

# TPS3809J25-Q1, TPS3809L30-Q1, TPS3809K33-Q1, TPS3809I50-Q1 3-PIN SUPPLY VOLTAGE SUPERVISORS

SGLS142A – DECEMBER 2002 – REVISED JUNE 2008

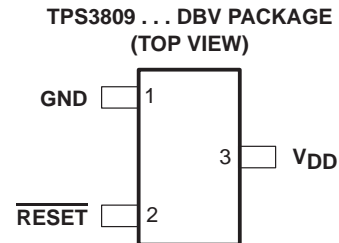
- Qualified for Automotive Applications
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Using Human Body Model (C = 100 pF, R = 1500 Ω)
- 3-Pin SOT-23 Package
- Supply Current of 9 μA (Typical)
- Precision Supply Voltage Monitor  
2.5 V, 3 V, 3.3 V, 5 V
- Power-On Reset Generator With Fixed Delay Time of 200 ms
- Pin-For-Pin Compatible With MAX 809

## description

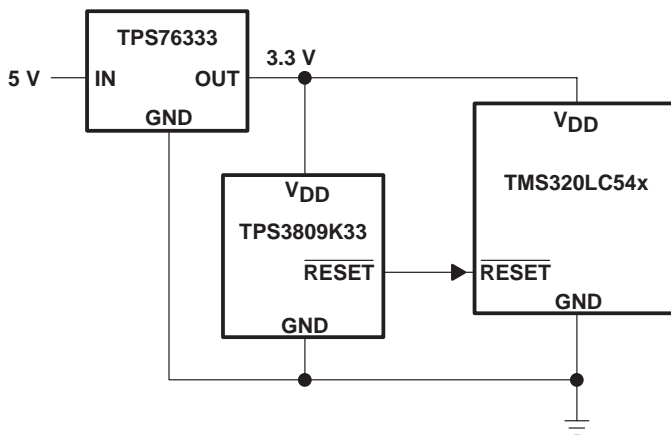
The TPS3809 family of supervisory circuits provides circuit initialization and timing supervision, primarily for DSPs and processor-based systems.

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 TPS3809xxxQ-Q1 devices are characterized for operation over a temperature range of  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ , and are qualified in accordance with AEC-Q100 stress test qualification for integrated circuits.



## typical applications



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



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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

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### AVAILABLE OPTIONS†‡

T <sub>A</sub>	DEVICE NAME	THRESHOLD VOLTAGE	MARKING
-40°C to 125°C	TPS3809J25QDBVRQ1§	2.25 V	PCZQ
	TPS3809L30QDBVRQ1§	2.64 V	PDAQ
	TPS3809K33QDBVRQ1§	2.93 V	PDBQ
	TPS3809I50QDBVRQ1§	4.55 V	PDCQ

† For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at <http://www.ti.com>.

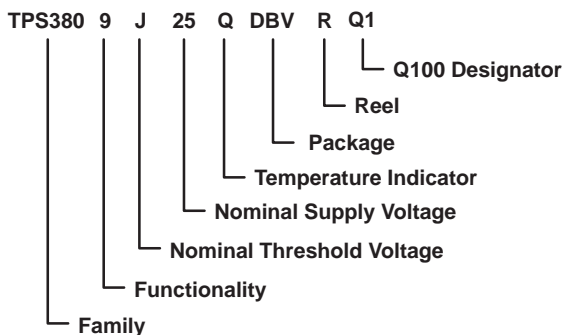
‡ Package drawings, thermal data, and symbolization are available at <http://www.ti.com/packaging>.

§ The DBVR passive indicates tape and reel of 3000 parts.

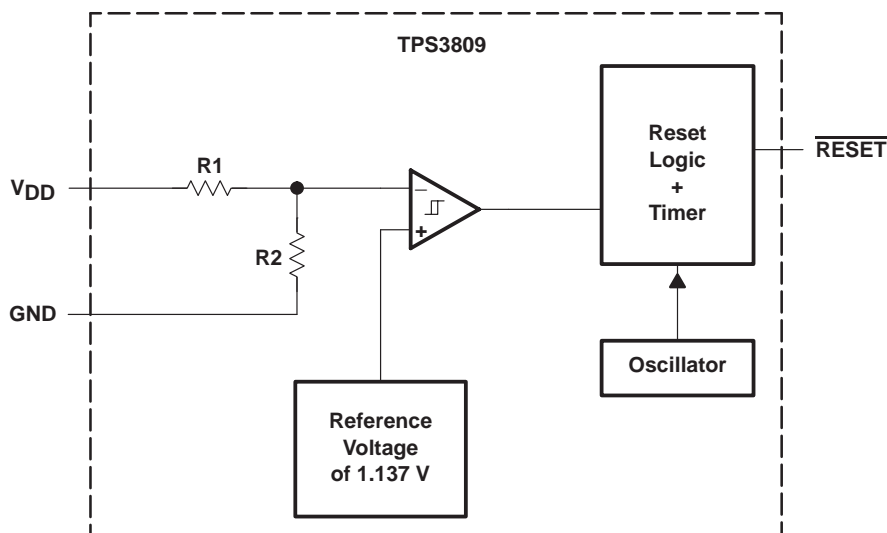
### FUNCTION/TRUTH TABLE, TPS3809

V <sub>DD</sub> >V <sub>IT</sub>	RESET
0	L
1	H

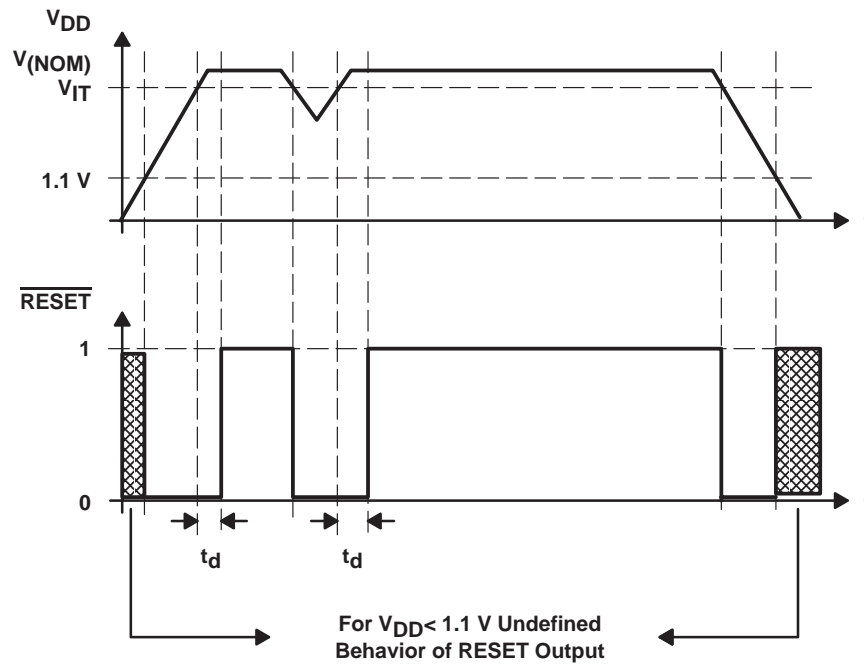
### ORDERING INFORMATION



### functional block diagram



timing diagram



absolute maximum ratings over operating free-air temperature (unless otherwise noted)†

Supply voltage, $V_{DD}$ (see Note 1)	7 V
All other pins (see Note 1)	-0.3 V to 7 V
Maximum low output current, $I_{OL}$	5 mA
Maximum high output current, $I_{OH}$	-5 mA
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{DD}$ )	$\pm 20$ mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{DD}$ )	$\pm 20$ mA
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, $T_A$	-40°C to 125°C
Storage temperature range, $T_{stg}$	-65°C to 150°C
Soldering temperature	260°C

† 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.

NOTE 1: 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 RATING TABLE

PACKAGE	$T_A < 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
DBV	437 mW	3.5 mW/°C	280 mW	227 mW	87 mW

recommended operating conditions at specified temperature range

	MIN	MAX	UNIT
Supply voltage, $V_{DD}$	2	6	V
Operating free-air temperature range, $T_A$	-40	125	°C

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT		
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	T <sub>A</sub> = -40°C to 25°C	V <sub>DD</sub> -0.4				
			T <sub>A</sub> = 125°C	V <sub>DD</sub> -0.5				
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 (see Note 2)		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 (see Note 3)	TPS3809J25	T <sub>A</sub> = -40°C to 125°C	2.20	2.25	2.30	V	
		TPS3809L30		2.58	2.64	2.70		
		TPS3809K33		2.87	2.93	2.99		
		TPS3809I50		T <sub>A</sub> = -40°C to 85°C	4.45	4.55		4.65
				T <sub>A</sub> = -40°C to 125°C	4.4	4.55		4.65
V <sub>hys</sub>	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	15	μA		
		V <sub>DD</sub> = 6 V, Output unconnected		20	30			
C <sub>i</sub>	Input capacitance	V <sub>I</sub> = 0 V to V <sub>DD</sub>		5		pF		

NOTES: 2. The lowest supply voltage at which RESET becomes active. t<sub>r</sub>, V<sub>DD</sub> ≥ 15 μs/V.

3. To ensure 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 timing diagram	120	200	280	ms
t <sub>PHL</sub>	Propagation (delay) time, high-to-low-level output	V <sub>DD</sub> to 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

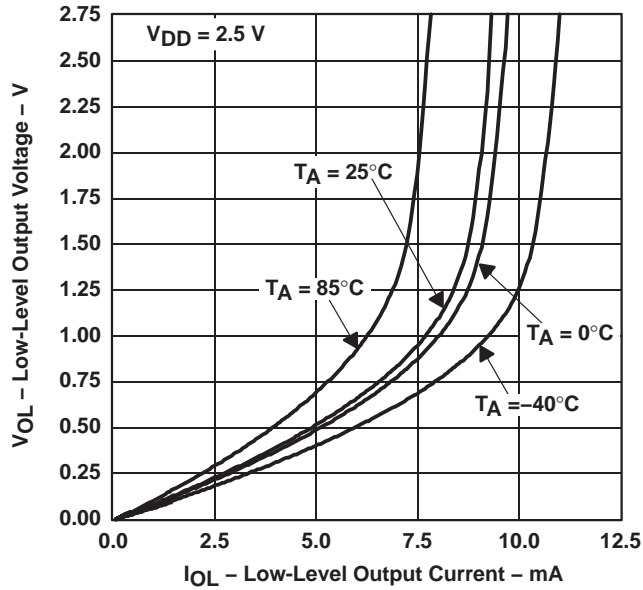


Figure 1

SUPPLY CURRENT  
vs  
SUPPLY VOLTAGE

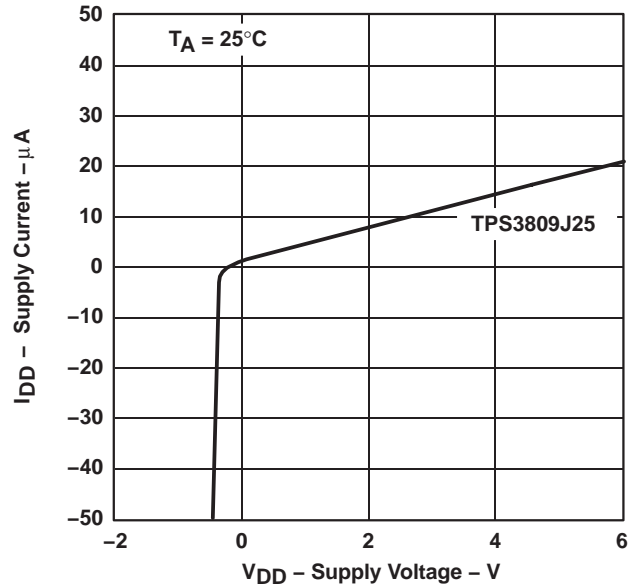


Figure 2

HIGH-LEVEL OUTPUT VOLTAGE  
vs  
HIGH-LEVEL OUTPUT CURRENT

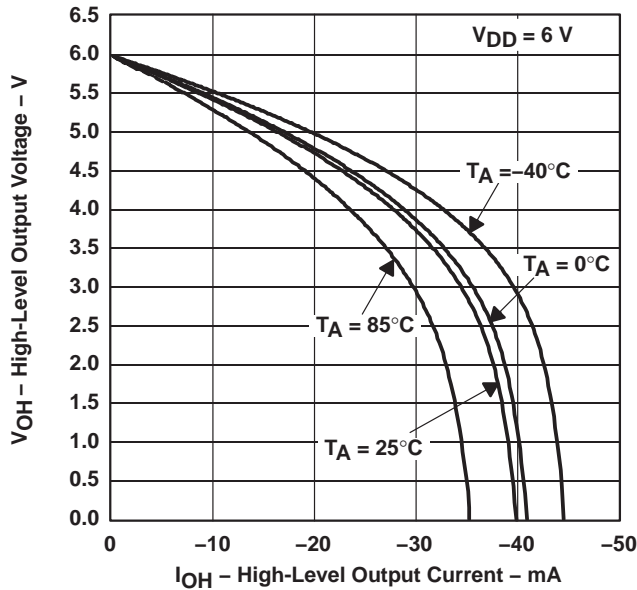


Figure 3

HIGH-LEVEL OUTPUT VOLTAGE  
vs  
HIGH-LEVEL OUTPUT CURRENT

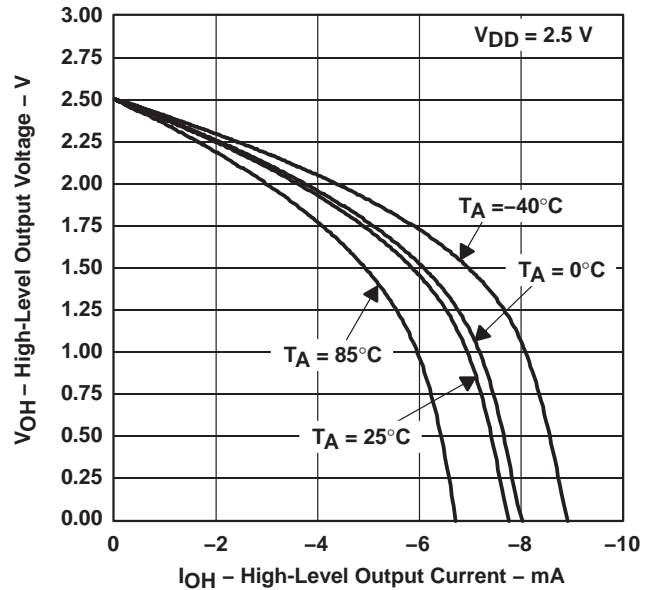


Figure 4

# TPS3809J25-Q1, TPS3809L30-Q1, TPS3809K33-Q1, TPS3809I50-Q1 3-PIN SUPPLY VOLTAGE SUPERVISORS

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## TYPICAL CHARACTERISTICS

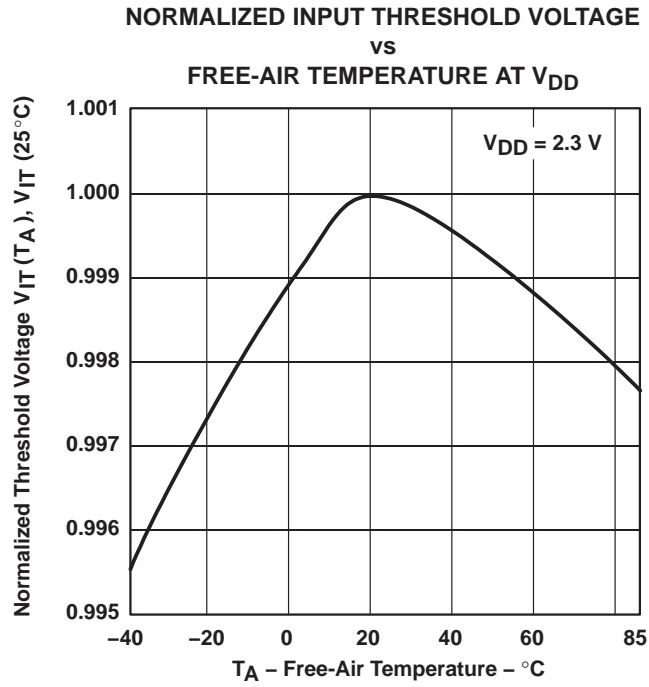


Figure 5

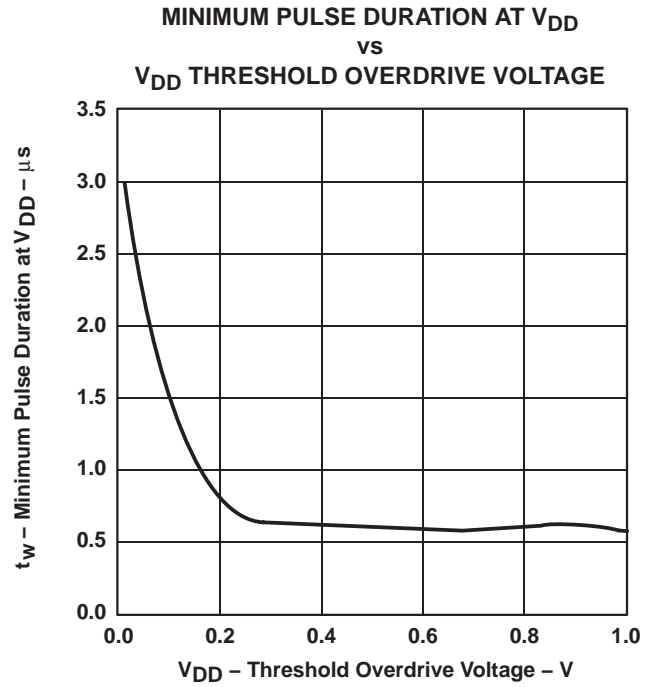


Figure 6

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
2T09I50QDBVRG4Q	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	PDCQ	<a href="#">Samples</a>
2T09J25QDBVRG4Q	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	PCZQ	<a href="#">Samples</a>
2U3809K33QDBVRG4Q1	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	PDBQ	<a href="#">Samples</a>
2U3809L30QDBVRG4Q1	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	PDAQ	<a href="#">Samples</a>
TPS3809I50QDBVRQ1	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	PDCQ	<a href="#">Samples</a>
TPS3809J25QDBVRQ1	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	PCZQ	<a href="#">Samples</a>
TPS3809K33QDBVRQ1	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	PDBQ	<a href="#">Samples</a>
TPS3809L30QDBVRQ1	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	PDAQ	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

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

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

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

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

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

(2) 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)

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

<sup>(4)</sup> Only one of markings shown within the brackets will appear on the physical device.

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**OTHER QUALIFIED VERSIONS OF TPS3809I50-Q1, TPS3809J25-Q1, TPS3809K33-Q1, TPS3809L30-Q1 :**

- Catalog: [TPS3809I50](#), [TPS3809J25](#), [TPS3809K33](#), [TPS3809L30](#)
- Enhanced Product: [TPS3809I50-EP](#), [TPS3809K33-EP](#), [TPS3809L30-EP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- 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
2T09I50QDBVRG4Q	SOT-23	DBV	3	3000	180.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3
2T09J25QDBVRG4Q	SOT-23	DBV	3	3000	180.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3
2U3809K33QDBVRG4Q1	SOT-23	DBV	3	3000	180.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3
2U3809L30QDBVRG4Q1	SOT-23	DBV	3	3000	180.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3
TPS3809I50QDBVRQ1	SOT-23	DBV	3	3000	180.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3
TPS3809J25QDBVRQ1	SOT-23	DBV	3	3000	180.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3
TPS3809K33QDBVRQ1	SOT-23	DBV	3	3000	180.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3
TPS3809L30QDBVRQ1	SOT-23	DBV	3	3000	180.0	9.0	3.3	3.2	1.47	4.0	8.0	Q3

**TAPE AND REEL BOX DIMENSIONS**

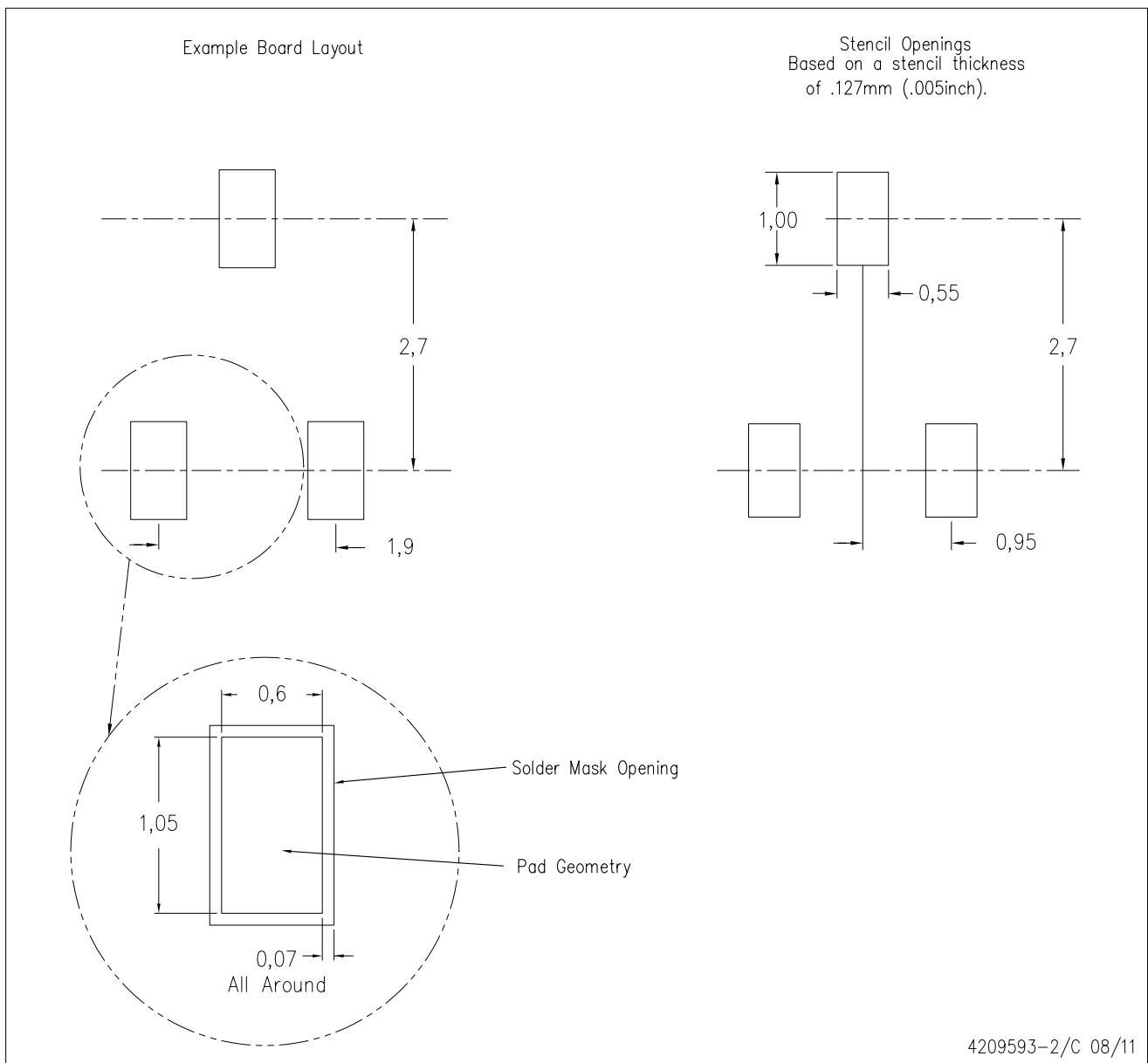

\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
2T09I50QDBVVG4Q	SOT-23	DBV	3	3000	182.0	182.0	20.0
2T09J25QDBVVG4Q	SOT-23	DBV	3	3000	182.0	182.0	20.0
2U3809K33QDBVVG4Q1	SOT-23	DBV	3	3000	182.0	182.0	20.0
2U3809L30QDBVVG4Q1	SOT-23	DBV	3	3000	182.0	182.0	20.0
TPS3809I50QDBVRQ1	SOT-23	DBV	3	3000	182.0	182.0	20.0
TPS3809J25QDBVRQ1	SOT-23	DBV	3	3000	182.0	182.0	20.0
TPS3809K33QDBVRQ1	SOT-23	DBV	3	3000	182.0	182.0	20.0
TPS3809L30QDBVRQ1	SOT-23	DBV	3	3000	182.0	182.0	20.0



DBV (R-PDSO-G3)

PLASTIC SMALL OUTLINE



- 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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TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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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>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
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