0520PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	G1
TPS7A0522PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1P3F
TPS7A0522PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1P3F
TPS7A0522PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1P3F
TPS7A0522PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1P3F
TPS7A0522PDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1U9W
TPS7A0522PDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1U9W
TPS7A0522PDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1U9W
TPS7A0522PDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1U9W
TPS7A0525PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IOF
TPS7A0525PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IOF
TPS7A0525PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IOF

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TPS7A0525PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IOF
TPS7A0525PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CB
TPS7A0525PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CB
TPS7A0525PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CB
TPS7A0525PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CB
TPS7A0525PYKAR	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	Q
TPS7A0525PYKAR.A	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	Q
TPS7A0527PDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1UAW
TPS7A0527PDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1UAW
TPS7A0527PDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1UAW
TPS7A0527PDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1UAW
TPS7A05285PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IRF
TPS7A05285PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IRF
TPS7A05285PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IRF
TPS7A05285PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IRF
TPS7A05285PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CC
TPS7A05285PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CC
TPS7A05285PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CC
TPS7A05285PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CC
TPS7A05285PYKAR	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	R
TPS7A05285PYKAR.A	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	R
TPS7A0528PDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QSW
TPS7A0528PDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QSW
TPS7A0528PDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QSW
TPS7A0528PDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QSW
TPS7A0528PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	DH
TPS7A0528PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	DH
TPS7A0528PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	DH
TPS7A0528PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	DH
TPS7A0530PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QWF
TPS7A0530PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QWF

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TPS7A0530PDBVRG4	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1QWF
TPS7A0530PDBVRG4.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1QWF
TPS7A0530PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1QWF
TPS7A0530PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1QWF
TPS7A0530PDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QUW
TPS7A0530PDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QUW
TPS7A0530PDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QUW
TPS7A0530PDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QUW
TPS7A0530PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	DG
TPS7A0530PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	DG
TPS7A0530PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	DG
TPS7A0530PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	DG
TPS7A0530PYKAR	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	W
TPS7A0530PYKAR.A	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	W
TPS7A0531PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1P4F
TPS7A0531PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1P4F
TPS7A0531PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1P4F
TPS7A0531PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1P4F
TPS7A0531PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	I6
TPS7A0531PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	I6
TPS7A0533PDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	1IPF
TPS7A0533PDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IPF
TPS7A0533PDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IPF
TPS7A0533PDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	1IPF
TPS7A0533PDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QVW
TPS7A0533PDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QVW
TPS7A0533PDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QVW
TPS7A0533PDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	1QVW
TPS7A0533PDQNR	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CD
TPS7A0533PDQNR.A	Active	Production	X2SON (DQN) | 4	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CD
TPS7A0533PDQNT	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CD

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TPS7A0533PDQNT.A	Active	Production	X2SON (DQN) | 4	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CD
TPS7A0533PYKAR	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	S
TPS7A0533PYKAR.A	Active	Production	DSBGA (YKA) | 4	12000 | LARGE T&R	Yes	SNAGCU	Level-1-260C-UNLIM	-40 to 125	S

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

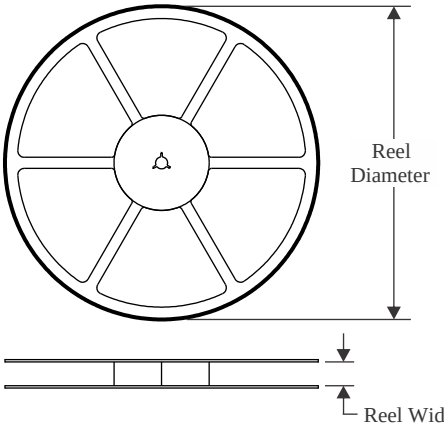
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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

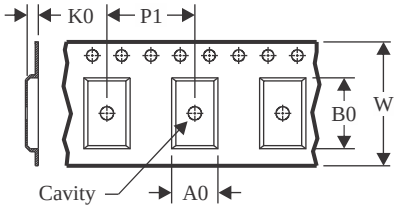
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

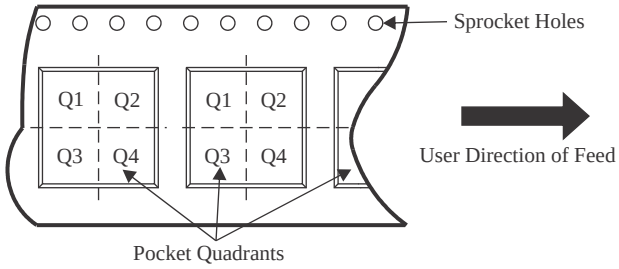


TAPE DIMENSIONS



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



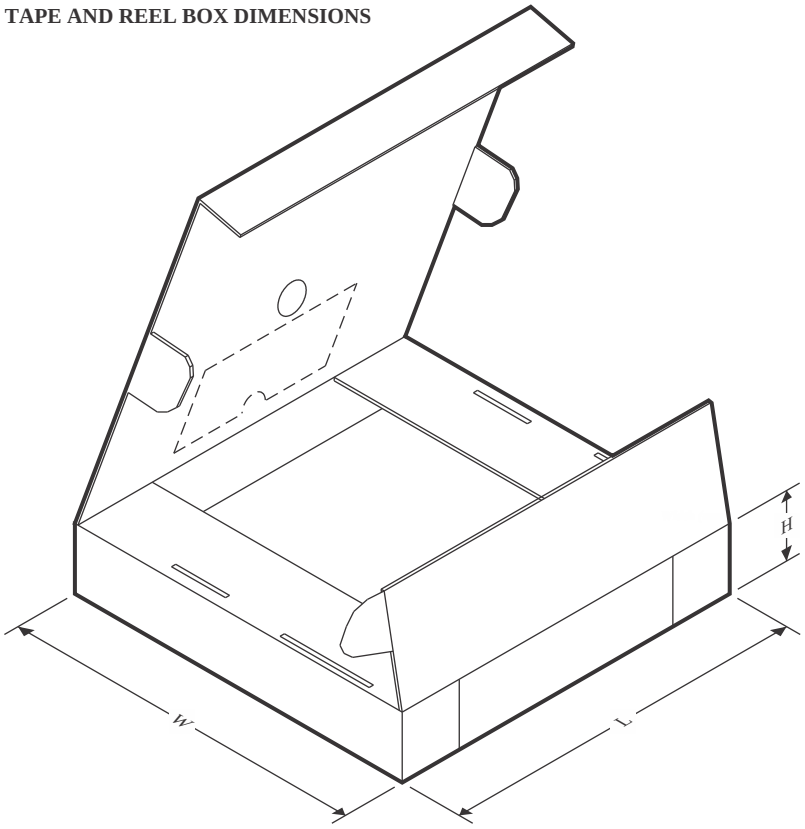
*All dimensions are nominal

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
TPS7A0508PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0508PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0508PDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0508PDBZT	SOT-23	DBZ	3	250	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0508PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0508PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0508PYKAR	DSBGA	YKA	4	12000	180.0	8.4	0.76	0.76	0.46	2.0	8.0	Q1
TPS7A0510PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0510PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0510PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0510PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0510PYKAR	DSBGA	YKA	4	12000	180.0	8.4	0.76	0.76	0.46	2.0	8.0	Q1
TPS7A0511PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0512PDBVR	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0512PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0512PDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3

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
TPS7A0512PDBZT	SOT-23	DBZ	3	250	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0512PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0512PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0512PYKAR	DSBGA	YKA	4	12000	180.0	8.4	0.76	0.76	0.46	2.0	8.0	Q1
TPS7A0515PDBVR	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0515PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0515PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0515PDQNR1	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q1
TPS7A0515PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0515PYKAR	DSBGA	YKA	4	12000	180.0	8.4	0.76	0.76	0.46	2.0	8.0	Q1
TPS7A051825PYKAR	DSBGA	YKA	4	12000	180.0	8.4	0.76	0.76	0.46	2.0	8.0	Q1
TPS7A0518PDBVR	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0518PDBVRG4	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0518PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0518PDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0518PDBZT	SOT-23	DBZ	3	250	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0518PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0518PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0518PDQNTG4	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0518PYKAR	DSBGA	YKA	4	12000	180.0	8.4	0.76	0.76	0.46	2.0	8.0	Q1
TPS7A0518YKAR	DSBGA	YKA	4	12000	180.0	8.4	0.76	0.76	0.46	2.0	8.0	Q1
TPS7A0520PDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0520PDBZT	SOT-23	DBZ	3	250	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0520PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0522PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0522PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0522PDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0522PDBZT	SOT-23	DBZ	3	250	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0525PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0525PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0525PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0525PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0525PYKAR	DSBGA	YKA	4	12000	180.0	8.4	0.76	0.76	0.46	2.0	8.0	Q1
TPS7A0527PDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0527PDBZT	SOT-23	DBZ	3	250	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A05285PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A05285PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A05285PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A05285PDQNR	X2SON	DQN	4	3000	180.0	9.5	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A05285PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A05285PDQNT	X2SON	DQN	4	250	180.0	9.5	1.16	1.16	0.5	4.0	8.0	Q2

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
TPS7A05285PYKAR	DSBGA	YKA	4	12000	180.0	8.4	0.76	0.76	0.46	2.0	8.0	Q1
TPS7A0528PDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0528PDBZT	SOT-23	DBZ	3	250	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0528PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0528PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0530PDBVR	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0530PDBVRG4	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0530PDBVRG4	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0530PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0530PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0530PDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0530PDBZT	SOT-23	DBZ	3	250	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0530PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0530PDQNR	X2SON	DQN	4	3000	180.0	9.5	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0530PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0530PYKAR	DSBGA	YKA	4	12000	180.0	8.4	0.76	0.76	0.46	2.0	8.0	Q1
TPS7A0531PDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0531PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0531PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0533PDBVR	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0533PDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TPS7A0533PDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0533PDBZT	SOT-23	DBZ	3	250	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TPS7A0533PDQNR	X2SON	DQN	4	3000	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0533PDQNR	X2SON	DQN	4	3000	180.0	9.5	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0533PDQNT	X2SON	DQN	4	250	180.0	8.4	1.16	1.16	0.5	4.0	8.0	Q2
TPS7A0533PYKAR	DSBGA	YKA	4	12000	180.0	8.4	0.76	0.76	0.46	2.0	8.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS7A0508PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TPS7A0508PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TPS7A0508PDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TPS7A0508PDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
TPS7A0508PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TPS7A0508PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TPS7A0508PYKAR	DSBGA	YKA	4	12000	182.0	182.0	20.0
TPS7A0510PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TPS7A0510PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TPS7A0510PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TPS7A0510PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TPS7A0510PYKAR	DSBGA	YKA	4	12000	182.0	182.0	20.0
TPS7A0511PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TPS7A0512PDBVR	SOT-23	DBV	5	3000	208.0	191.0	35.0
TPS7A0512PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TPS7A0512PDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TPS7A0512PDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
TPS7A0512PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS7A0512PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TPS7A0512PYKAR	DSBGA	YKA	4	12000	182.0	182.0	20.0
TPS7A0515PDBVR	SOT-23	DBV	5	3000	208.0	191.0	35.0
TPS7A0515PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TPS7A0515PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TPS7A0515PDQNR1	X2SON	DQN	4	3000	210.0	185.0	35.0
TPS7A0515PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TPS7A0515PYKAR	DSBGA	YKA	4	12000	182.0	182.0	20.0
TPS7A051825PYKAR	DSBGA	YKA	4	12000	182.0	182.0	20.0
TPS7A0518PDBVR	SOT-23	DBV	5	3000	208.0	191.0	35.0
TPS7A0518PDBVRG4	SOT-23	DBV	5	3000	210.0	185.0	35.0
TPS7A0518PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TPS7A0518PDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TPS7A0518PDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
TPS7A0518PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TPS7A0518PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TPS7A0518PDQNTG4	X2SON	DQN	4	250	210.0	185.0	35.0
TPS7A0518PYKAR	DSBGA	YKA	4	12000	182.0	182.0	20.0
TPS7A0518YKAR	DSBGA	YKA	4	12000	182.0	182.0	20.0
TPS7A0520PDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TPS7A0520PDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
TPS7A0520PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TPS7A0522PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TPS7A0522PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TPS7A0522PDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TPS7A0522PDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
TPS7A0525PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TPS7A0525PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TPS7A0525PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TPS7A0525PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TPS7A0525PYKAR	DSBGA	YKA	4	12000	182.0	182.0	20.0
TPS7A0527PDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TPS7A0527PDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
TPS7A05285PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TPS7A05285PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TPS7A05285PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TPS7A05285PDQNR	X2SON	DQN	4	3000	184.0	184.0	19.0
TPS7A05285PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TPS7A05285PDQNT	X2SON	DQN	4	250	184.0	184.0	19.0
TPS7A05285PYKAR	DSBGA	YKA	4	12000	182.0	182.0	20.0
TPS7A0528PDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TPS7A0528PDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
TPS7A0528PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS7A0528PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TPS7A0530PDBVR	SOT-23	DBV	5	3000	208.0	191.0	35.0
TPS7A0530PDBVRG4	SOT-23	DBV	5	3000	210.0	185.0	35.0
TPS7A0530PDBVRG4	SOT-23	DBV	5	3000	210.0	185.0	35.0
TPS7A0530PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TPS7A0530PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TPS7A0530PDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TPS7A0530PDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
TPS7A0530PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TPS7A0530PDQNR	X2SON	DQN	4	3000	184.0	184.0	19.0
TPS7A0530PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TPS7A0530PYKAR	DSBGA	YKA	4	12000	182.0	182.0	20.0
TPS7A0531PDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TPS7A0531PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TPS7A0531PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TPS7A0533PDBVR	SOT-23	DBV	5	3000	208.0	191.0	35.0
TPS7A0533PDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TPS7A0533PDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TPS7A0533PDBZT	SOT-23	DBZ	3	250	180.0	180.0	18.0
TPS7A0533PDQNR	X2SON	DQN	4	3000	210.0	185.0	35.0
TPS7A0533PDQNR	X2SON	DQN	4	3000	184.0	184.0	19.0
TPS7A0533PDQNT	X2SON	DQN	4	250	210.0	185.0	35.0
TPS7A0533PYKAR	DSBGA	YKA	4	12000	182.0	182.0	20.0

GENERIC PACKAGE VIEW

DQN 4 X2SON - 0.4 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.

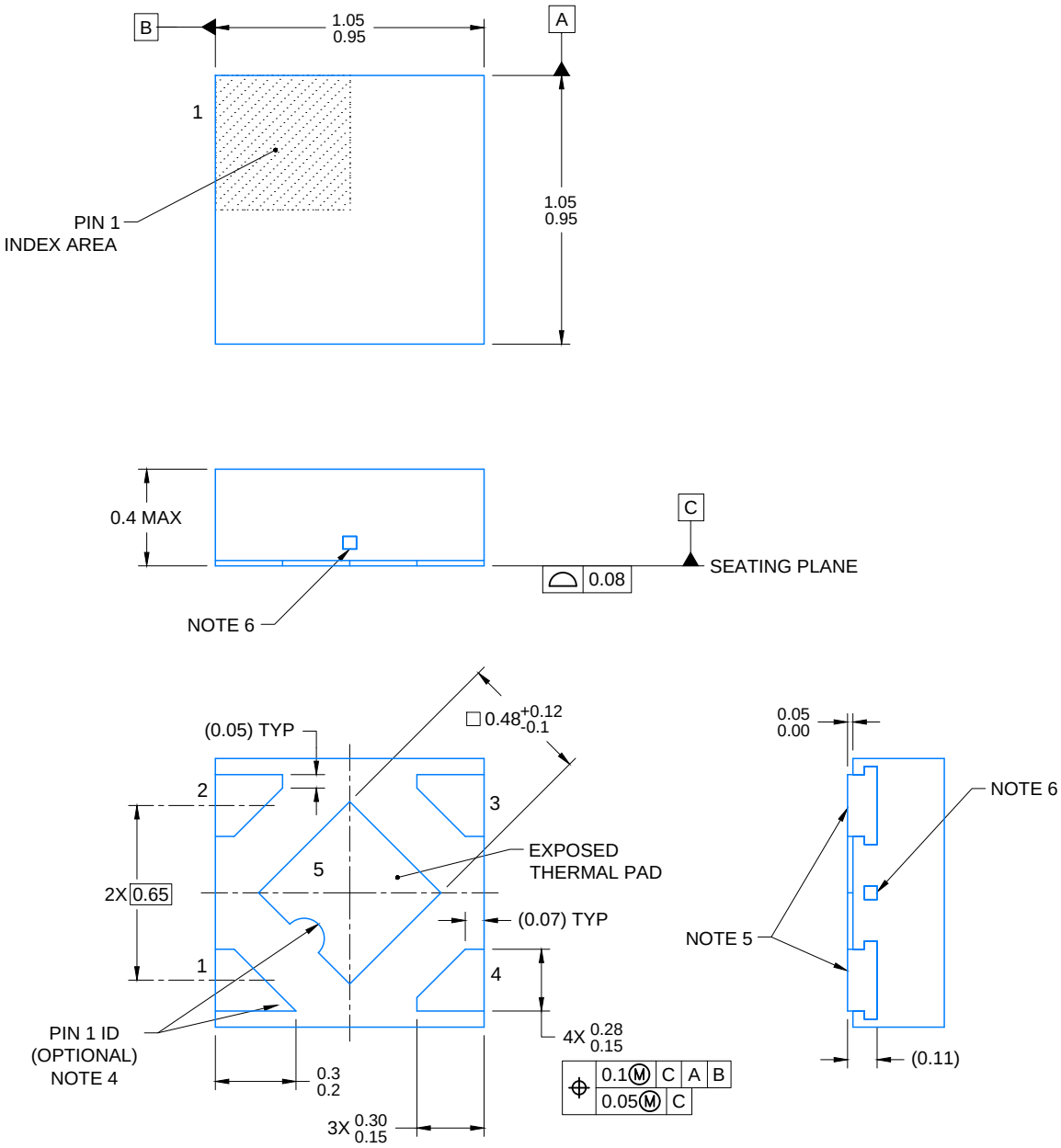
4210367/F

PACKAGE OUTLINE

DQN0004A

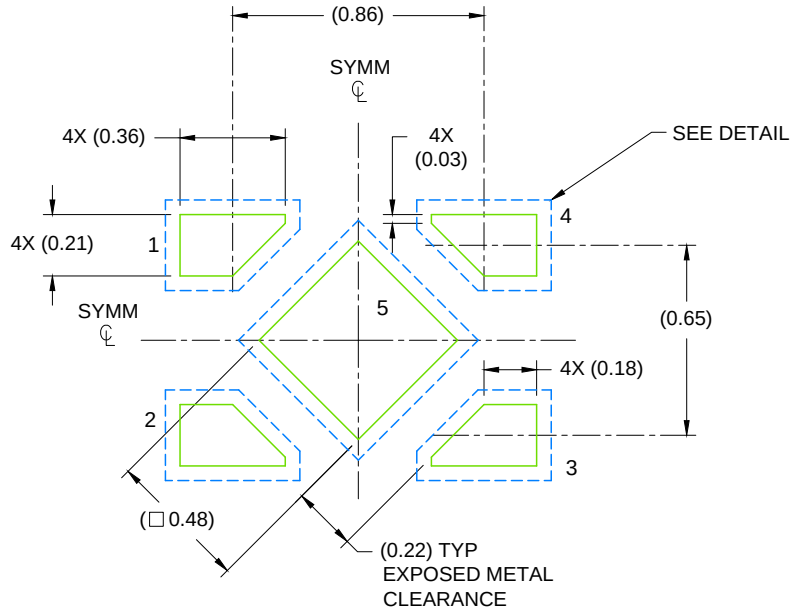
X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



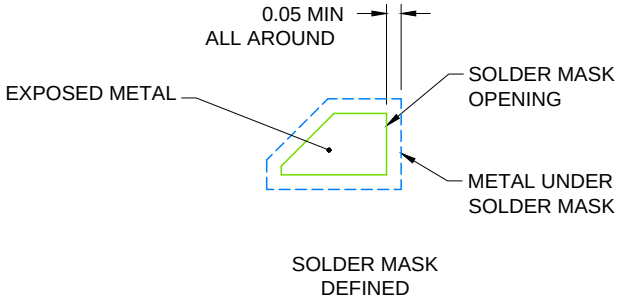
NOTES:

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 optimal thermal and mechanical performance.
4. Features may not exist. Recommend use of pin 1 marking on top of package for orientation purposes.
5. Shape of exposed side leads may differ.
6. Number and location of exposed tie bars may vary.



LAND PATTERN EXAMPLE

SCALE: 40X

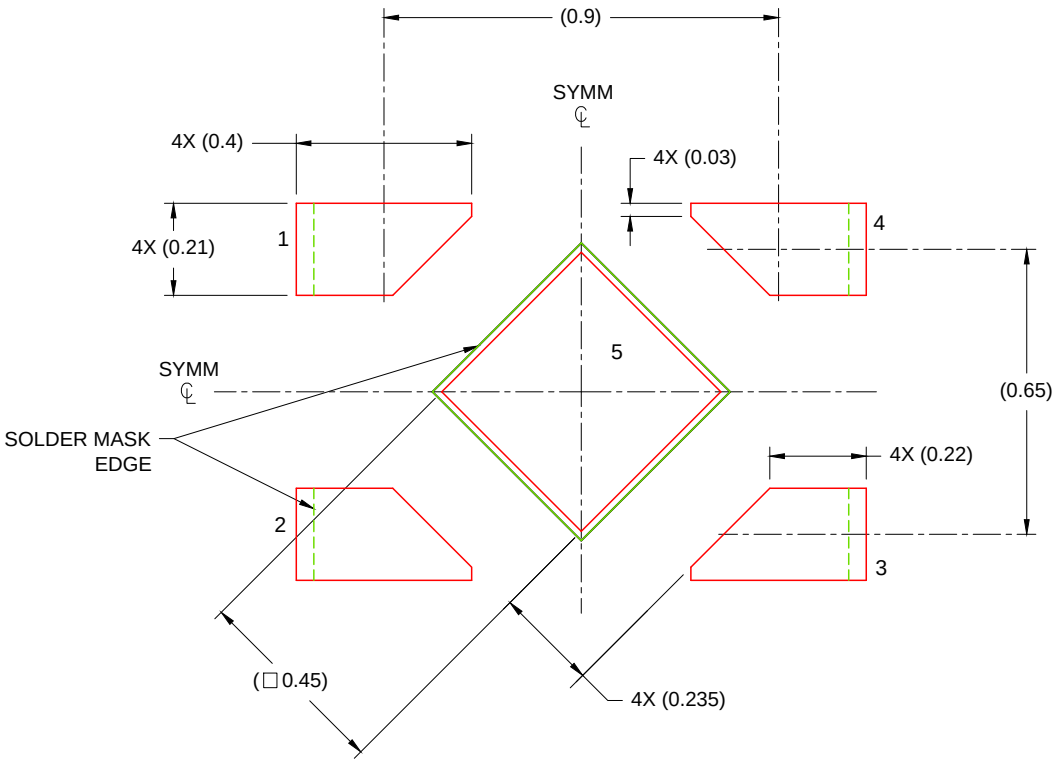


SOLDER MASK DETAIL

4215302/E 12/2016

NOTES: (continued)

7. 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/slua271).
8. If any vias are implemented, it is recommended that vias under paste be filled, plugged or tented.



SOLDER PASTE EXAMPLE
BASED ON 0.075 - 0.1mm THICK STENCIL

EXPOSED PAD
88% PRINTED SOLDER COVERAGE BY AREA
SCALE: 60X

4215302/E 12/2016

NOTES: (continued)

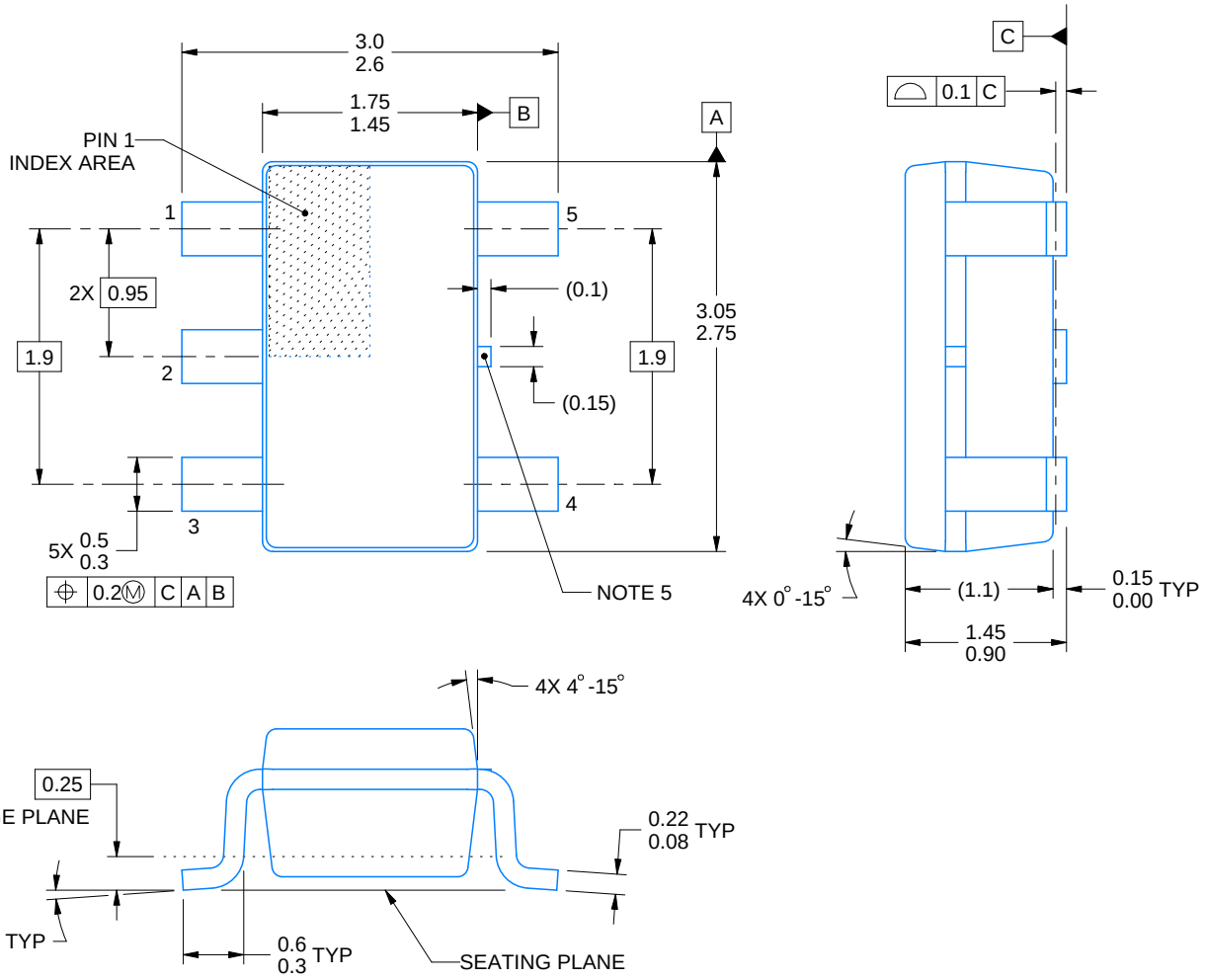
9. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

PACKAGE OUTLINE

DBV0005A

SOT-23 - 1.45 mm max height

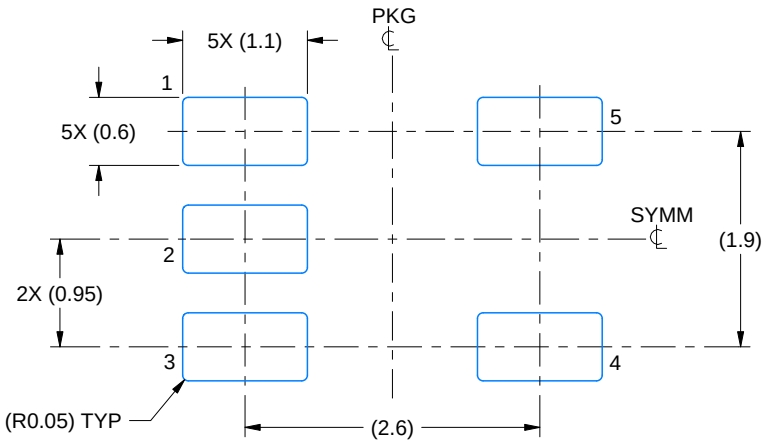
SMALL OUTLINE TRANSISTOR



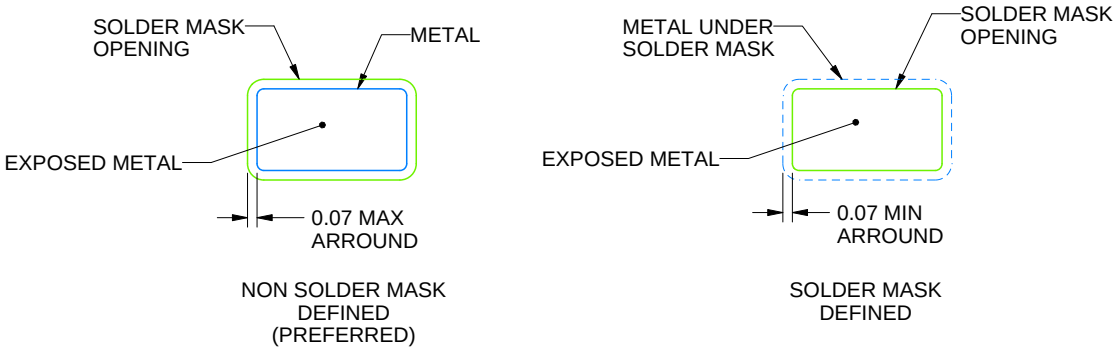
4214839/K 08/2024

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. Refernce JEDEC MO-178.
4. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25 mm per side.
5. Support pin may differ or may not be present.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X

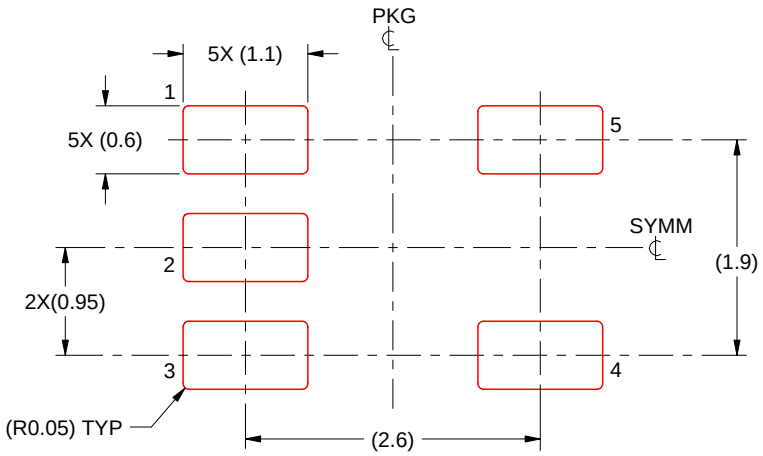


SOLDER MASK DETAILS

4214839/K 08/2024

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

4214839/K 08/2024

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

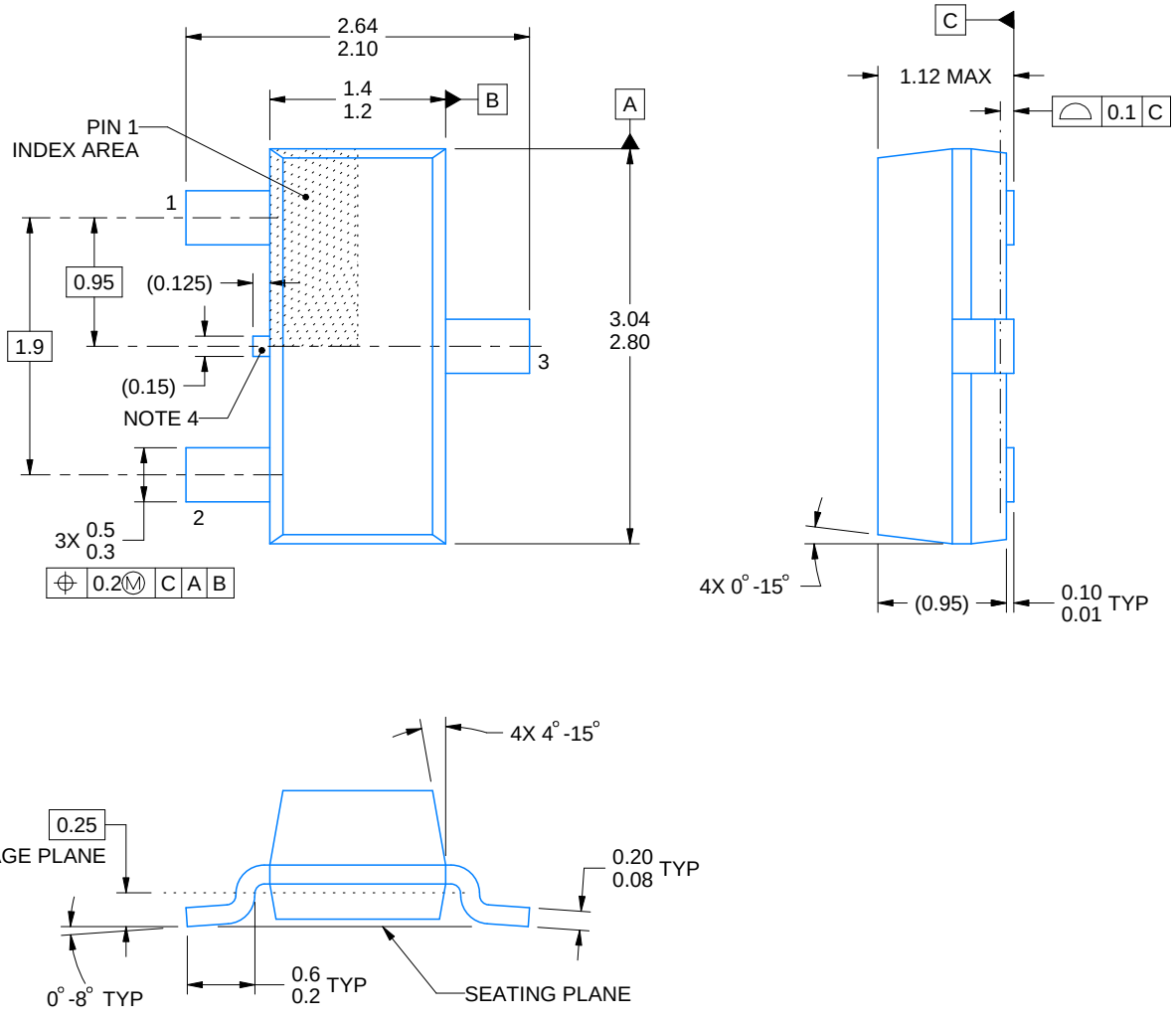
PACKAGE OUTLINE

DBZ0003A



SOT-23 - 1.12 mm max height

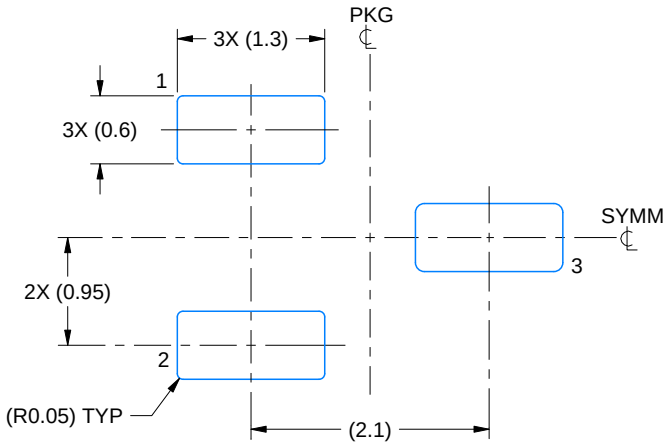
SMALL OUTLINE TRANSISTOR



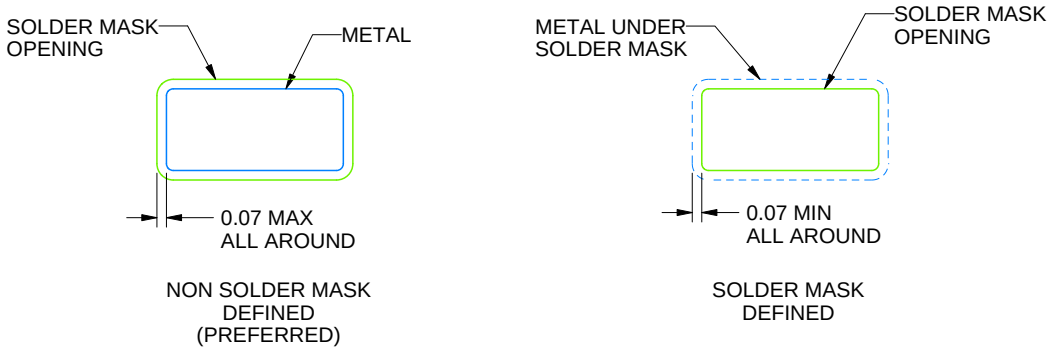
4214838/F 08/2024

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. Reference JEDEC registration TO-236, except minimum foot length.
4. Support pin may differ or may not be present.
5. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side



LAND PATTERN EXAMPLE
SCALE:15X

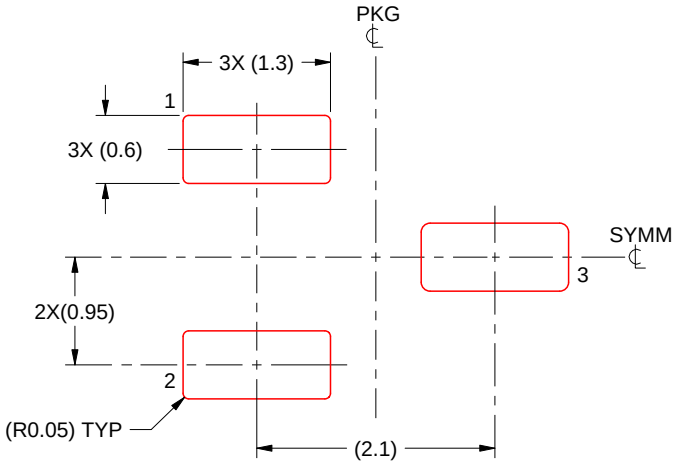


SOLDER MASK DETAILS

4214838/F 08/2024

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 THICK STENCIL
SCALE:15X

4214838/F 08/2024

NOTES: (continued)

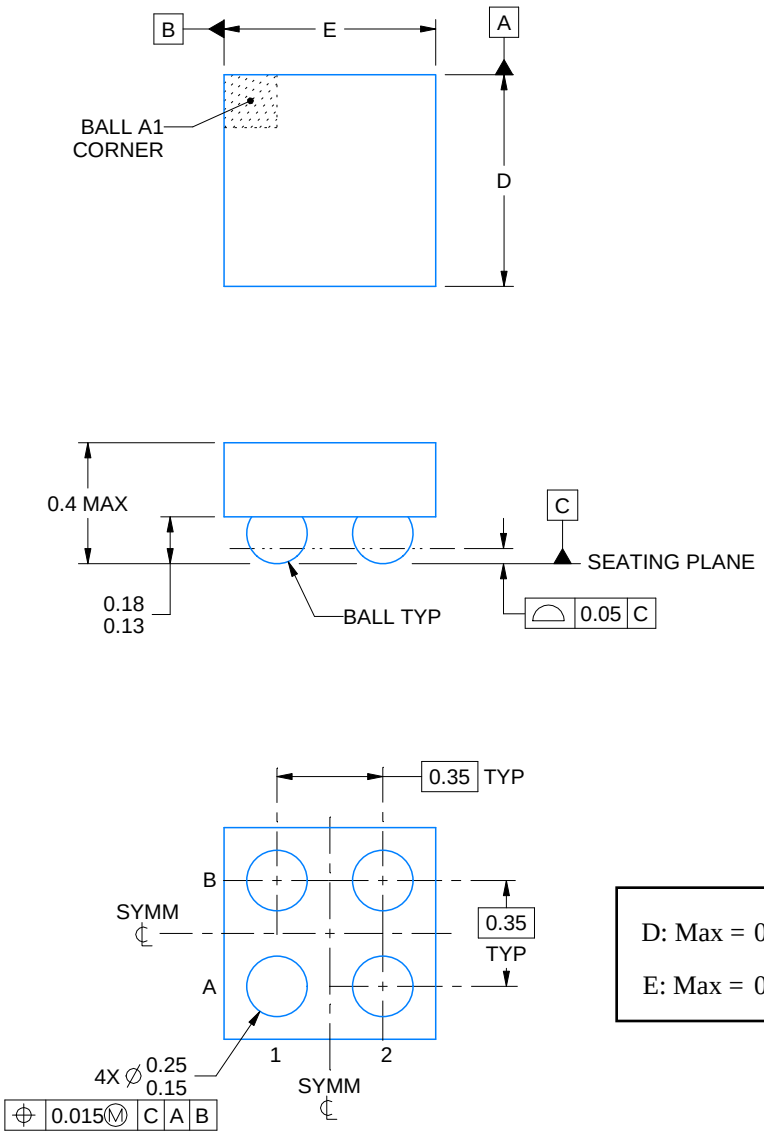
7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

PACKAGE OUTLINE

YKA0004

DSBGA - 0.4 mm max height

DIE SIZE BALL GRID ARRAY



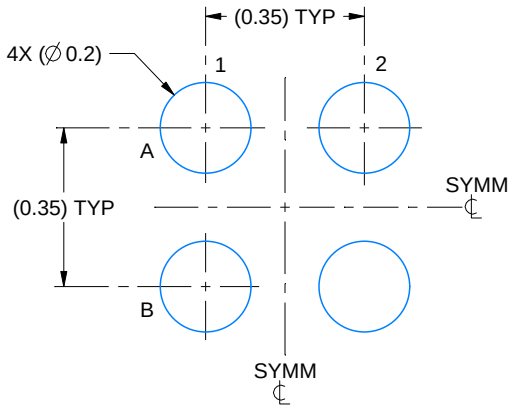
D: Max = 0.694 mm, Min =0.634 mm

E: Max = 0.694 mm, Min =0.634 mm

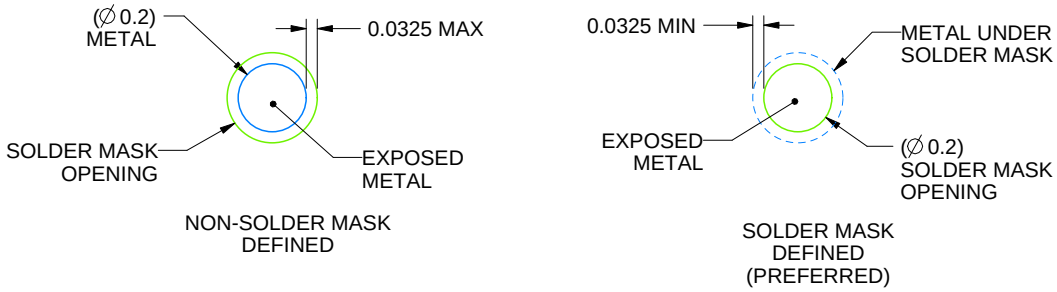
4221909/B 08/2018

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.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:60X

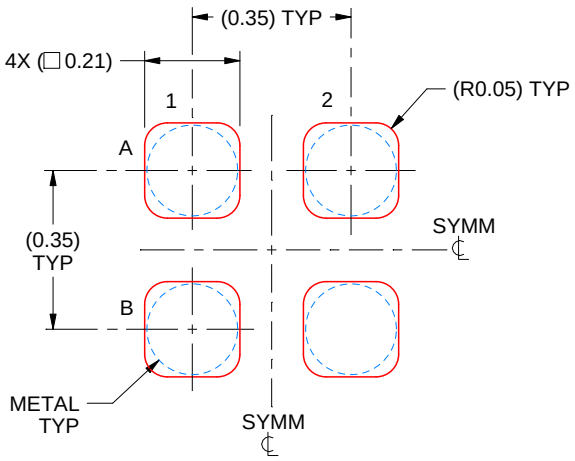


SOLDER MASK DETAILS
NOT TO SCALE

4221909/B 08/2018

NOTES: (continued)

3. Final dimensions may vary due to manufacturing tolerance considerations and also routing constraints.
For more information, see Texas Instruments literature number SNVA009 (www.ti.com/lit/snva009).



SOLDER PASTE EXAMPLE
BASED ON 0.075 mm - 0.1 mm THICK STENCIL
SCALE:60X

4221909/B 08/2018

NOTES: (continued)

4. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release.

重要なお知らせと免責事項

TI は、技術データと信頼性データ (データシートを含みます)、設計リソース (リファレンス デザインを含みます)、アプリケーションや設計に関する各種アドバイス、Web ツール、安全性情報、その他のリソースを、欠陥が存在する可能性のある「現状のまま」提供しており、商品性および特定目的に対する適合性の黙示保証、第三者の知的財産権の非侵害保証を含むいかなる保証も、明示的または黙示的にかかわらず拒否します。

これらのリソースは、TI 製品を使用する設計の経験を積んだ開発者への提供を意図したものです。(1) お客様のアプリケーションに適した TI 製品の選定、(2) お客様のアプリケーションの設計、検証、試験、(3) お客様のアプリケーションに該当する各種規格や、その他のあらゆる安全性、セキュリティ、規制、または他の要件への確実な適合に関する責任を、お客様のみが単独で負うものとします。

上記の各種リソースは、予告なく変更される可能性があります。これらのリソースは、リソースで説明されている TI 製品を使用するアプリケーションの開発の目的でのみ、TI はその使用をお客様に許諾します。これらのリソースに関して、他の目的で複製することや掲載することは禁止されています。TI や第三者の知的財産権のライセンスが付与されている訳ではありません。お客様は、これらのリソースを自身で使用した結果発生するあらゆる申し立て、損害、費用、損失、責任について、TI およびその代理人を完全に補償するものとし、TI は一切の責任を拒否します。

TI の製品は、 TI の販売条件 、 TI の総合的な品質ガイドライン 、 ti.com または TI 製品などに関連して提供される他の適用条件に従い提供されます。TI がこれらのリソースを提供することは、適用される TI の保証または他の保証の放棄の拡大や変更を意味するものではありません。 TI がカスタム、またはカスタマー仕様として明示的に指定していない限り、TI の製品は標準的なカタログに掲載される汎用機器です。

お客様がいかなる追加条項または代替条項を提案する場合も、TI はそれらに異議を唱え、拒否します。

Copyright © 2026, Texas Instruments Incorporated

最終更新日：2025 年 10 月