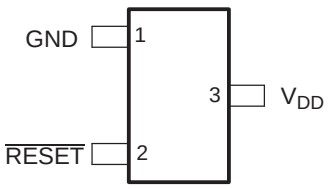
## FEATURES

- **Controlled Baseline**
  - **One Assembly Site**
  - **One Test Site**
  - **One Fabrication Site**
- **Extended Temperature Performance of –55°C to 125°C**
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product-Change Notification**
- **Qualification Pedigree** (1)
- **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**

(1) Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.

**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, $\overline{RESET}$ is asserted when the supply voltage $V_{DD}$ becomes higher than 1.1 V. Thereafter, the supervisory circuit monitors $V_{DD}$ and keeps $\overline{RESET}$ 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 $V_{IT}$. When the supply voltage drops below the $V_{IT}$, the output becomes active (low) again. No external components are required. All the devices of this family have a fixed-sense $V_{IT}$ 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 package. The TPS3809 devices are characterized for operation over a temperature range of –55°C to 125°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.

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

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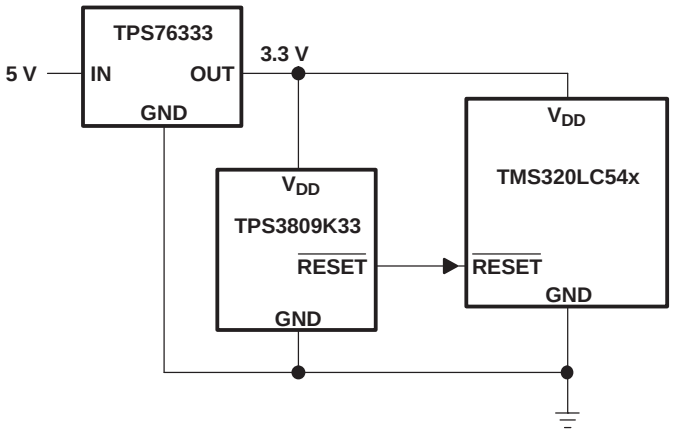
## TYPICAL APPLICATIONS




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

## AVAILABLE OPTIONS

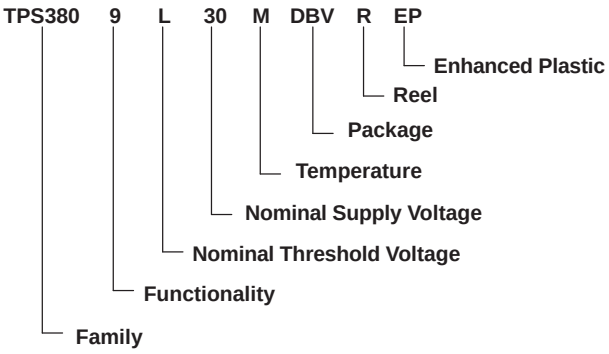
| $T_A$ | DEVICE NAME | THRESHOLD VOLTAGE | MARKING |
|---|---|---|---|
| –55°C to 125°C | TPS3809L30MDBVREP(1) | 2.64 V | PLYM |
| | TPS3809K33MDBVREP(1) | 2.93 V | PLZM |
| | TPS3809I50MDBVREP(1) | 4.55 V | PMAM |

(1) The DBVR passive indicates tape and reel of 3000 parts.

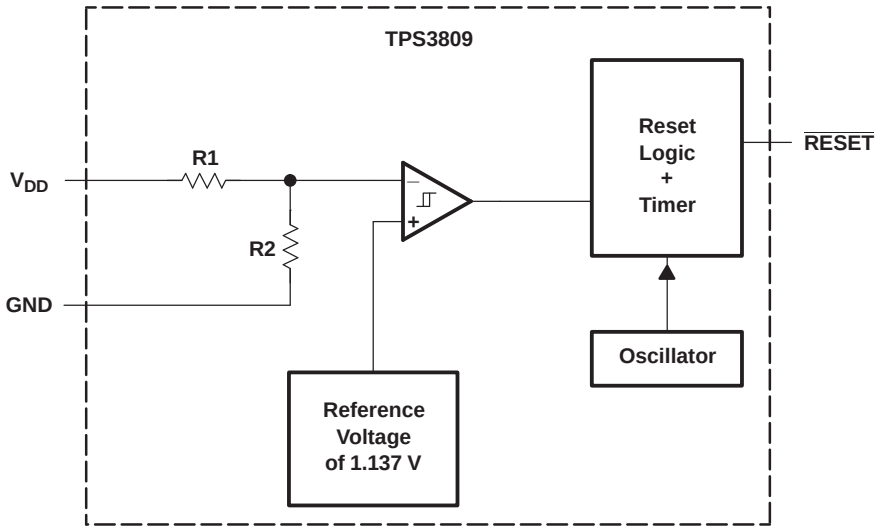
### FUNCTION/TRUTH TABLE

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

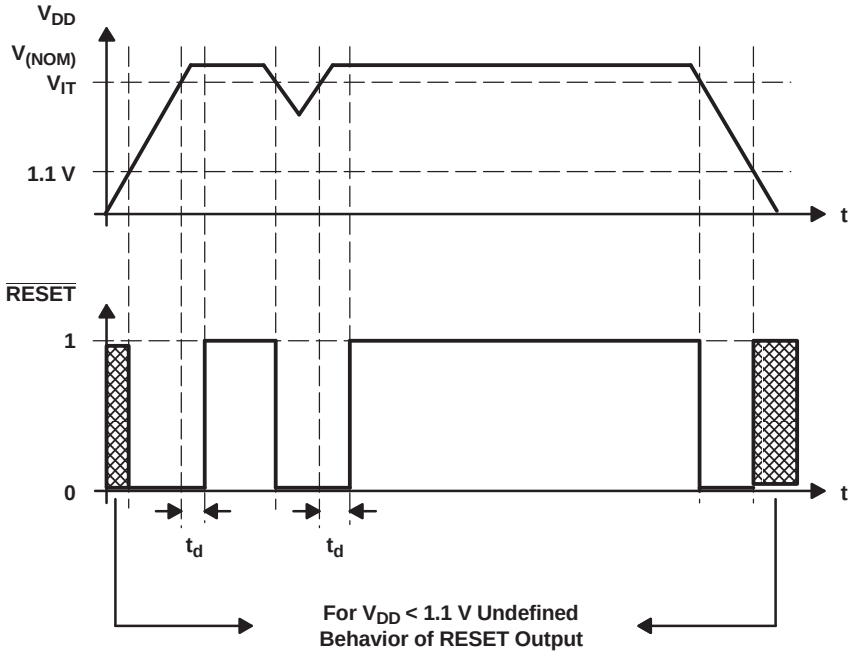
### ORDERING INFORMATION



## FUNCTIONAL BLOCK DIAGRAM




## TIMING DIAGRAM



## Absolute Maximum Ratings(1)

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

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| | Supply voltage(2) | $V_{DD}$ | | 7 | V |
| | | All other pins | –0.3 | 7 | |
| $I_{OL}$ | Maximum low output current | | | 5 | mA |
| $I_{OH}$ | Maximum high output current | | | –5 | mA |
| $I_{IK}$ | Input clamp current | $V_I < 0$ or $V_I > V_{DD}$ | | ±20 | mA |
| $I_{OK}$ | Output clamp current | $V_O < 0$ or $V_O > V_{DD}$ | | ±20 | mA |
| | Continuous total power dissipation | | | See Dissipation Rating Table | |
| $T_A$ | Operating free-air temperature range | | –55 | 125 | °C |
| $T_{stg}$ | Storage temperature range | | –65 | 150 | °C |
| | Soldering temperature | | | 260 | °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 | $T_A < 25°C$ POWER RATING | DERATING FACTOR ABOVE $T_A = 25°C$ | $T_A = 70°C$ POWER RATING | $T_A = 85°C$ POWER RATING |
|---|---|---|---|---|
| DBV | 437 mW | 3.5 mW/°C | 280 mW | 227 mW |

## Recommended Operating Conditions

| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| $V_{DD}$ | Supply voltage | 2 | 6 | V |
| $T_A$ | Operating free-air temperature | –55 | 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 | | $V_{DD}$ – 0.4 | | | |
| | | | $V_{DD}$ = 6 V, | $I_{OH}$ = –4 mA, | $T_A$ = 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(1) | | $V_{DD}$ ≥ 1.1 V, | $I_{OL}$ = 50 µA | | | | 0.2 | V |
| $V_{IT–}$ | Negative-going input threshold voltage(2) | TPS3809L30 | | | | 2.58 | 2.64 | 2.7 | V |
| | | TPS3809K33 | | | | 2.87 | 2.93 | 2.99 | |
| | | TPS3809I50 | | | | 4.45 | 4.55 | 4.65 | |
| $V_{hys}$ | Hysteresis | TPS3809L30 | | | | | 35 | | mV |
| | | TPS3809K33 | | | | | 40 | | |
| | | TPS3809I50 | | | | | 60 | | |
| $I_{DD}$ | Supply current | | $V_{DD}$ = 2 V, | Output unconnected | | | 9 | 12 | µA |
| | | | $V_{DD}$ = 6 V, | Output unconnected | | | 20 | 25 | |
| $C_i$ | Input capacitance | | $V_I$ = 0 V to $V_{DD}$ | | | | 5 | | pF |

(1) The lowest supply voltage at which $\overline{\text{RESET}}$ becomes active. $t_r$, $V_{DD}$ ≥ 15 µs/V.
(2) To ensure best stability of the threshold voltage, a bypass capacitor (0.1-µF ceramic) should be placed near the supply terminals.

## Timing Requirements

$R_L$ = 1 MΩ, $C_L$ = 50 pF, $T_A$ = 25°C

| PARAMETER | | TEST CONDITIONS | MIN | 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

$R_L$ = 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 | | ms |

## TYPICAL CHARACTERISTICS

LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

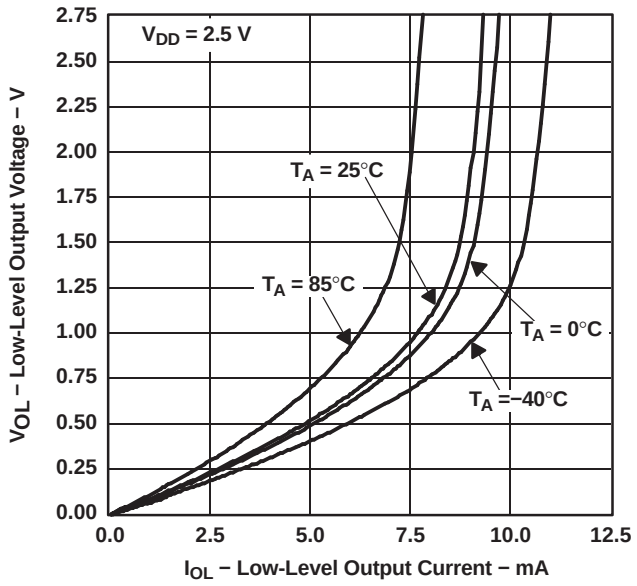



Figure 1.

HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

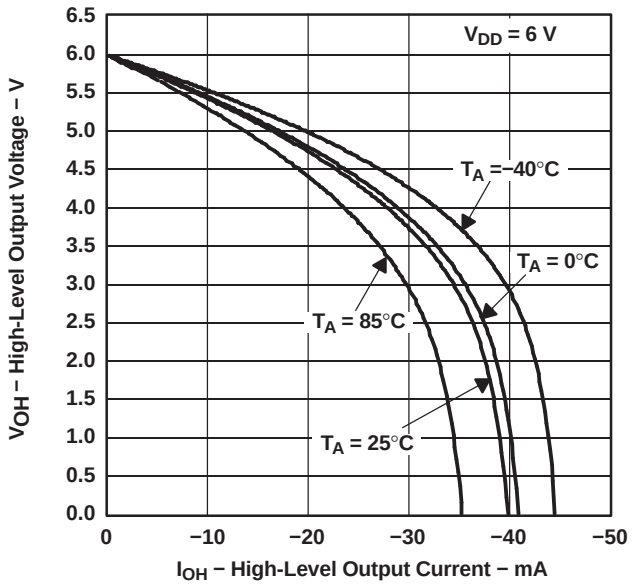



Figure 2.

HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

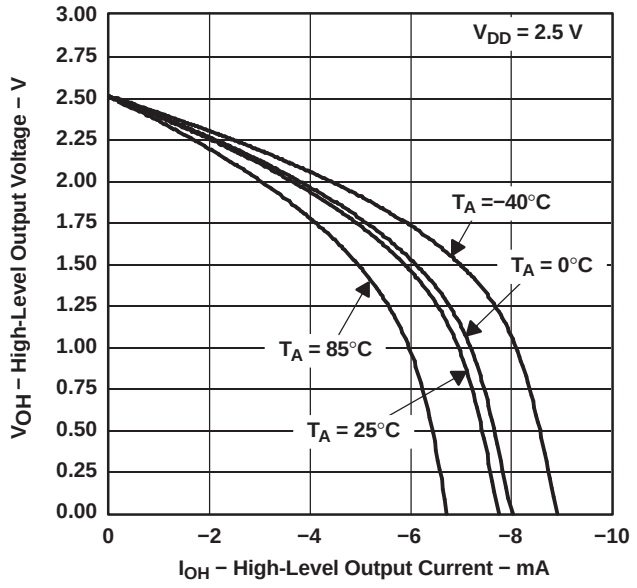



Figure 3.

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

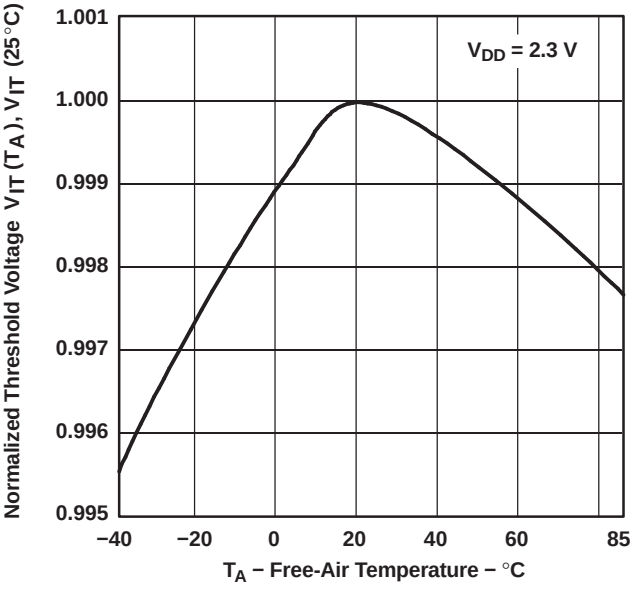



Figure 4.

## TYPICAL CHARACTERISTICS (continued)

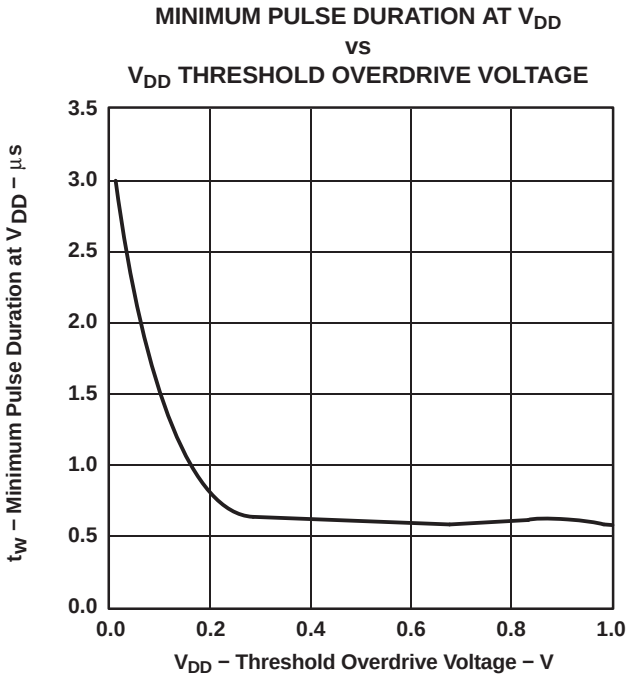



**Figure 5.**

## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TPS3809I50MDBVREP | ACTIVE | SOT-23 | DBV | 3 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | PMAM | Samples |
| TPS3809K33MDBVREP | ACTIVE | SOT-23 | DBV | 3 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | PLZM | Samples |
| TPS3809L30MDBVREP | ACTIVE | SOT-23 | DBV | 3 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | PLYM | Samples |
| V62/06636-01XE | ACTIVE | SOT-23 | DBV | 3 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | PLYM | Samples |
| V62/06636-02XE | ACTIVE | SOT-23 | DBV | 3 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | PLZM | Samples |
| V62/06636-03XE | ACTIVE | SOT-23 | DBV | 3 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -55 to 125 | PMAM | Samples |

(1) The marketing status values are defined as follows:
**ACTIVE:** Product device recommended for new designs.
**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.
**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**OTHER QUALIFIED VERSIONS OF TPS3809-EP :**

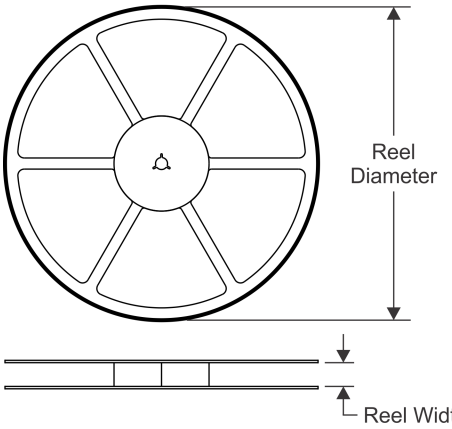
- Catalog: TPS3809
- Automotive: TPS3809-Q1

NOTE: Qualified Version Definitions:

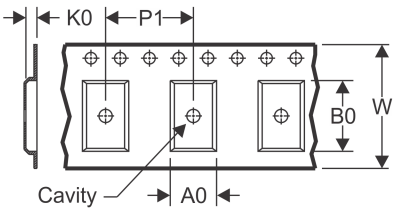
- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

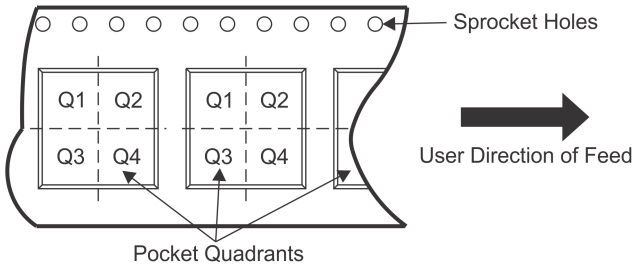



**TAPE DIMENSIONS**




| | |
|---|---|
| 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 |

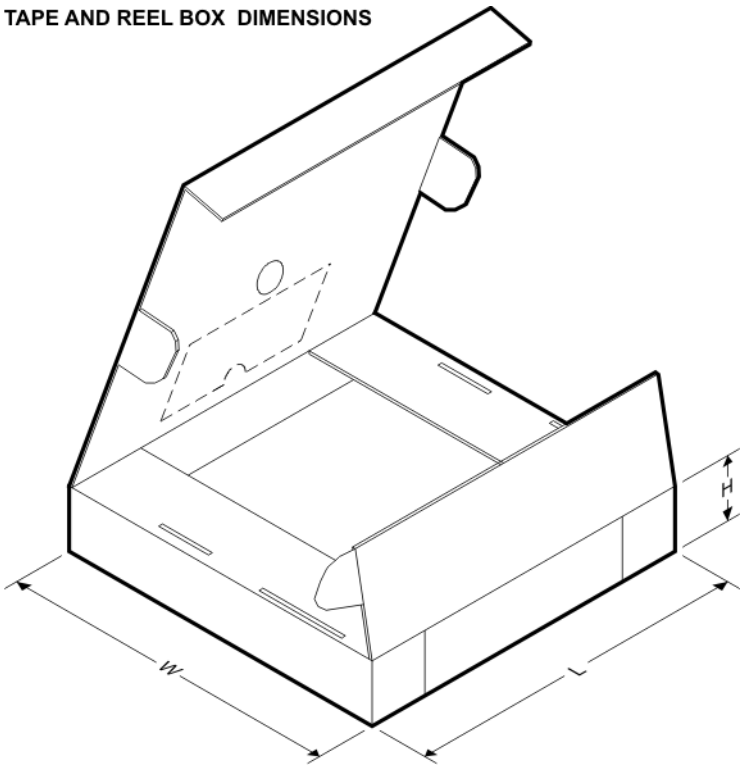
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**




*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TPS3809I50MDBVREP | SOT-23 | DBV | 3 | 3000 | 180.0 | 9.0 | 3.3 | 3.2 | 1.47 | 4.0 | 8.0 | Q3 |
| TPS3809K33MDBVREP | SOT-23 | DBV | 3 | 3000 | 180.0 | 9.0 | 3.3 | 3.2 | 1.47 | 4.0 | 8.0 | Q3 |
| TPS3809L30MDBVREP | 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

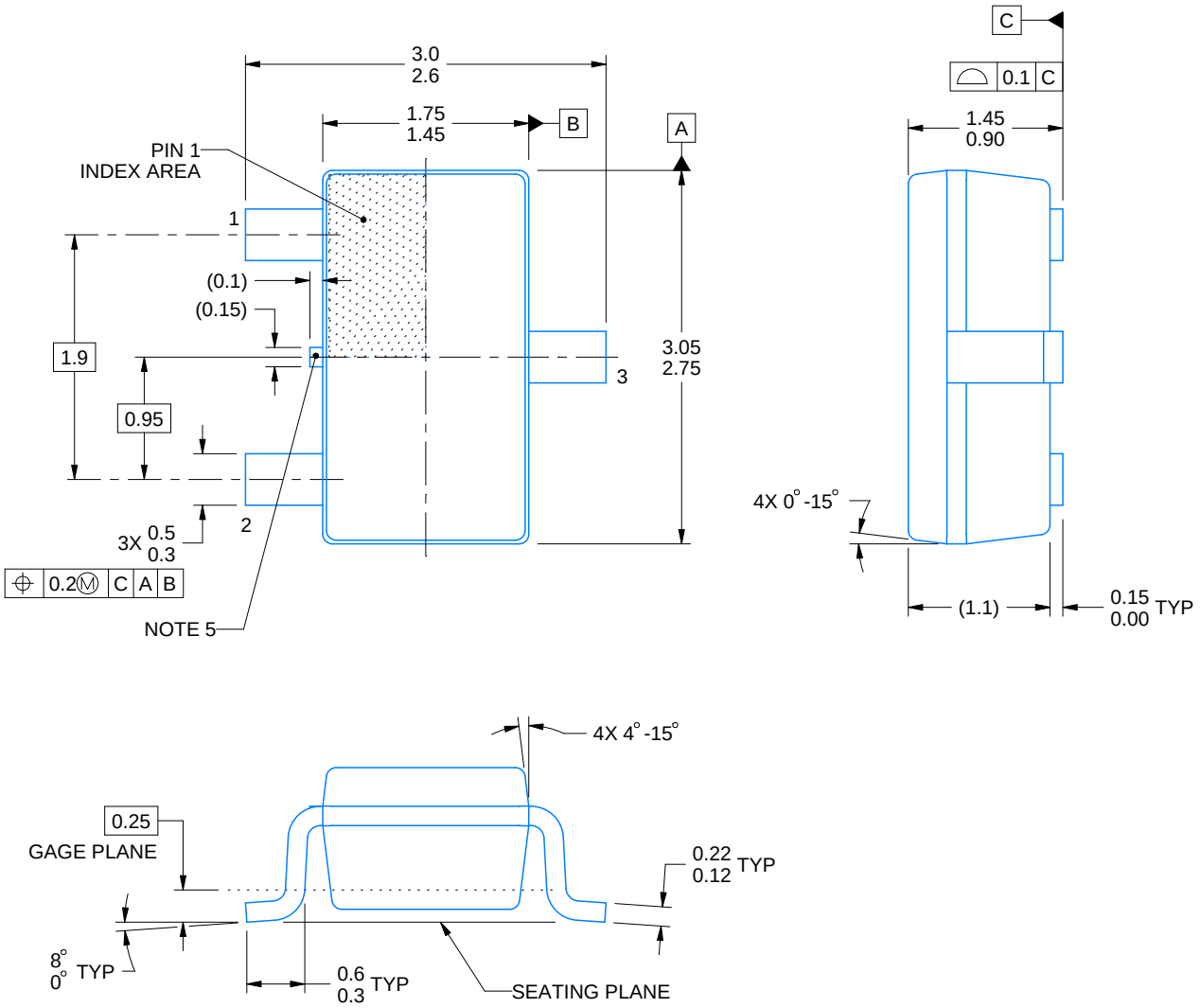
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| TPS3809I50MDBVREP | SOT-23 | DBV | 3 | 3000 | 182.0 | 182.0 | 20.0 |
| TPS3809K33MDBVREP | SOT-23 | DBV | 3 | 3000 | 182.0 | 182.0 | 20.0 |
| TPS3809L30MDBVREP | SOT-23 | DBV | 3 | 3000 | 182.0 | 182.0 | 20.0 |

# PACKAGE OUTLINE

## DBV0003A

## SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR

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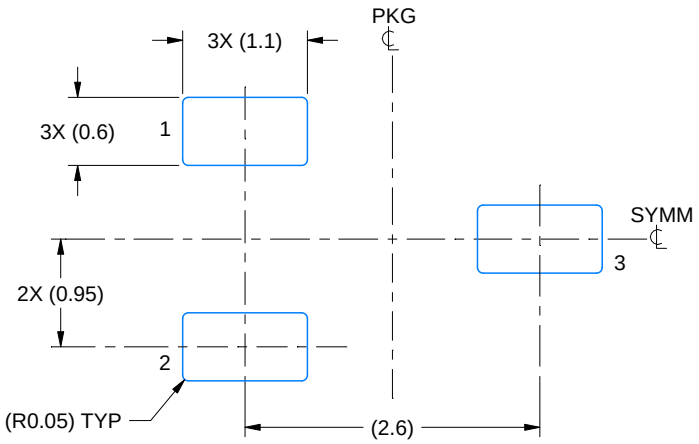
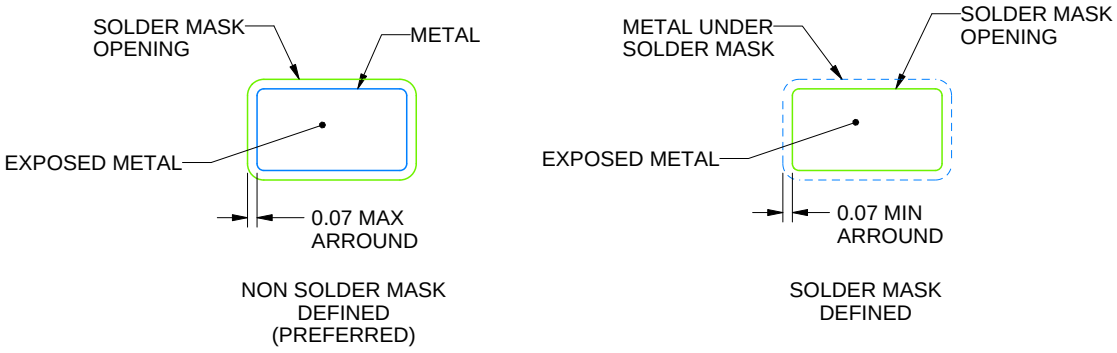
NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. 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

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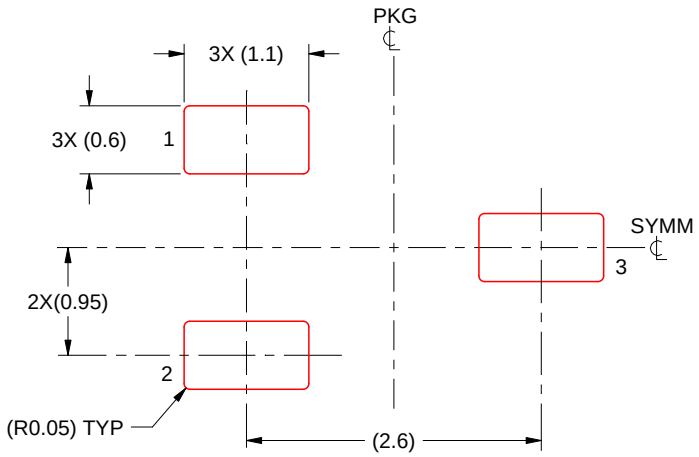
NOTES: (continued)

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

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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.

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