



## 3-PIN SUPPLY VOLTAGE SUPERVISORS

 Check for Samples: [TPS3809J25](#), [TPS3809L30](#), [TPS3809K33](#), [TPS3809I50](#)

### FEATURES

- 3-Pin SOT-23 Package
- Supply Current of 9  $\mu$ A (Typical)
- Precision Supply Voltage Monitor  
2.5 V, 3 V, 3.3 V, 5 V
- Pin-For-Pin Compatible With MAX 809
- Temperature Range:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

### APPLICATIONS

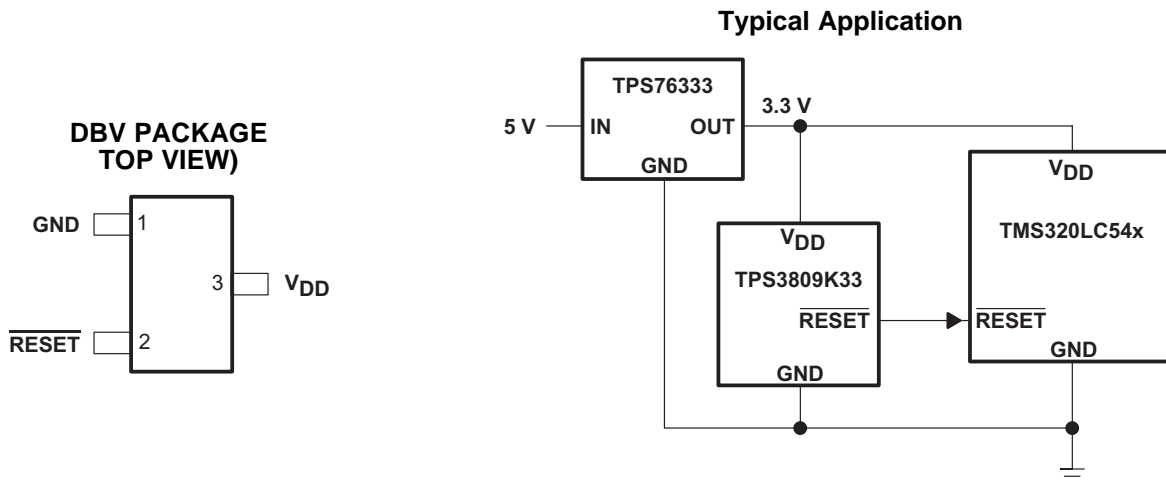
- Applications Using DSPs, Microcontrollers, or Microprocessors
- Wireless Communication Systems
- Portable/Battery-Powered Equipment
- Programmable Controls
- Intelligent Instruments
- Industrial Equipment
- Notebook/Desktop Computers
- Automotive Systems

### DESCRIPTION

The TPS3809 family of supervisory circuits provides circuit initialization and timing supervision, primarily for DSPs and processor-based systems.

During power-on,  $\overline{\text{RESET}}$  is asserted when the supply voltage  $V_{\text{DD}}$  becomes higher than 1.1 V. Thereafter, the supervisory circuit monitors  $V_{\text{DD}}$  and keeps  $\overline{\text{RESET}}$  active as long as  $V_{\text{DD}}$  remains below the threshold voltage  $V_{\text{IT}}$ . An internal timer delays the return of the output to the inactive state (high) to ensure proper system reset. The delay time,  $t_{\text{d(typ)}} = 200$  ms, starts after  $V_{\text{DD}}$  has risen above the threshold voltage  $V_{\text{IT}}$ . When the supply voltage drops below the threshold voltage  $V_{\text{IT}}$ , the output becomes active (low) again. No external components are required. All the devices of this family have a fixed sense-threshold voltage  $V_{\text{IT}}$  set by an internal voltage divider.

The product spectrum is designed for supply voltages of 2.5 V, 3 V, 3.3 V, and 5 V. The circuits are available in a 3-pin SOT-23. The TPS3809 devices are characterized for operation over a temperature range of  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### AVAILABLE OPTIONS<sup>(1)</sup>

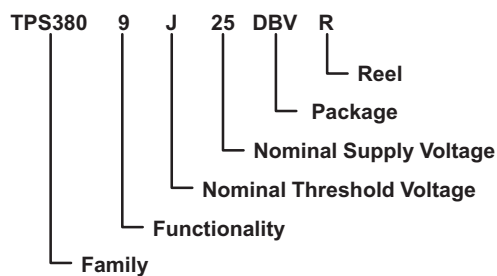
T <sub>A</sub>	DEVICE NAME		THRESHOLD VOLTAGE	MARKING
-40°C to 85°C	TPS3809J25DBVR	TPS3809J25DBVT	2.25 V	PCZI
	TPS3809L30DBVR	TPS3809L30DBVT	2.64 V	PDAI
	TPS3809K33DBVR	TPS3809K33DBVT	2.93 V	PDBI
	TPS3809I50DBVR	TPS3809I50DBVT	4.55 V	PDCI

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this data sheet, or refer to our web site at [www.ti.com](http://www.ti.com).

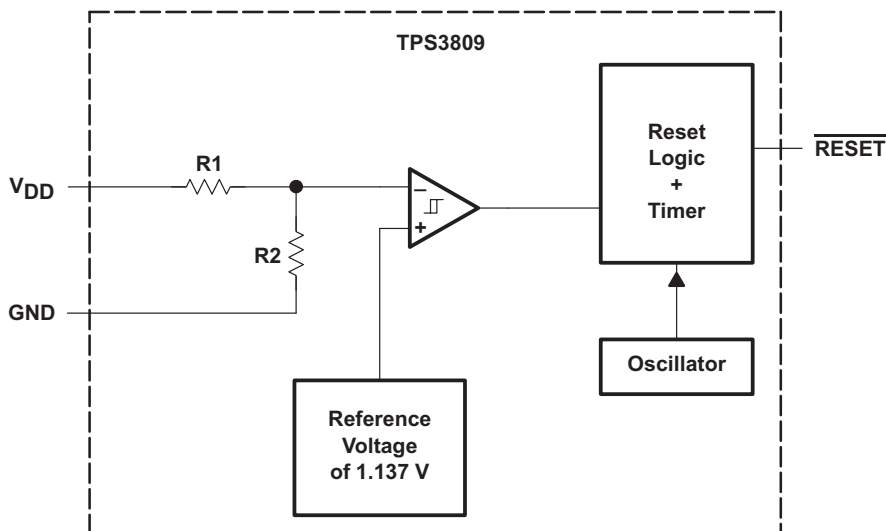
#### FUNCTION/TRUTH TABLE, TPS3809

V <sub>DD</sub> > V <sub>IT</sub>	$\overline{\text{RESET}}$
0	L
1	H

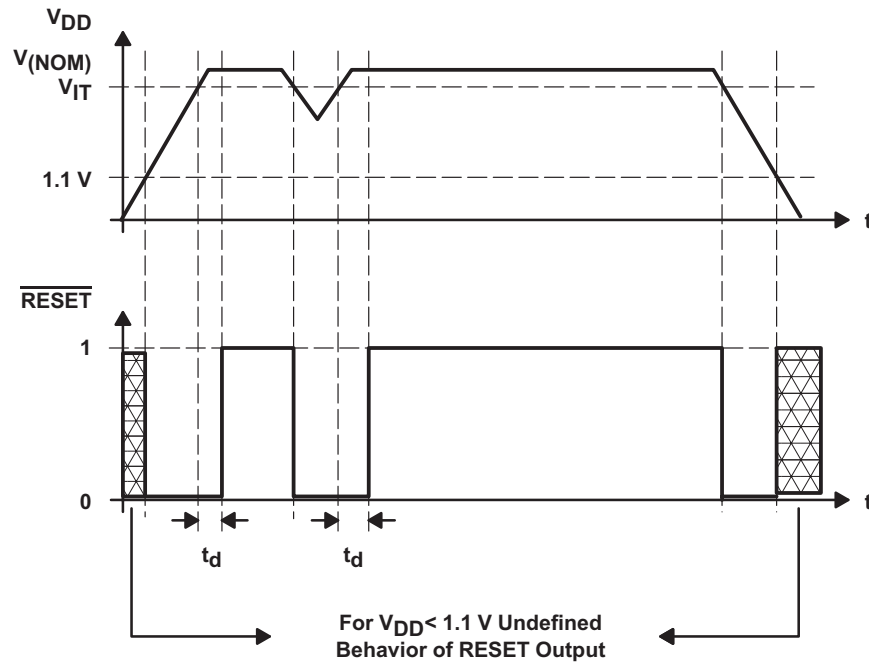
#### ORDERING INFORMATION



### FUNCTIONAL BLOCK DIAGRAMS



**TIMING DIAGRAM**



**ABSOLUTE MAXIMUM RATINGS<sup>(1) (2)</sup>**

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

	UNIT
Supply voltage, V <sub>DD</sub>	7 V
All other pins	-0.3 V to 7 V
Maximum low-output current, I <sub>OL</sub>	5 mA
Maximum high-output current, I <sub>OH</sub>	-5 mA
Input-clamp current, I <sub>IK</sub> (V <sub>I</sub> < 0 or V <sub>I</sub> > V <sub>DD</sub> )	±20 mA
Output-clamp current, I <sub>OK</sub> (V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>DD</sub> )	±20 mA
Continuous total power dissipation	See Dissipation Rating Table
Operating junction temperature range, T <sub>A</sub>	-40°C to 85°C
Storage temperature range, T <sub>stg</sub>	-65°C to 150°C

- (1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *recommended operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values are with respect to GND. For reliable operation, the device should not be operated at 7 V for more than t = 1000h continuously.

**DISSIPATION RATINGS**

PACKAGE	T <sub>A</sub> < 25°C POWER RATING	DERATING FACTOR ABOVE T <sub>A</sub> < 25°C	T <sub>A</sub> = 70°C POWER RATING	T <sub>A</sub> = 85°C POWER RATING
DBV	437 mW	3.5 mW/°C	280 mW	227 mW

**RECOMMENDED OPERATING CONDITIONS**

	MIN	MAX	UNIT
Supply voltage, V <sub>DD</sub>	2	6	V
Pull-up resistor value, $\overline{\text{RESET}}$	$\frac{V_{\text{Pull-up}}}{50\mu\text{A}}$		Ω
Operating free-air temperature range, T <sub>A</sub>	-40	+85	°C

## ELECTRICAL CHARACTERISTICS

Overrecommended operating free-air temperature range (unless otherwise noted).

PARAMETER	TEST CONDITIONS	TPS3800-xx, TPS3801-xx, TPS3802-xx			UNIT	
		MIN	TYP	MAX		
V <sub>OH</sub> High-level output voltage	V <sub>DD</sub> = 2.5 V to 6 V I <sub>OH</sub> = -500 μA	V <sub>DD</sub> -0.2			V	
	V <sub>DD</sub> = 3.3 V I <sub>OH</sub> = -2 mA	V <sub>DD</sub> -0.4				
	V <sub>DD</sub> = 6 V I <sub>OH</sub> = -4 mA	V <sub>DD</sub> -0.4				
V <sub>OL</sub> Low-level output voltage	V <sub>DD</sub> = 2 V to 6 V, I <sub>OL</sub> = 500 μA	0.2			V	
	V <sub>DD</sub> = 3.3 V, I <sub>OL</sub> = 2 mA	0.4				
	V <sub>DD</sub> = 6 V, I <sub>OL</sub> = 4 mA	0.4				
Power-up reset voltage <sup>(1)</sup>	V <sub>DD</sub> ≥ 1.1 V, I <sub>OL</sub> = 50 μA	0.2			V	
V <sub>IT-</sub> Negative-going input threshold voltage <sup>(2)</sup>	TPS3809J25	T <sub>A</sub> = -40°C to 85°C	2.2	2.25	2.3	V
	TPS3809L30		2.58	2.64	2.7	
	TPS3809K33		2.87	2.93	2.99	
	TPS3809I50		4.45	4.55	4.65	
V <sub>hys</sub> Threshold hysteresis	TPS3809J25		30		mV	
	TPS3809L30		35			
	TPS3809K33		40			
	TPS3809I50		60			
I <sub>DD</sub> Supply current	V <sub>DD</sub> = 2 V, output unconnected	9		12	μA	
	V <sub>DD</sub> = 6 V, output unconnected	20		25		
C <sub>i</sub> Input capacitance	V <sub>I</sub> = 0 V to V <sub>DD</sub>	5			pF	

(1) The lowest supply voltage at which  $\overline{\text{RESET}}$  becomes active.  $t_r, v_{DD} \geq 15 \mu\text{s/V}$ .

(2) To ensure the best stability of the threshold voltage, a bypass capacitor (0.1-μF ceramic) should be placed near the supply terminals.

## TIMING REQUIREMENTS

at R<sub>L</sub> = 1 MΩ, C<sub>L</sub> = 50 pF, T<sub>A</sub> = 25°C

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>w</sub> Pulse width	at V <sub>DD</sub> V <sub>DD</sub> = V <sub>IT-</sub> + 0.2 V, V <sub>DD</sub> = V <sub>IT-</sub> - 0.2 V	3			μs

## SWITCHING CHARACTERISTICS

at R<sub>L</sub> = 1 MΩ, C<sub>L</sub> = 50 pF, T<sub>A</sub> = 25°C

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>d</sub> Delay time	V <sub>DD</sub> ≥ V <sub>IT-</sub> + 0.2 V, See <a href="#">timing diagram</a>	120	200	280	ms
t <sub>PHL</sub> Propagation (delay) time, high-to-low-level output	V <sub>DD</sub> to $\overline{\text{RESET}}$ delay V <sub>IL</sub> = V <sub>IT-</sub> - 0.2 V, V <sub>IH</sub> = V <sub>IT-</sub> + 0.2 V	1			μs

TYPICAL CHARACTERISTICS

LOW-LEVEL OUTPUT VOLTAGE  
vs  
LOW-LEVEL OUTPUT CURRENT

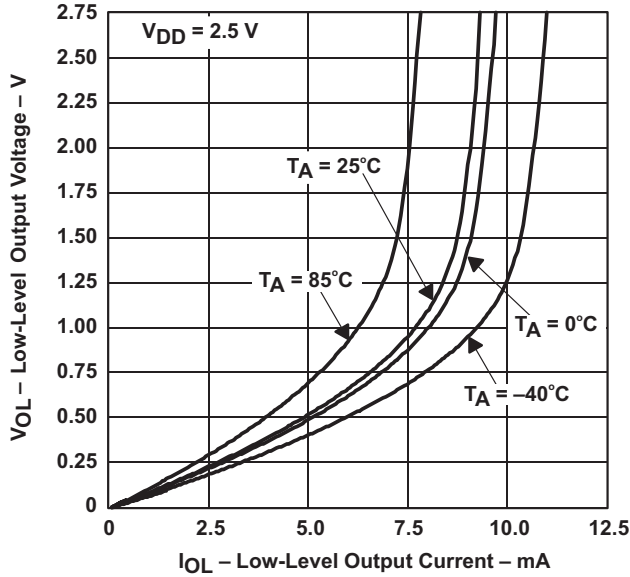


Figure 1.

SUPPLY CURRENT  
vs  
SUPPLY VOLTAGE

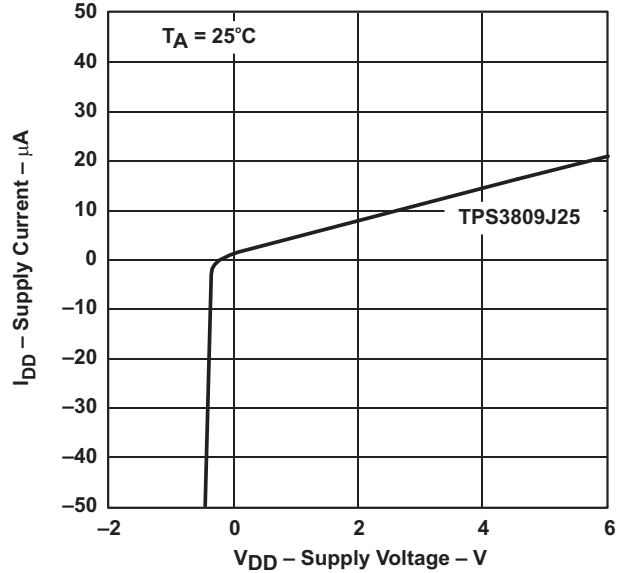


Figure 2.

HIGH-LEVEL OUTPUT VOLTAGE  
vs  
HIGH-LEVEL OUTPUT CURRENT

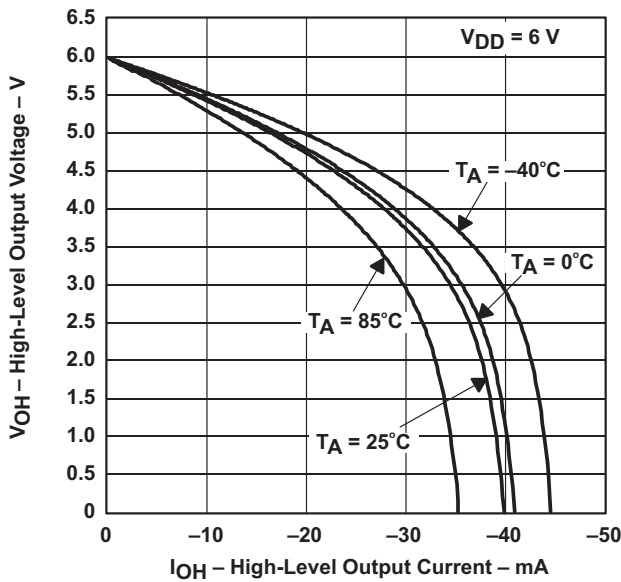


Figure 3.

HIGH-LEVEL OUTPUT VOLTAGE  
vs  
HIGH-LEVEL OUTPUT CURRENT

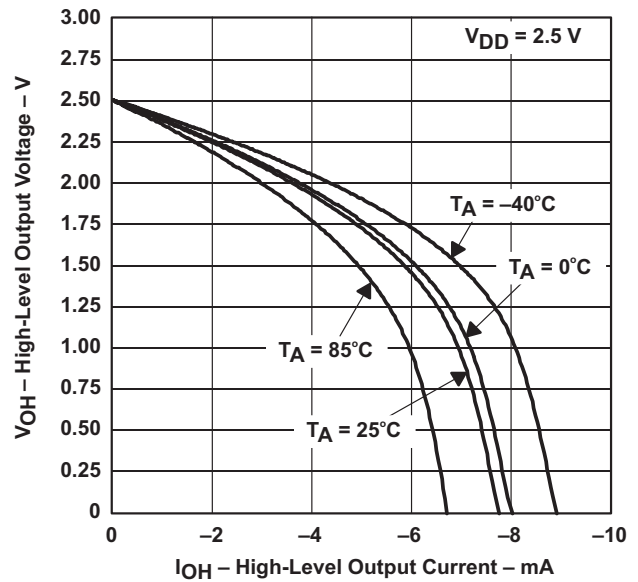


Figure 4.

**TYPICAL CHARACTERISTICS (continued)**

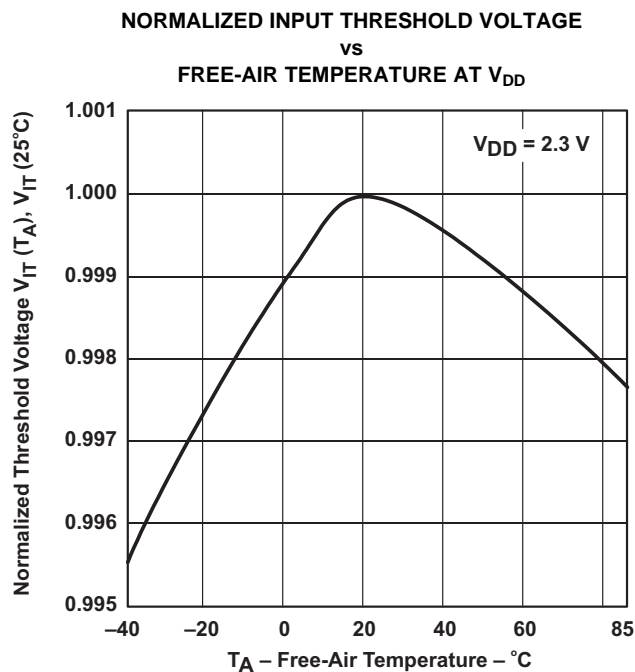


Figure 5.

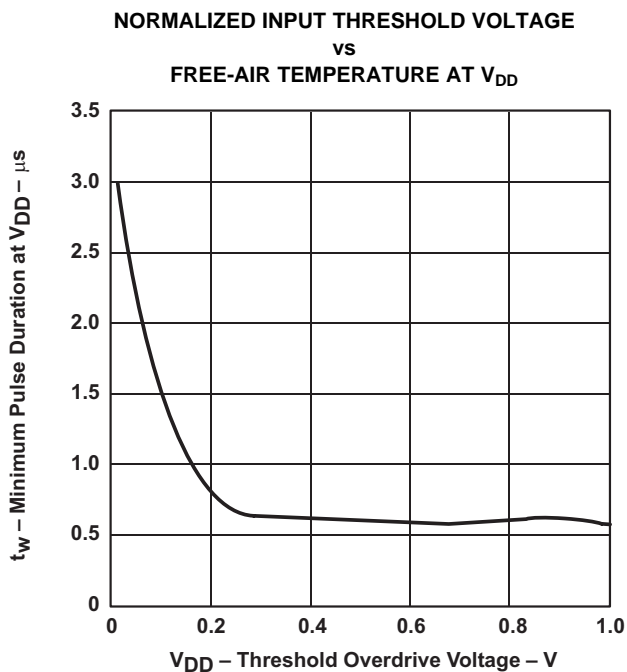


Figure 6.

**REVISION HISTORY**

Changes from Original (August 1999) to Revision A	Page
• Added Pull-up resistor value, $\overline{\text{RESET}}$ to the Recommended Operating Conditions Table .....	3

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TPS3809I50DBVR	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TPS3809I50DBVRG4	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TPS3809I50DBVT	ACTIVE	SOT-23	DBV	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TPS3809I50DBVTG4	ACTIVE	SOT-23	DBV	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TPS3809J25DBVR	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TPS3809J25DBVRG4	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TPS3809J25DBVT	ACTIVE	SOT-23	DBV	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TPS3809J25DBVTG4	ACTIVE	SOT-23	DBV	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TPS3809K33DBVR	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TPS3809K33DBVRG4	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TPS3809K33DBVT	ACTIVE	SOT-23	DBV	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TPS3809K33DBVTG4	ACTIVE	SOT-23	DBV	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TPS3809L30DBVR	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TPS3809L30DBVRG4	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TPS3809L30DBVT	ACTIVE	SOT-23	DBV	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TPS3809L30DBVTG4	ACTIVE	SOT-23	DBV	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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**OTHER QUALIFIED VERSIONS OF TPS3809I50, TPS3809J25, TPS3809K33, TPS3809L30 :**

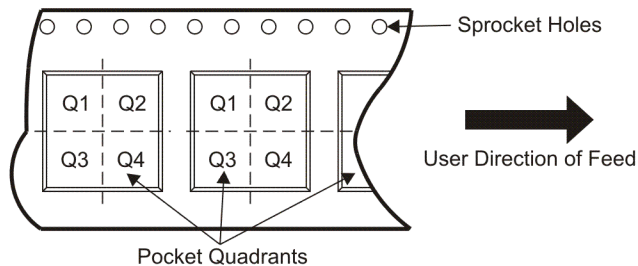
● Automotive: [TPS3809I50-Q1](#), [TPS3809J25-Q1](#), [TPS3809K33-Q1](#), [TPS3809L30-Q1](#)

● Enhanced Product: [TPS3809I50-EP](#), [TPS3809K33-EP](#), [TPS3809L30-EP](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TPS3809I50DBVR	SOT-23	DBV	3	3000	178.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3
TPS3809I50DBVT	SOT-23	DBV	3	250	178.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3
TPS3809J25DBVR	SOT-23	DBV	3	3000	180.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3
TPS3809J25DBVT	SOT-23	DBV	3	250	180.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3
TPS3809K33DBVR	SOT-23	DBV	3	3000	178.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3
TPS3809K33DBVT	SOT-23	DBV	3	250	178.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3
TPS3809L30DBVR	SOT-23	DBV	3	3000	178.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3

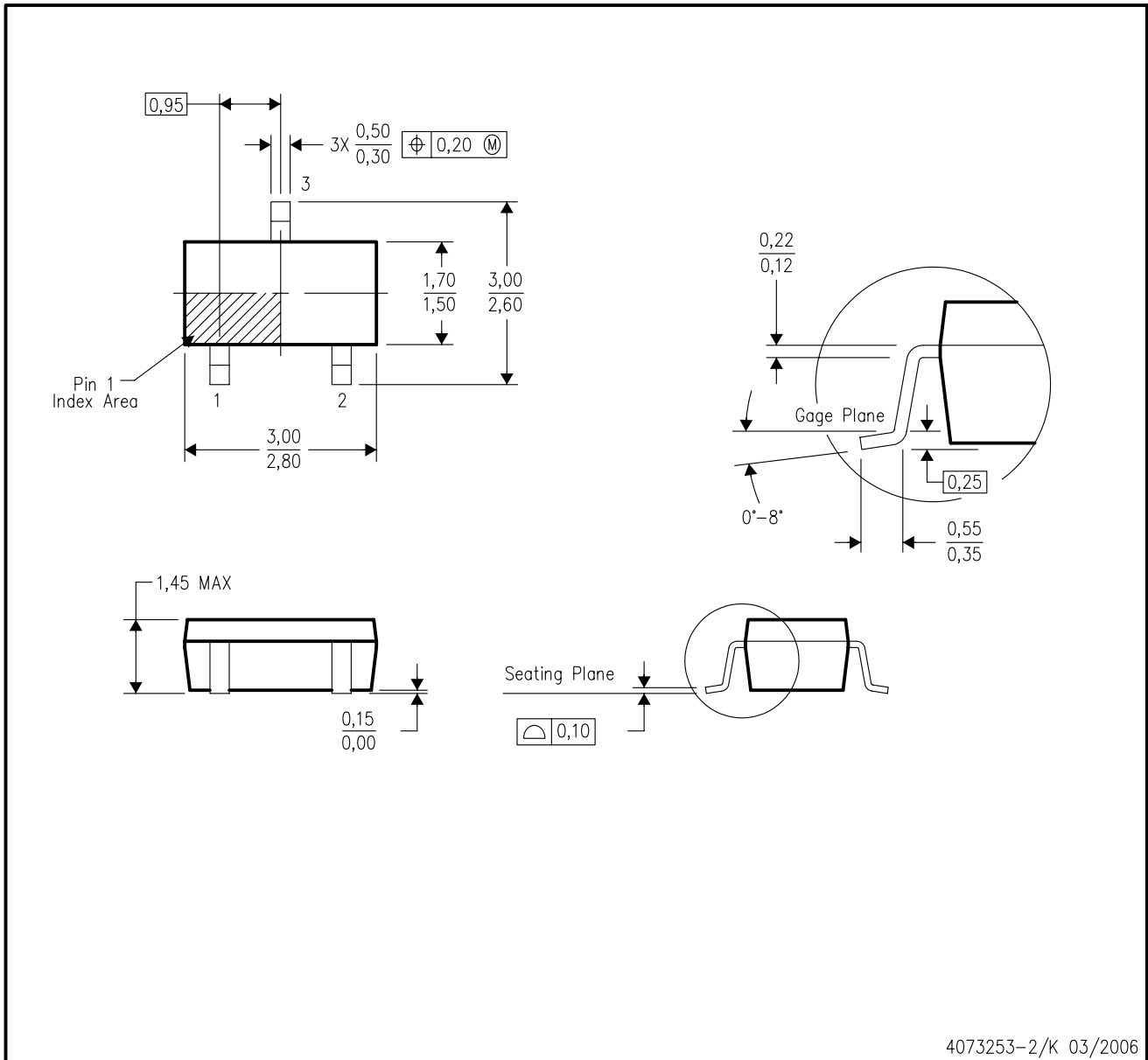
**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS3809I50DBVR	SOT-23	DBV	3	3000	180.0	180.0	18.0
TPS3809I50DBVT	SOT-23	DBV	3	250	180.0	180.0	18.0
TPS3809J25DBVR	SOT-23	DBV	3	3000	182.0	182.0	20.0
TPS3809J25DBVT	SOT-23	DBV	3	250	182.0	182.0	20.0
TPS3809K33DBVR	SOT-23	DBV	3	3000	180.0	180.0	18.0
TPS3809K33DBVT	SOT-23	DBV	3	250	180.0	180.0	18.0
TPS3809L30DBVR	SOT-23	DBV	3	3000	180.0	180.0	18.0

DBV (R-PDSO-G3)

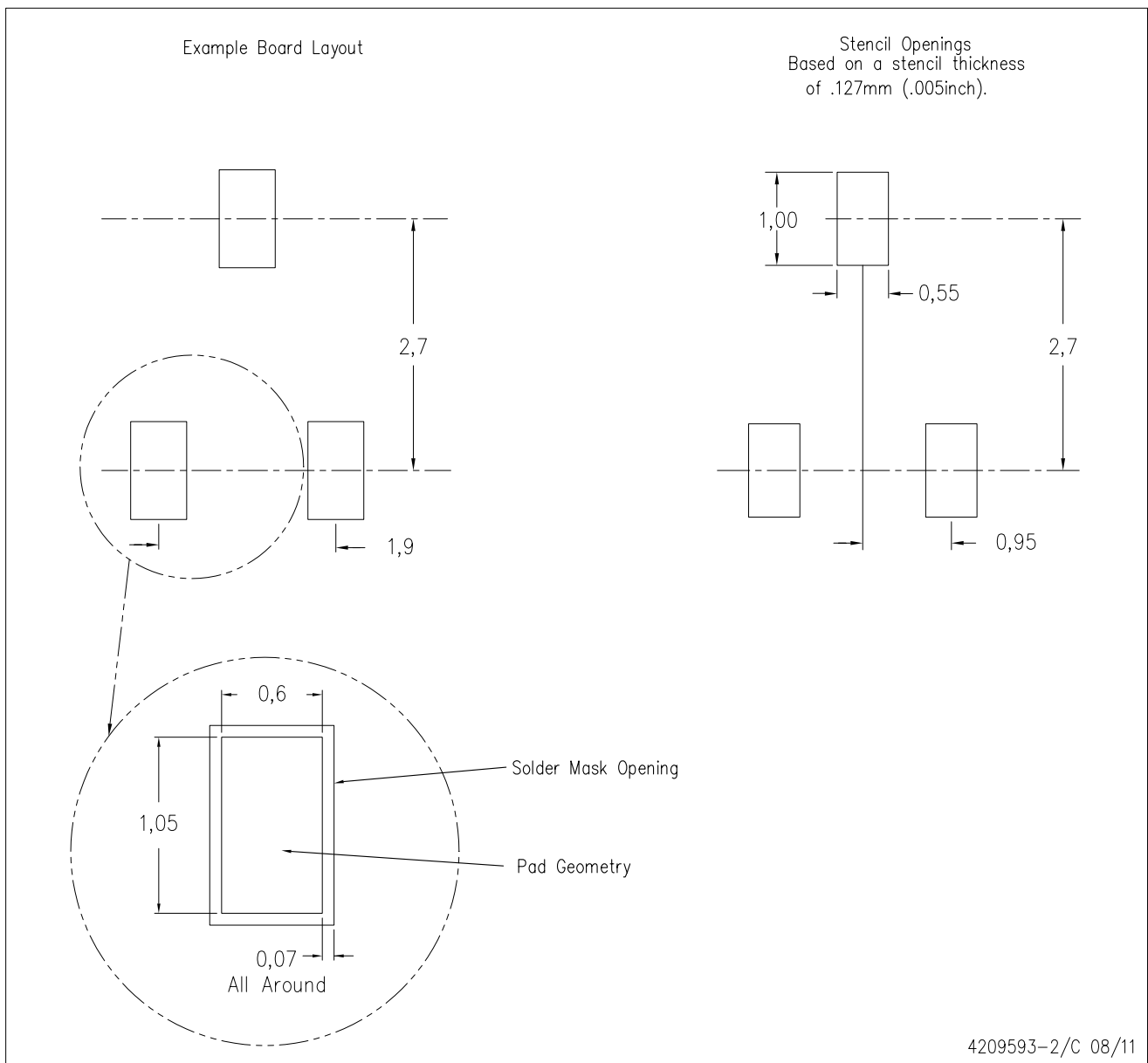
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.

DBV (R-PDSO-G3)

PLASTIC SMALL OUTLINE



4209593-2/C 08/11

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
  - D. Publication IPC-7351 is recommended for alternate designs.
  - E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

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Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
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### Applications

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