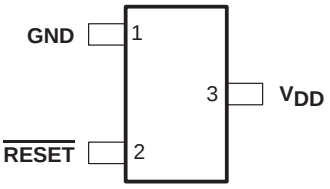
- **Qualified for Automotive Applications**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Using Human Body Model (C = 100 pF, R = 1500 Ω)**
- **3-Pin SOT-23 Package**
- **Supply Current of 9 μA (Typical)**
- **Precision Supply Voltage Monitor 2.5 V, 3 V, 3.3 V, 5 V**
- **Power-On Reset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

TPS3809 . . . DBV PACKAGE
(TOP VIEW)



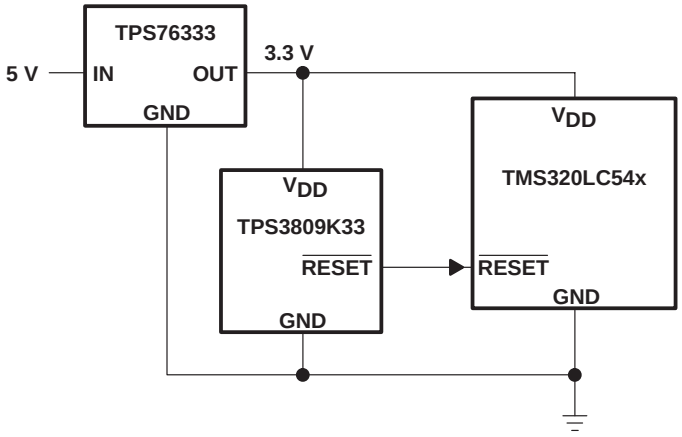
description

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_{DD} becomes higher than 1.1 V. Thereafter, the supervisory circuit monitors V_{DD} and keeps $\overline{\text{RESET}}$ active as long as V_{DD} remains below the threshold voltage V_{IT}. An internal timer delays the return of the output to the inactive state (high) to ensure proper system reset. The delay time, $t_{d(typ)}$ = 200 ms, starts after V_{DD} has risen above the threshold voltage V_{IT}. When the supply voltage drops below the threshold voltage V_{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_{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°C to 125°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.

AVAILABLE OPTIONS†‡

T_A	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.

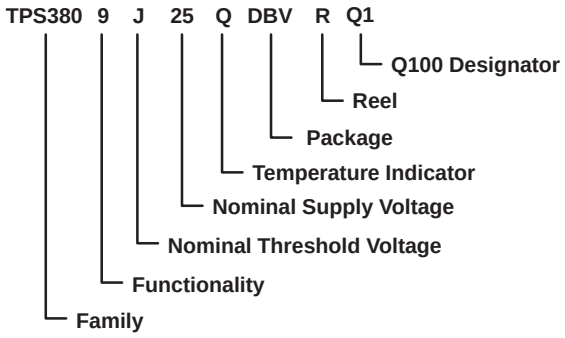
‡ Package drawings, thermal data, and symbolization are available at http://www.ti.com/packaging.

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

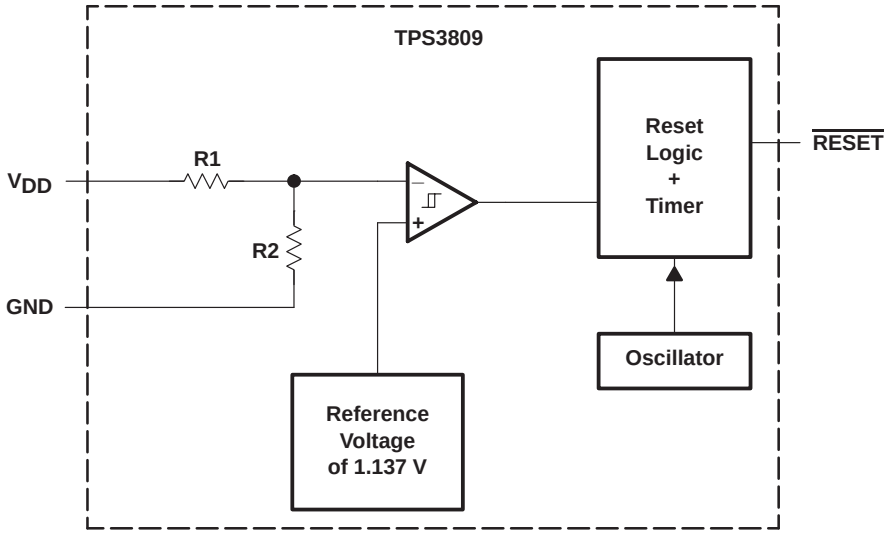
FUNCTION/TRUTH TABLE, TPS3809

$V_{DD}>V_{IT}$	$\overline{RESET}$
0	L
1	H

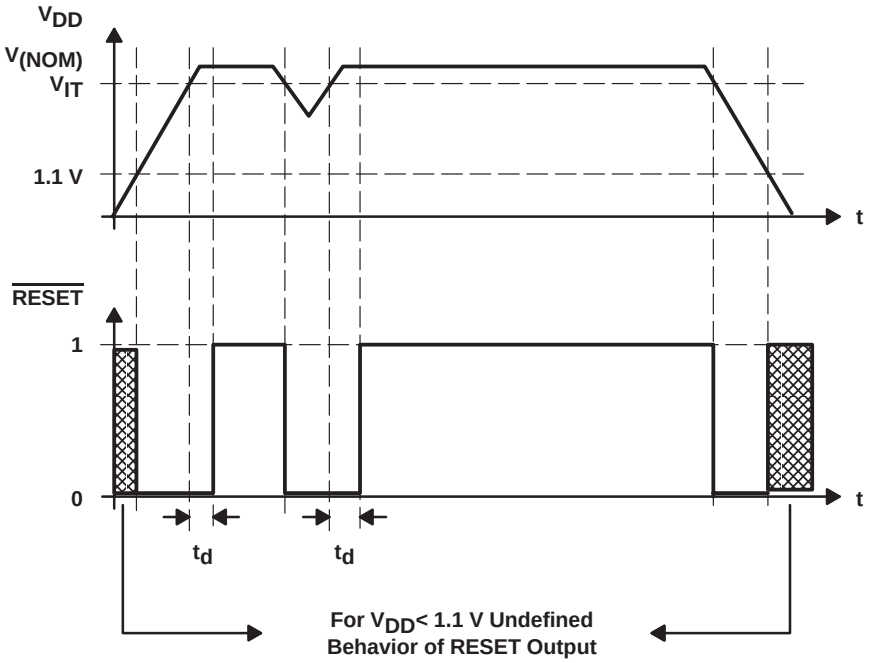
ORDERING INFORMATION



functional block diagram



timing diagram



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

Supply voltage, V_{DD} (see Note1) . . . . . 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}) . . . . . ±20 mA
Output clamp current, I_{OK} (V_O<0 or V_O>V_{DD}) . . . . . ±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°C POWER RATING	DERATING FACTOR ABOVE T_A = 25°C	T_A = 70°C POWER RATING	T_A = 85°C POWER RATING	T_A = 125°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

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

PARAMETER			TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{OH}	High-level output voltage		V_{DD} = 2.5 V to 6 V, I_{OH} = −500 µA		V_{DD}–0.2			V
			V_{DD} = 3.3 V, I_{OH} = −2 mA		V_{DD}–0.4			
			V_{DD} = 6 V, I_{OH} = −4 mA	T_A = −40°C to 25°C	V_{DD}–0.4			
				T_A = 125°C	V_{DD}–0.5			
V_{OL}	Low-level output voltage		V_{DD} = 2 V to 6 V, I_{OL} = 500 µA				0.2	V
			V_{DD} = 3.3 V, I_{OL} = 2 mA				0.4	
			V_{DD} = 6 V, I_{OL} = 4 mA				0.4	
	Power-up reset voltage (see Note 2)		V_{DD} ≥ 1.1 V, I_{OL} = 50 µA				0.2	V
V_{IT-}	Negative-going input threshold voltage (see Note 3)	TPS3809J25	T_A = −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_A = −40°C to 85°C		4.45	4.55	4.65	
			T_A = −40°C to 125°C		4.4	4.55	4.65	
V_{hys}	Hysteresis	TPS3809J25				30		mV
		TPS3809L30				35		
		TPS3809K33				40		
		TPS3809I50				60		
I_{DD}	Supply current		V_{DD} = 2 V, Output unconnected			9	15	µA
			V_{DD} = 6 V, Output unconnected			20	30	
C_i	Input capacitance		V_I = 0 V to V_{DD}			5		pF

NOTES: 2. The lowest supply voltage at which $\overline{\text{RESET}}$ becomes active. $t_{r,\ VDD}$ ≥ 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_L = 1 MΩ, C_L = 50 pF, T_A = 25°C

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_w	Pulse width	at V_{DD}	V_{DD} = V_{IT-} + 0.2 V, V_{DD} = V_{IT-} − 0.2 V	3			µs

switching characteristics at R_L = 1 MΩ, C_L = 50 pF, T_A = 25°C

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_d	Delay time		V_{DD} ≥ V_{IT-} + 0.2 V, See timing diagram	120	200	280	ms
t_{PHL}	Propagation (delay) time, high-to-low-level output	V_{DD} to $\overline{\text{RESET}}$ delay	V_{IL} = V_{IT-} −0.2 V, V_{IH} = V_{IT-} +0.2 V		1		µs

TYPICAL CHARACTERISTICS

LOW-LEVEL OUTPUT VOLTAGE vs LOW-LEVEL OUTPUT CURRENT

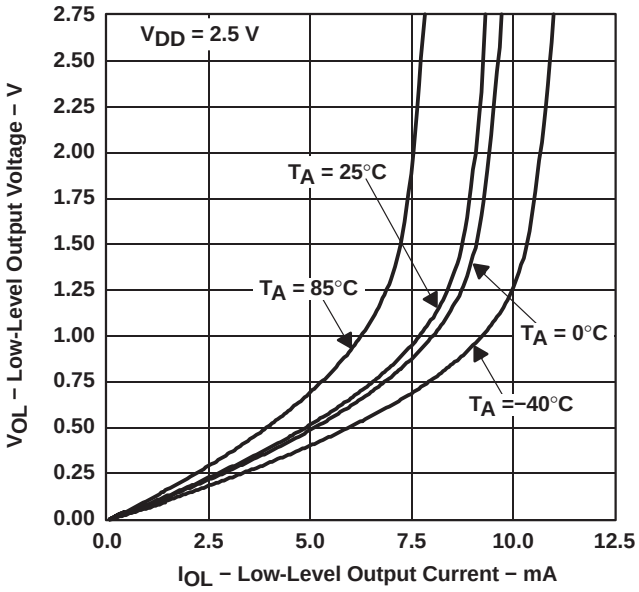


Figure 1

SUPPLY CURRENT vs SUPPLY VOLTAGE

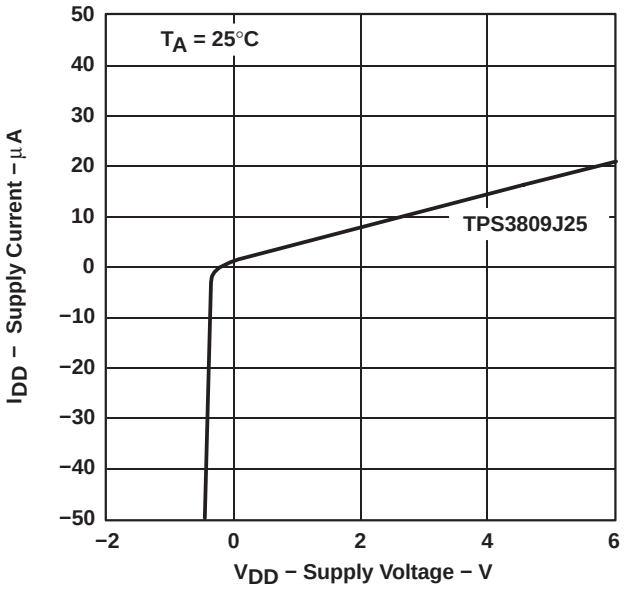


Figure 2

HIGH-LEVEL OUTPUT VOLTAGE vs HIGH-LEVEL OUTPUT CURRENT

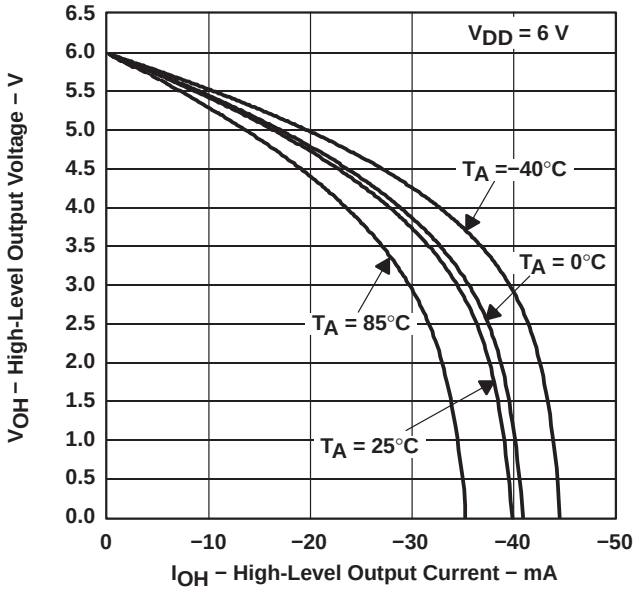


Figure 3

HIGH-LEVEL OUTPUT VOLTAGE vs HIGH-LEVEL OUTPUT CURRENT

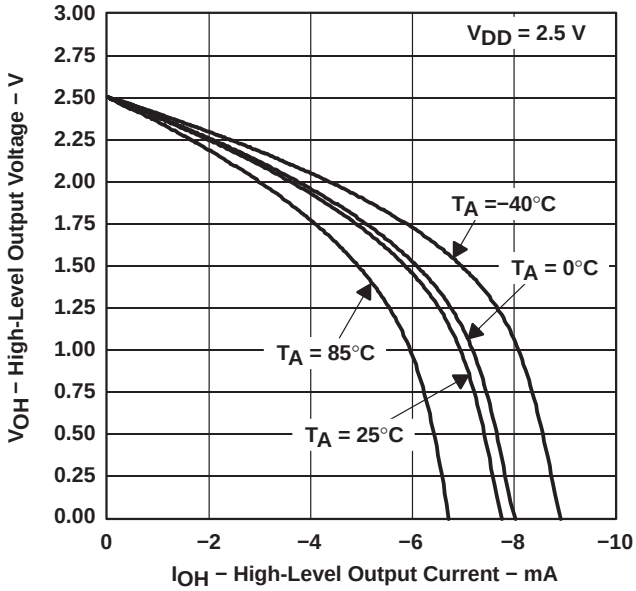


Figure 4

TYPICAL CHARACTERISTICS

NORMALIZED INPUT THRESHOLD VOLTAGE vs FREE-AIR TEMPERATURE AT V_{DD}

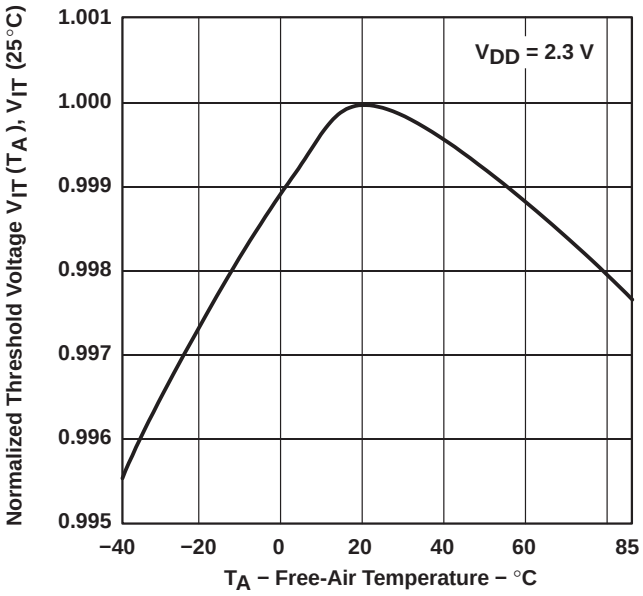


Figure 5

MINIMUM PULSE DURATION AT V_{DD} vs V_{DD} THRESHOLD OVERDRIVE VOLTAGE

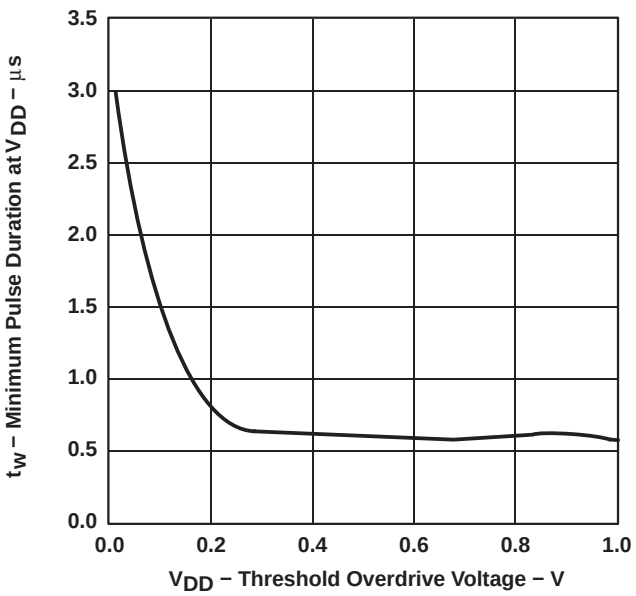


Figure 6

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
2T09I50QDBVRG4Q	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
2T09J25QDBVRG4Q	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
2U3809K33QDBVRG4Q1	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
2U3809L30QDBVRG4Q1	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3809I50QDBVRQ1	ACTIVE	SOT-23	DBV	3	3000	TBD	CU NIPDAU	Level-1-220C-UNLIM
TPS3809J25QDBVRQ1	ACTIVE	SOT-23	DBV	3	3000	TBD	CU NIPDAU	Level-1-220C-UNLIM
TPS3809K33QDBVRQ1	ACTIVE	SOT-23	DBV	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3809L30QDBVRQ1	ACTIVE	SOT-23	DBV	3	3000	TBD	CU NIPDAU	Level-1-220C-UNLIM

(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.

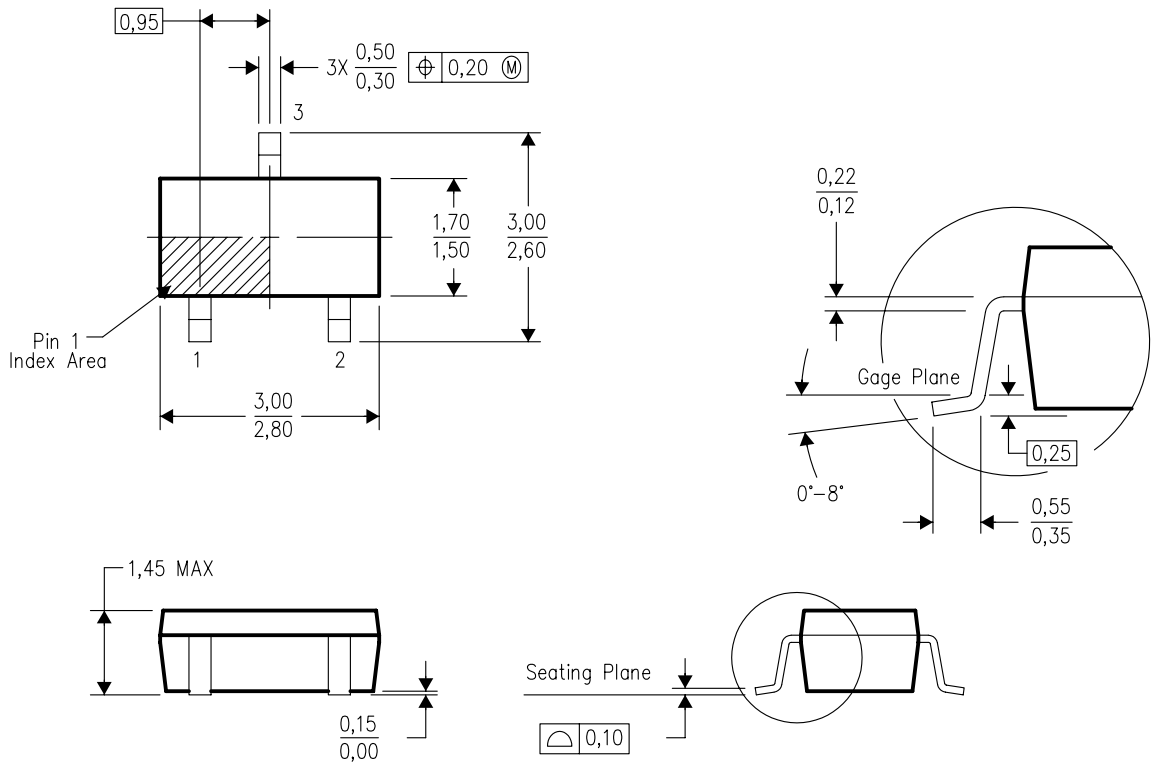
(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been 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.

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

DBV (R–PDSO–G3) PLASTIC SMALL–OUTLINE PACKAGE



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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.

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