

## Ultra-Low Power, Supply Voltage Supervisor

Check for Samples: [TPS3839](#)

### FEATURES

- 1-mm × 1-mm  $\mu$ SON or 3-Pin SOT23 Package
- Ultra-Low Supply Current: 150 nA (typ)
- Operating Supply Voltage: 0.6 V to 6.5 V
- Ensured Valid RESET for  $V_{DD} > 0.6$  V
- Push-Pull RESET Output
- Temperature Range:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Factory-Trimmed RESET Threshold Voltages

### APPLICATIONS

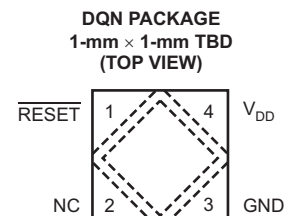
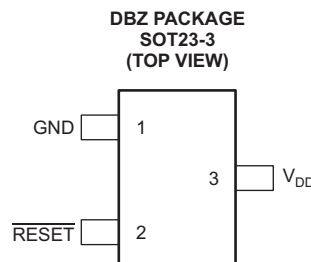
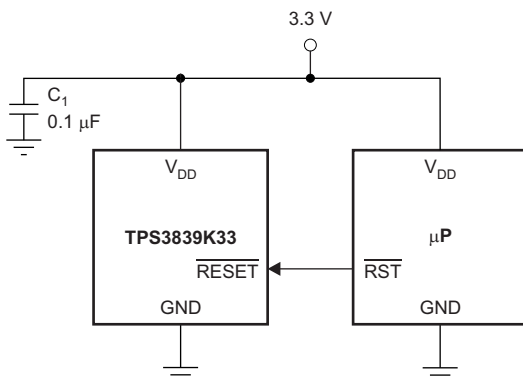
- Portable and Battery-Powered Equipment
- Industrial Equipment
- Cell Phones
- Glucose Monitors
- Metering
- Televisions

### DESCRIPTION

The TPS3839 is an ultra-low current, 150-nA (typ) voltage supervisory circuit that monitors a single voltage. The device asserts an active-low reset signal whenever the  $V_{DD}$  supply voltage drops below the factory-trimmed reset threshold voltage. The reset output remains asserted for 200 ms (typ) after the  $V_{DD}$  voltage rises above the threshold voltage. The TPS3839 is designed to ignore fast transients on the  $V_{DD}$  pin.

The ultra-low current consumption of 150 nA makes the TPS3839 ideal for use in low-power and portable applications. The TPS3839 is ensured to have the correct output logic state for supply voltages down to 0.6 V.

The device features precision factory-trimmed threshold voltages and extremely low power operation. The TPS3839 is available in a 3-pin SOT23 (DBZ) package or a 4-pin 1-mm × 1-mm (DQN)  $\mu$ SON package.



PRODUCT PREVIEW



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PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.

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This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### ORDERING INFORMATION<sup>(1)</sup>

| PRODUCT       | THRESHOLD VOLTAGE (V) | PACKAGE TYPE | TOP MARKINGS |
|---------------|-----------------------|--------------|--------------|
| TPS3839A09DQN | 0.900                 | X2SON        | TBD          |
| TPS3839G12DQN | 1.120                 | X2SON        | TBD          |
| TPS3839G12DBZ | 1.120                 | SOT23        | TBD          |
| TPS3839E16DQN | 1.520                 | X2SON        | TBD          |
| TPS3839G18DQN | 1.670                 | X2SON        | TBD          |
| TPS3839G18DBZ | 1.670                 | SOT23        | TBD          |
| TPS3839L30DBZ | 2.630                 | SOT23        | TBD          |
| TPS3839K33DQN | 2.930                 | X2SON        | TBD          |
| TPS3839K33DBZ | 2.930                 | SOT23        | TBD          |
| TPS3839G33DQN | 3.080                 | X2SON        | TBD          |
| TPS3839K50DQN | 4.380                 | X2SON        | TBD          |
| TPS3839K50DBZ | 4.380                 | SOT23        | TBD          |

- (1) For the most current package and ordering information see the Package Option Addendum at the end of this document, or visit the device product folder at [www.ti.com](http://www.ti.com).

### ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Over operating free-air temperature range, unless otherwise noted.

|                                       |                                   | VALUE                         |      | UNIT |
|---------------------------------------|-----------------------------------|-------------------------------|------|------|
|                                       |                                   | MIN                           | MAX  |      |
| Voltage                               | VDD                               | −0.3                          | 7    | V    |
|                                       | On RESET                          | −0.3                          | 7    | V    |
| Current                               | RESET pin                         |                               | 5    | mA   |
| Continuous total power dissipation    |                                   | See Thermal Information Table |      |      |
| Temperature <sup>(2)</sup>            | Operating ambient, T <sub>A</sub> | −40                           | +85  | °C   |
|                                       | Storage, T <sub>stg</sub>         | −65                           | +150 | °C   |
| Electrostatic discharge (ESD) rating: | Human body model (HBM)            |                               | 2    | kV   |
|                                       | Charge device model (CDM)         |                               | 500  | V    |

- (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) As a result of the low dissipated power in this device, it is assumed that T<sub>J</sub> is equal to T<sub>A</sub>.

### THERMAL INFORMATION

| THERMAL METRIC <sup>(1)</sup> |                                              | TPS3839    | UNITS |
|-------------------------------|----------------------------------------------|------------|-------|
|                               |                                              | DRY (μSON) |       |
|                               |                                              | 6 PINS     |       |
| θ <sub>JA</sub>               | Junction-to-ambient thermal resistance       | 293.8      | °C/W  |
| θ <sub>JCTop</sub>            | Junction-to-case (top) thermal resistance    | 165.1      |       |
| θ <sub>JB</sub>               | Junction-to-board thermal resistance         | 160.8      |       |
| ψ <sub>JT</sub>               | Junction-to-top characterization parameter   | 27.3       |       |
| ψ <sub>JB</sub>               | Junction-to-board characterization parameter | 65.8       |       |
| θ <sub>JCbot</sub>            | Junction-to-case (bottom) thermal resistance | 65.8       |       |

- (1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](http://www.ti.com).

## ELECTRICAL CHARACTERISTICS

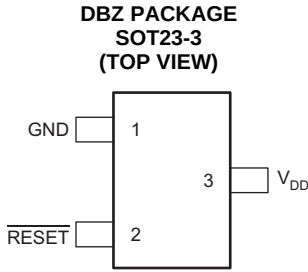
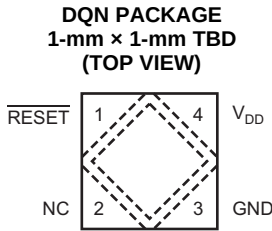
At  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $0.9\text{ V} < V_{DD} < 6.5\text{ V}$ , and  $C_1 = 0.1\text{ }\mu\text{F}$ , unless otherwise noted.

| PARAMETER   |                                                     | TEST CONDITIONS                                                             | MIN            | TYP       | MAX   | UNIT |
|-------------|-----------------------------------------------------|-----------------------------------------------------------------------------|----------------|-----------|-------|------|
| $V_{DD}$    | Input supply range                                  |                                                                             | 0.9            |           | 6.5   | V    |
| $V_{(VO)}$  | Minimum $V_{DD}$ voltage for valid output           | $I_{OL} = 1\text{ }\mu\text{A}$                                             |                |           | 0.6   | V    |
| $I_{DD}$    | Supply current (into VDD pin)                       | Output not connected                                                        |                | 150       | 600   | mA   |
| $V_{OL}$    | Low-level output voltage $\overline{\text{RESET}}$  | $V_{DD} = 0.9\text{ V to }1.2\text{ V}$ , $I_{OL} = 120\text{ }\mu\text{A}$ |                |           | 0.4   | V    |
|             |                                                     | $V_{DD} = 1.2\text{ V to }2.8\text{ V}$ , $I_{OL} = 0.5\text{ mA}$          |                |           | 0.4   | V    |
|             |                                                     | $V_{DD} = 2.8\text{ V to }6.5\text{ V}$ , $I_{OL} = 2\text{ mA}$            |                |           | 0.4   | V    |
| $V_{OH}$    | High-level output voltage $\overline{\text{RESET}}$ | $V_{DD} = 0.9\text{ V to }1.8\text{ V}$ , $I_{OH} = -50\text{ }\mu\text{A}$ | $V_{DD} - 0.4$ |           |       | V    |
|             |                                                     | $V_{DD} = 1.8\text{ V to }3.3\text{ V}$ , $I_{OH} = -0.5\text{ mA}$         | $V_{DD} - 0.4$ |           |       | V    |
|             |                                                     | $V_{DD} = 3.3\text{ V to }6.5\text{ V}$ , $I_{OH} = -2\text{ mA}$           | $V_{DD} - 0.4$ |           |       | V    |
| $V_{(THA)}$ | Negative-going input threshold accuracy             |                                                                             | -2.0           | $\pm 1.0$ | +2.0  | %    |
| $V_{IT-}$   | Negative-going threshold voltage                    | TPS3839A09                                                                  | 0.882          | 0.900     | 0.918 | V    |
|             |                                                     | TPS3839G12                                                                  | 1.098          | 1.120     | 1.142 | V    |
|             |                                                     | TPS3839E16                                                                  | 1.490          | 1.520     | 1.550 | V    |
|             |                                                     | TPS3839G18                                                                  | 1.637          | 1.670     | 1.703 | V    |
|             |                                                     | TPS3839L30                                                                  | 2.577          | 2.630     | 2.683 | V    |
|             |                                                     | TPS3839K33                                                                  | 2.871          | 2.930     | 2.989 | V    |
|             |                                                     | TPS3839G33                                                                  | 3.018          | 3.080     | 3.142 | V    |
|             |                                                     | TPS3839K50                                                                  | 4.292          | 4.380     | 4.468 | V    |
| $V_{hys}$   | Hysteresis voltage                                  | $V_{(SENSE)}$ falling                                                       |                | 10        |       | mV   |

## TIMING REQUIREMENTS

| PARAMETER |                                                        | MIN | TYP | MAX | UNIT          |
|-----------|--------------------------------------------------------|-----|-----|-----|---------------|
| $t_W$     | Minimum $V_{DD}$ pulse width to RESET                  |     | 1   |     | $\mu\text{s}$ |
| $t_D$     | RESET delay time (power-up delay)                      | 120 | 200 | 320 | ms            |
| $t_{PHL}$ | Propagation delay, $V_{DD}$ falling (power-down delay) |     | 20  |     | $\mu\text{s}$ |

PIN CONFIGURATIONS



PIN ASSIGNMENTS

| PIN NAME                  | PIN NO |     | DESCRIPTION                                                                                                                                                                                                                                                                                |
|---------------------------|--------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                           | DQN    | DBZ |                                                                                                                                                                                                                                                                                            |
| GND                       | 3      | 1   | Ground                                                                                                                                                                                                                                                                                     |
| NC                        | 2      | —   | Do not connect                                                                                                                                                                                                                                                                             |
| $\overline{\text{RESET}}$ | 1      | 2   | Active low RESET output. RESET has a push-pull output drive and is capable of directly driving input pins. This in remains low as long as $V_{DD}$ is below the factory threshold voltage and remains low until a certain time ( $t_D$ ) after $V_{DD}$ rises above the threshold voltage. |
| VDD                       | 4      | 3   | Supply voltage                                                                                                                                                                                                                                                                             |

FUNCTIONAL BLOCK DIAGRAM

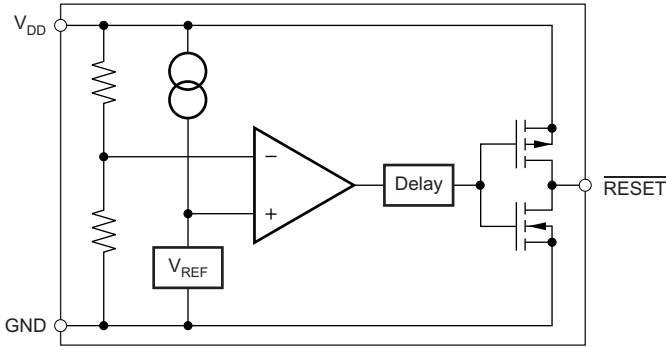


Figure 1. TPS3895A Block Diagram

## APPLICATION INFORMATION

### APPLICATION CIRCUIT

Figure 2 shows an example typical application circuit.

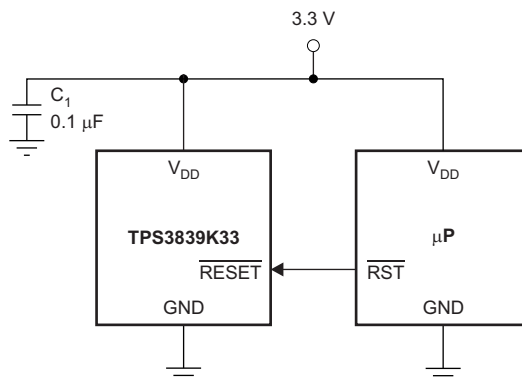


Figure 2. Typical Application Circuit

### VDD TRANSIENT REJECTION

The TPS3839 has built-in rejection of fast transients on the  $V_{DD}$  pin. Transient rejection is dependent on both transient duration and transient amplitude. Transient amplitude is measured from the bottom of the transient to the negative threshold voltage of the TPS3839, as shown in Figure 3.

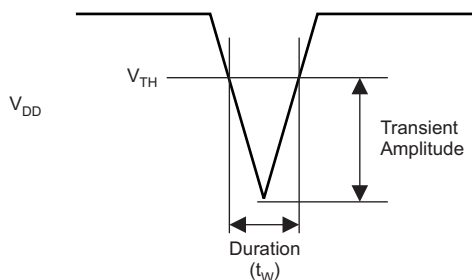


Figure 3. Voltage Transient Measurement

The TPS3839 does not respond to fast-duration, low-amplitude or long-duration, small-amplitude transients. Figure 4 shows the relationship between the transient amplitude and duration required to trigger a reset. Any combination of duration and amplitude above the curve generates a reset signal.



Figure 4. TPS3839 Transient Rejection

## INPUT CAPACITOR

The TPS3839 uses a unique sampling scheme to maintain an extremely low average quiescent current of 150 nA. The TPS3839 typically only consumes approximately 100 nA of dc current. However, this current rises to approximately 15  $\mu$ A for about 200  $\mu$ s while the TPS3839 samples the input voltage. If the source impedance is high then the additional current during sampling may trigger a false reset because of the apparent voltage drop at  $V_{DD}$ . For high  $V_{DD}$  source or trace impedance applications, it is recommended to add a small 0.1- $\mu$ F bypass capacitor near the TPS3839  $V_{DD}$  pin. The bypass capacitor effectively keeps the average current at 150 nA and reduces the effects of a high-impedance voltage source.

## BIDIRECTIONAL RESET PINS

Some microcontrollers have bidirectional RESET pins that act both as an input and an output. A series resistor should be placed between the TPS3839 output and the microcontroller RESET pin to protect against excessive current flow when both the TPS3839 and the microcontroller attempt to drive the RESET line. Figure 5 shows the connection of the TPS3839 with a microcontroller using a series resistor to drive a bidirectional RESET line.

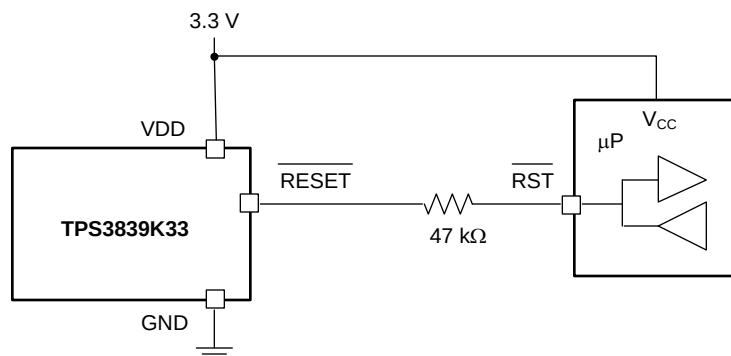


Figure 5. Connection to Bidirectional RESET Pin

## SINGLE ALKALINE CELL MONITORING

The low operating voltage and threshold options make the TPS3839 well-suited for monitoring single-cell alkaline battery applications. Figure 6 shows the TPS3839A09 used to disable a boost converter when the cell voltage reaches 0.9 V, which is the end of the discharge voltage for a single alkaline battery cell. When the cell voltage reaches 0.9 V, the TPS61261 enable pin is driven low. This setting disables the TPS61261 and places it in a low-current shutdown state. The combination of the TPS3839 and TPS61261 only consumes 250 nA (typical) from the discharged battery.

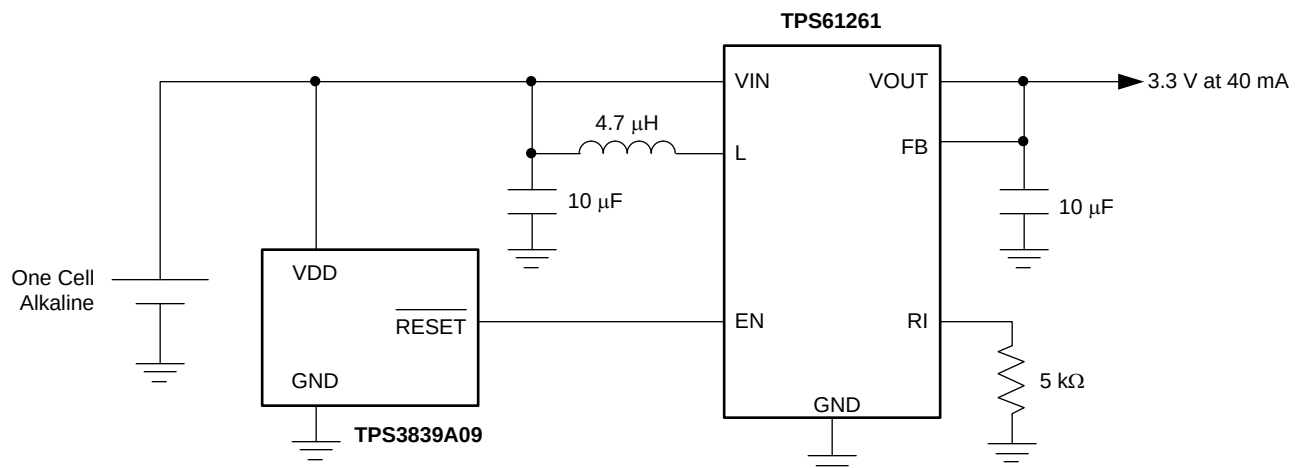


Figure 6. Disabled Boost Converter

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|----------------------|------------------------------|-----------------------------|
| TPS3839A09DBZR   | PREVIEW               | SOT-23       | DBZ             | 3    |             | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839A09DBZT   | PREVIEW               | SOT-23       | DBZ             | 3    |             | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839A09DQNR   | PREVIEW               | X2SON        | DQN             | 4    | 3000        | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839A09DQNT   | PREVIEW               | X2SON        | DQN             | 4    | 250         | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839E16DBZR   | PREVIEW               | SOT-23       | DBZ             | 3    |             | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839E16DBZT   | PREVIEW               | SOT-23       | DBZ             | 3    |             | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839E16DQNR   | PREVIEW               | X2SON        | DQN             | 4    | 3000        | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839E16DQNT   | PREVIEW               | X2SON        | DQN             | 4    | 250         | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839G12DBZR   | PREVIEW               | SOT-23       | DBZ             | 3    | 3000        | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839G12DBZT   | PREVIEW               | SOT-23       | DBZ             | 3    | 250         | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839G12DQNR   | PREVIEW               | X2SON        | DQN             | 4    | 3000        | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839G12DQNT   | PREVIEW               | X2SON        | DQN             | 4    | 250         | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839G18DBZR   | PREVIEW               | SOT-23       | DBZ             | 3    | 3000        | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839G18DBZT   | PREVIEW               | SOT-23       | DBZ             | 3    | 250         | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839G18DQNR   | PREVIEW               | X2SON        | DQN             | 4    | 3000        | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839G18DQNT   | PREVIEW               | X2SON        | DQN             | 4    | 250         | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839G33DBZR   | PREVIEW               | SOT-23       | DBZ             | 3    |             | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839G33DBZT   | PREVIEW               | SOT-23       | DBZ             | 3    |             | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839G33DQNR   | PREVIEW               | X2SON        | DQN             | 4    | 3000        | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839G33DQNT   | PREVIEW               | X2SON        | DQN             | 4    | 250         | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839K33DBZR   | PREVIEW               | SOT-23       | DBZ             | 3    | 3000        | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839K33DBZT   | PREVIEW               | SOT-23       | DBZ             | 3    | 250         | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839K33DQNR   | PREVIEW               | X2SON        | DQN             | 4    | 3000        | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839K33DQNT   | PREVIEW               | X2SON        | DQN             | 4    | 250         | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839K50DBZR   | PREVIEW               | SOT-23       | DBZ             | 3    | 3000        | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839K50DBZT   | PREVIEW               | SOT-23       | DBZ             | 3    | 250         | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839K50DQNR   | PREVIEW               | X2SON        | DQN             | 4    | 3000        | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839K50DQNT   | PREVIEW               | X2SON        | DQN             | 4    | 250         | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839L30DBZR   | PREVIEW               | SOT-23       | DBZ             | 3    | 3000        | TBD                     | Call TI              | Call TI                      |                             |
| TPS3839L30DBZT   | PREVIEW               | SOT-23       | DBZ             | 3    | 250         | TBD                     | Call TI              | Call TI                      |                             |

| 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) |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|-------------------|------------------------------|--------------------------|
| TPS3839L30DQNR   | PREVIEW               | X2SON        | DQN             | 4    |             | TBD                     | Call TI           | Call TI                      |                          |
| TPS3839L30DQNT   | PREVIEW               | X2SON        | DQN             | 4    |             | TBD                     | Call TI           | Call TI                      |                          |

<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.

**OBSELETE:** 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.

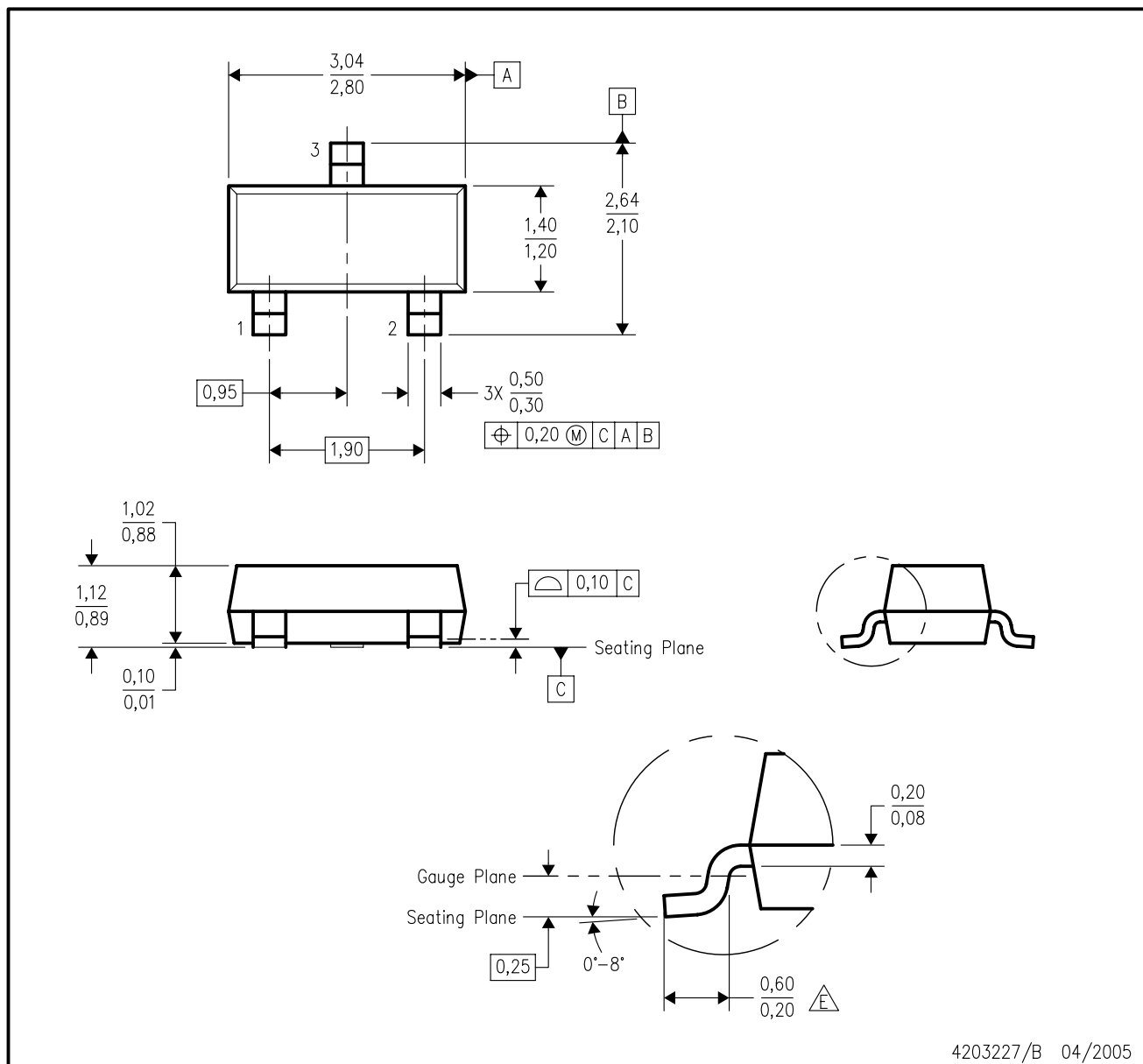
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DBZ (R-PDSO-G3)

PLASTIC SMALL-OUTLINE



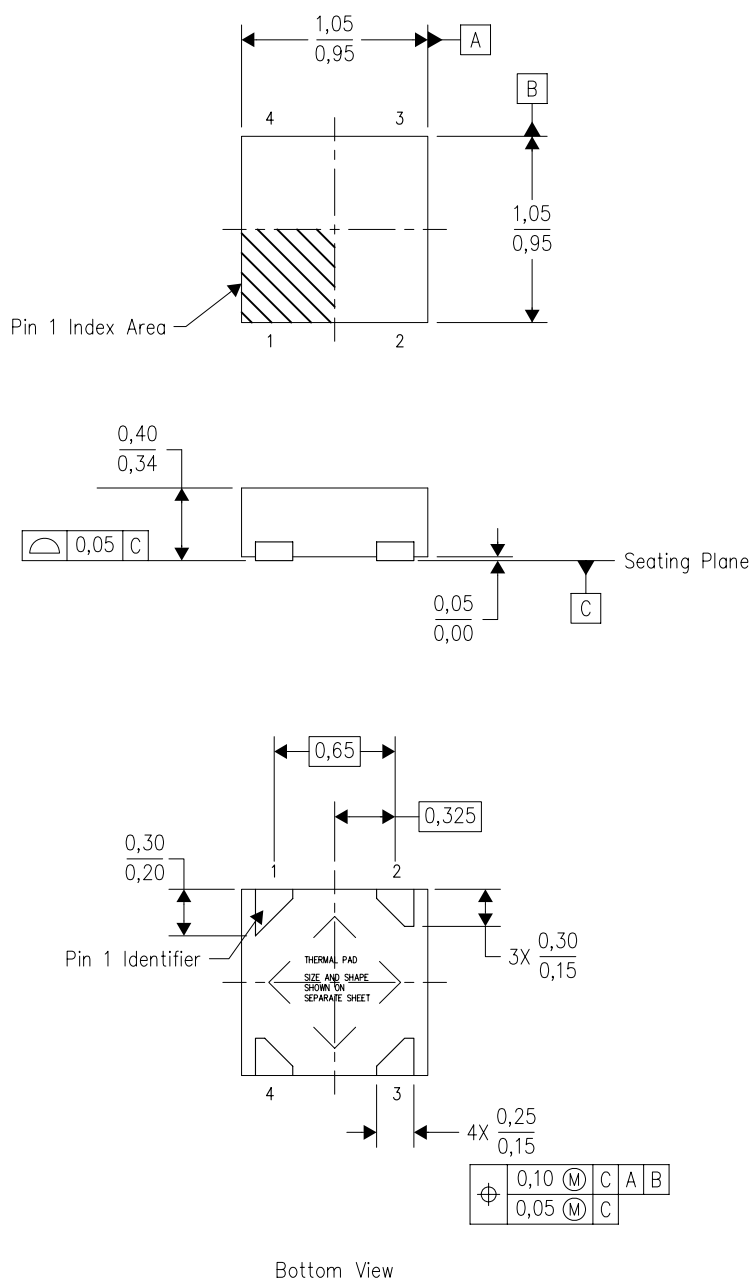
4203227/B 04/2005

NOTES:

- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
- B. This drawing is subject to change without notice.
- C. Lead dimensions are inclusive of plating.
- D. Body dimensions are exclusive of mold flash and protrusion. Mold flash and protrusion not to exceed 0.25 per side.
- E. Falls within JEDEC TO-236 variation AB, except minimum foot length.

DQN (S-PX2SON-N4)

PLASTIC SMALL OUTLINE NO-LEAD



4210367/C 05/2011

- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - This drawing is subject to change without notice.
  - SON (Small Outline No-Lead) package configuration.
  - The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.

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| RFID                   | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>                                 |
| OMAP Mobile Processors | <a href="http://www.ti.com/omap">www.ti.com/omap</a>                                 |
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|                               |                                                                                          |
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