

# TPS3306-15-Q1, TPS3306-18-Q1, TPS3306-20-Q1, TPS3306-25-Q1, TPS3306-33-Q1 DUAL PROCESSOR SUPERVISORY CIRCUITS WITH POWER FAIL

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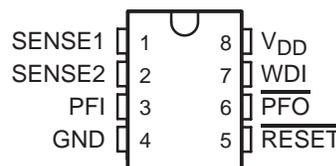
- Qualified for Automotive Applications
- Dual Supervisory Circuits With Power Fail for DSP and Processor-Based Systems
- Voltage Monitor for Power Fail or Low-Battery Warning
- Watchdog Timer With 0.8-s Time-Out
- Power-On Reset Generator With Integrated 100-ms Delay Time
- Open-Drain Reset and Power-Fail Output
- Supply Current of 15  $\mu$ A (Typ)
- Supply Voltage Range . . . 2.7 V to 6 V
- Defined  $\overline{\text{RESET}}$  Output From  $V_{\text{DD}} \geq 1.1$  V
- SO-8 Package
- Temperature Range . . .  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- Applications Include:
  - Multivoltage DSPs and Processors
  - Portable Battery-Powered Equipment
  - Embedded Control Systems
  - Intelligent Instruments
  - Automotive Systems

## description

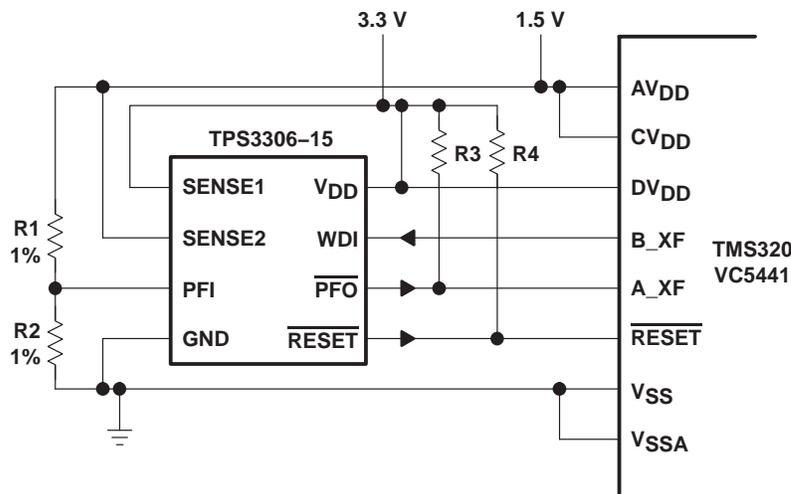
The TPS3306 family is a series of supervisory circuits designed for circuit initialization, which require two supply voltages, primarily in DSP and processor-based systems.

The product spectrum of the TPS3306-xx is designed for monitoring two independent supply voltages of 3.3 V/1.5 V, 3.3 V/1.8 V, 3.3 V/2 V, 3.3 V/2.5 V, or 3.3 V/5 V.

D PACKAGE  
(TOP VIEW)



TYPICAL OPERATING CIRCUIT



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**TEXAS  
INSTRUMENTS**

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## description (continued)

The various supervisory circuits are designed to monitor the nominal supply voltage, as shown in the following supply-voltage monitoring table.

SUPPLY-VOLTAGE MONITORING

| DEVICE     | NOMINAL SUPERVISED VOLTAGE |        | THRESHOLD VOLTAGE (TYP) |        |
|------------|----------------------------|--------|-------------------------|--------|
|            | SENSE1                     | SENSE2 | SENSE1                  | SENSE2 |
| TPS3306-15 | 3.3 V                      | 1.5 V  | 2.93 V                  | 1.4 V  |
| TPS3306-18 | 3.3 V                      | 1.8 V  | 2.93 V                  | 1.68 V |
| TPS3306-20 | 3.3 V                      | 2 V    | 2.93 V                  | 1.85 V |
| TPS3306-25 | 3.3 V                      | 2.5 V  | 2.93 V                  | 2.25 V |
| TPS3306-33 | 5 V                        | 3.3 V  | 4.55 V                  | 2.93 V |

During power on,  $\overline{\text{RESET}}$  is asserted when the supply voltage,  $V_{DD}$ , becomes higher than 1.1 V. Thereafter, the supervisory circuits monitor the SENSEn inputs and keep  $\overline{\text{RESET}}$  active as long as SENSEn remains below the threshold voltage,  $V_{IT}$ .

An internal timer delays the return of the  $\overline{\text{RESET}}$  output to the inactive state (high) to ensure proper system reset. The delay time,  $t_{d(\text{typ})} = 100 \text{ ms}$ , starts after SENSE1 and SENSE2 inputs have risen above  $V_{IT}$ . When the voltage at SENSE1 or SENSE2 input drops below the  $V_{IT}$ , the output becomes active (low) again.

The integrated power-fail (PFI) comparator with separate open-drain ( $\overline{\text{PFO}}$ ) output can be used for low-battery detection, power-fail warning, or for monitoring a power supply other than the main supply.

The TPS3306-xx devices integrate a watchdog timer that is periodically triggered by a positive or negative transition of the watch-dog timer (WDI). When the supervising system fails to retrigger the watchdog circuit within the time-out interval,  $t_{t(\text{out})} = 0.50 \text{ s}$ ,  $\overline{\text{RESET}}$  becomes active for the time period  $t_d$ . This event also reinitializes the watchdog timer. Leaving WDI unconnected disables the watchdog.

The TPS3306-xx devices are available in standard 8-pin SO packages.

The TPS3306-xxQ family is characterized for operation over a temperature range of  $-40^\circ\text{C}$  to  $125^\circ\text{C}$ .

AVAILABLE OPTIONS†

| T <sub>A</sub>                             | PACKAGED DEVICES‡ |                 | TOP-SIDE MARKING |
|--|-------------------|-----------------|------------------|
|  | SMALL OUTLINE (D) |                 |                  |
| $-40^\circ\text{C}$ to $125^\circ\text{C}$ | Tape and reel     | TPS3306-15QDRQ1 | 615Q1            |
|  | Tape and reel     | TPS3306-18QDRQ1 | 618Q1            |
|  | Tape and reel     | TPS3306-20QDRQ1 | 620Q1            |
|  | Tape and reel     | TPS3306-25QDRQ1 | 625Q1            |
|  | Tape and reel     | TPS3306-33QDRQ1 | 633Q1            |

† 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>.



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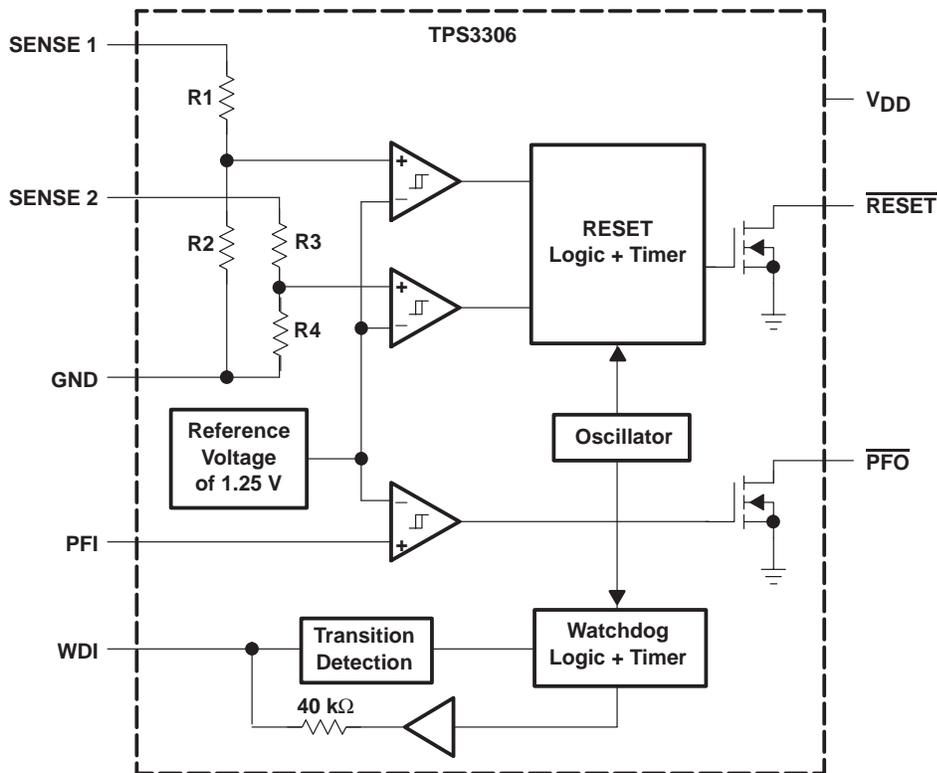
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FUNCTION/TRUTH TABLES

| SENSE1 > V <sub>IT1</sub> | SENSE2 > V <sub>IT2</sub> | $\overline{\text{RESET}}$ |
|---------------------------|---------------------------|---------------------------|
| 0                         | 0                         | L                         |
| 0                         | 1                         | L                         |
| 1                         | 0                         | L                         |
| 1                         | 1                         | H                         |

| PFI > V <sub>IT</sub> | $\overline{\text{PFO}}$ | TYPICAL DELAY |
|-----------------------|-------------------------|---------------|
| 0→1                   | L→H                     | 0.5 μs        |
| 1→0                   | H→L                     | 0.5 μs        |

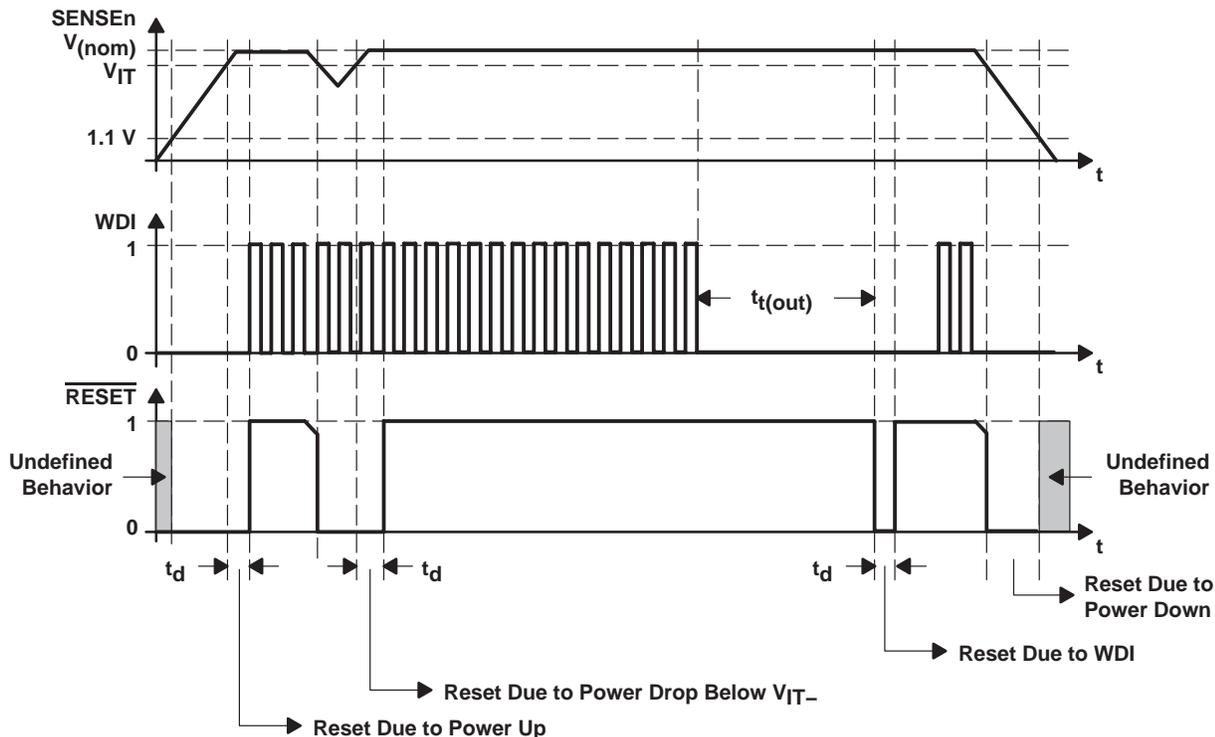
## functional block diagram



# TPS3306-15-Q1, TPS3306-18-Q1, TPS3306-20-Q1, TPS3306-25-Q1, TPS3306-33-Q1 DUAL PROCESSOR SUPERVISORY CIRCUITS WITH POWER FAIL

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## timing diagram



## Terminal Functions

| TERMINAL NAME | NO. | I/O | DESCRIPTION                              |
|---------------|-----|-----|--|
| GND           | 4   | I   | Ground                                   |
| PFI           | 3   | I   | Power-fail comparator input              |
| PFO           | 6   | O   | Power-fail comparator output, open drain |
| RESET         | 5   | O   | Active-low reset output, open drain      |
| SENSE1        | 1   | I   | Sense voltage 1                          |
| SENSE2        | 2   | I   | Sense voltage 2                          |
| WDI           | 7   | I   | Watchdog timer input                     |
| VDD           | 8   | I   | Supply voltage                           |

## detailed description

### watchdog

In a microprocessor- or DSP-based system, it is not only important to supervise the supply voltage, it is also important to ensure correct program execution. The task of a watchdog is to ensure that the program is not stalled in an indefinite loop. The microprocessor, microcontroller, or DSP has to typically toggle the watchdog input (WDI) within 0.8 s to avoid a time-out occurring. Either a low-to-high or a high-to-low transition resets the internal watchdog timer. If the input is unconnected or tied with a high-impedance driver, the watchdog is disabled and is retriggered internally.



**saving current while using the watchdog**

WDI is internally driven low during the first 7/8 of the watchdog time-out period, then momentarily pulses high, resetting the watchdog counter. For minimum watchdog input current (minimum overall power consumption), leave WDI low for the majority of the watchdog time-out period, pulsing it low-high-low once within 7/8 of the watchdog time-out period to reset the watchdog timer. If, instead, WDI is externally driven high for the majority of the time-out period, a current of  $5\text{ V}/40\text{ k}\Omega \approx 125\text{ }\mu\text{A}$  can flow into WDI.

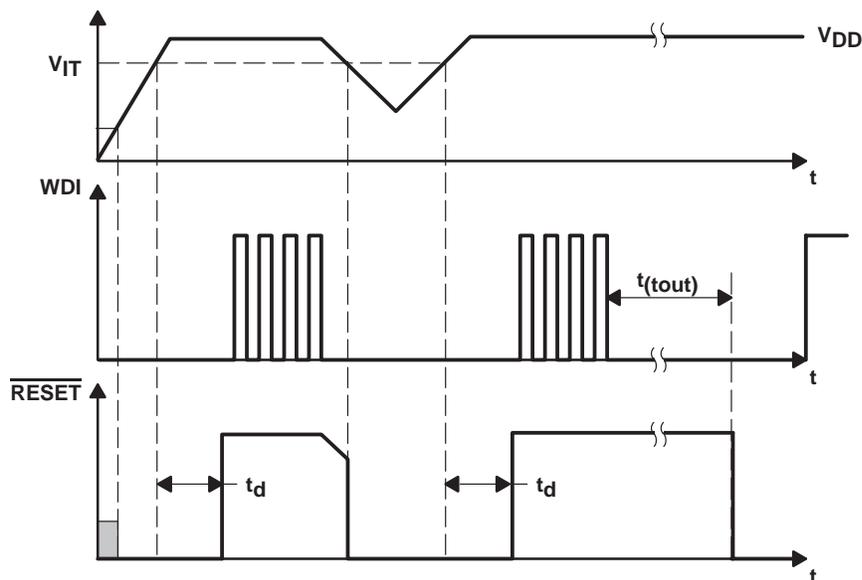
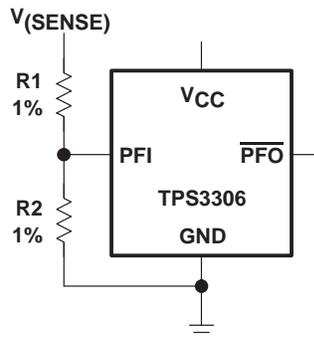


Figure 1. Watchdog Timing

**power-fail comparator (PFI and PFO)**

An additional comparator is provided to monitor voltages other than the nominal supply voltage. The power-fail-input (PFI) is compared with an internal voltage reference of 1.25 V. If the input voltage falls below the power-fail threshold ( $V_{PFI}$ ) of 1.25 V (typ), the power-fail output ( $\overline{PFO}$ ) goes low. If  $\overline{PFO}$  goes above 1.25 V plus about 10-mV hysteresis, the output returns to high. By connecting two external resistors, it is possible to supervise any voltages above 1.25 V. The sum of both resistors should be approximately 1 M $\Omega$ , to minimize power consumption and also to ensure that the current in the PFI pin can be neglected compared with the current through the resistor network. The tolerance of the external resistors should be not more than 1% to ensure minimal variation of sensed voltage. If the power-fail comparator is unused, connect PFI to ground and leave  $\overline{PFO}$  unconnected.

$$V_{PFI,trip} = 1.25\text{ V} \times \frac{R_1 + R_2}{R_2}$$



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

|  |                              |
|--|------------------------------|
| Supply voltage (see Note1): $V_{DD}$ .....                           | 7 V                          |
| All other pins .....   | -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 must not be operated at 7 V for more than  $t = 1000$  h continuously.

DISSIPATION RATING TABLE

| PACKAGE | $T_A \leq 25^\circ\text{C}$<br>POWER RATING | DERATING FACTOR<br>ABOVE $T_A = 25^\circ\text{C}$ | $T_A = 70^\circ\text{C}$<br>POWER RATING | $T_A = 85^\circ\text{C}$<br>POWER RATING |
|---------|---|---|--|--|
| D       | 725 mW                                      | 5.8 mW/°C   | 464 mW                                   | 377 mW                                   |

## recommended operating conditions at specified temperature range

|   | MIN                 | MAX                           | UNIT |
|---|---------------------|-------------------------------|------|
| Supply voltage, $V_{DD}$                    | 2.7                 | 6                             | V    |
| Input voltage at WDI and PFI, $V_I$         | 0                   | $V_{DD} + 0.3$                | V    |
| Input voltage at SENSE1 and SENSE2, $V_I$   | 0                   | $(V_{DD} + 0.3)V_{IT}/1.25$ V | V    |
| High-level input voltage at WDI, $V_{IH}$   | $0.7 \times V_{DD}$ |                               | V    |
| Low-level input voltage at WDI, $V_{IL}$    |                     | $0.3 \times V_{DD}$           | 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>OL</sub>                     | Low-level output voltage                            | V <sub>DD</sub> = 2.7 V to 6 V, I <sub>OL</sub> = 20 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> = 3 mA                   |   |      | 0.4  |      |    |
| Power-up reset voltage (see Note 2) |   | V <sub>DD</sub> ≥ 1.1 V, I <sub>OL</sub> = 20 μA                |   |      | 0.4  | V    |    |
| V <sub>IT</sub>                     | Negative-going input threshold voltage (see Note 3) | V <sub>DD</sub> = 2.7 V to 6 V, T <sub>A</sub> = -40°C to 125°C |   | 1.35 | 1.4  | 1.44 | V  |
|                                     |   |   |   | 1.62 | 1.68 | 1.74 |    |
|                                     |   |   |   | 1.79 | 1.85 | 1.91 |    |
|                                     |   |   |   | 2.18 | 2.25 | 2.34 |    |
|                                     |   |   |   | 2.84 | 2.93 | 3.04 |    |
|                                     |   |   |   | 4.44 | 4.55 | 4.68 |    |
|                                     |   | PFI   |   | 1.2  | 1.25 | 1.3  |    |
| V <sub>hys</sub>                    | Hysteresis  | PFI   | V <sub>IT</sub> = 1.25 V  |      |      | 10   | mV |
|                                     |   |   | V <sub>IT</sub> = 1.4 V   |      |      | 15   |    |
|                                     |   |   | V <sub>IT</sub> = 1.68 V  |      |      | 15   |    |
|                                     |   |   | V <sub>IT</sub> = 1.86 V  |      |      | 20   |    |
|                                     |   |   | V <sub>IT</sub> = 2.25 V  |      |      | 20   |    |
|                                     |   |   | V <sub>IT</sub> = 2.93 V  |      |      | 30   |    |
|                                     |   |   | V <sub>IT</sub> = 4.55 V  |      |      | 40   |    |
| I <sub>H(AV)</sub>                  | Average high-level input current                    | WDI   | W <sub>DI</sub> = V <sub>DD</sub> = 6 V, Time average (dc = 88%)      |      | 100  | 150  | μA |
| I <sub>L(AV)</sub>                  | Average low-level input current                     | WDI   | W <sub>DI</sub> = 0 V, V <sub>DD</sub> = 6 V, Time average (dc = 12%) |      | -15  | -20  | μA |
| I <sub>H</sub>                      | High-level input current                            | WDI   | W <sub>DI</sub> = V <sub>DD</sub> = 6 V                               |      | 120  | 170  | μA |
|                                     |   | SENSE1  | V <sub>SENSE1</sub> = V <sub>DD</sub> = 6 V                           |      | 5    | 10   |    |
|                                     |   | SENSE2  | V <sub>SENSE2</sub> = V <sub>DD</sub> = 6 V                           |      | 6    | 10   |    |
| I <sub>L</sub>                      | Low-level input current                             | WDI   | W <sub>DI</sub> = 0 V, V <sub>DD</sub> = 6 V                          |      | -120 | -170 | μA |
| I <sub>I</sub>                      | Input current                                       | PFI   | V <sub>DD</sub> = 6 V, 0 V ≤ V <sub>I</sub> ≤ V <sub>DD</sub>         |      | -30  | 30   | nA |
| I <sub>DD</sub>                     | Supply current                                      |   |   |      | 15   | 40   | μA |
| C <sub>i</sub>                      | Input capacitance                                   |   | V <sub>I</sub> = 0 V to V <sub>DD</sub>                               |      | 10   |      | 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 (ceramic 0.1 μF) should be placed close to the supply terminals.

**timing requirements at V<sub>DD</sub> = 2.7 V to 6 V, R<sub>L</sub> = 1 MΩ, C<sub>L</sub> = 50 pF, T<sub>A</sub> = 25°C**

| PARAMETER      |        | TEST CONDITIONS  | MIN | MAX | UNIT |
|----------------|--------|--|-----|-----|------|
| t <sub>w</sub> | SENSEn | V <sub>SENSEnL</sub> = V <sub>IT</sub> - 0.2 V, V <sub>SENSEnH</sub> = V <sub>IT</sub> + 0.2 V |     | 6   | μs   |
|                | WDI    | V <sub>IH</sub> = 0.7 × V <sub>DD</sub> , V <sub>IL</sub> = 0.3 × V <sub>DD</sub>              |     | 100 | ns   |



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switching characteristics at  $V_{DD} = 2.7\text{ V to }6\text{ V}$ ,  $R_L = 1\text{ M}\Omega$ ,  $C_L = 50\text{ pF}$ ,  $T_A = 25^\circ\text{C}$

| PARAMETER   | FROM (INPUT) | TO (OUTPUT)               | TEST CONDITIONS  | MIN | TYP | MAX | UNIT          |
|---|--------------|---------------------------|--|-----|-----|-----|---------------|
| $t_{t(out)}$ Watchdog time-out                                |              |                           | $V_{I(SENSEn)} \geq V_{IT} + 0.2\text{ V}$ ,<br>See timing diagram     | 0.5 | 0.8 | 1.2 | s             |
| $t_d$ Delay time  |              |                           | $V_{I(SENSEn)} \geq V_{IT} + 0.2\text{ V}$ ,<br>See timing diagram     | 70  | 100 | 140 | ms            |
| $t_{PHL}$ Propagation (delay) time, high- to low-level output | SENSEn       | $\overline{\text{RESET}}$ | $V_{IH} = V_{IT} + 0.2\text{ V}$ ,<br>$V_{IL} = V_{IT} - 0.2\text{ V}$ |     | 1   | 5   | $\mu\text{s}$ |
| $t_{PHL}$ Propagation (delay) time, high- to low-level output | PFI          | $\overline{\text{PFO}}$   |  |     | 0.5 | 1   | $\mu\text{s}$ |
| $t_{PLH}$ Propagation (delay) time, low- to high-level output |              |                           |  |     |     |     |               |

## TYPICAL CHARACTERISTICS

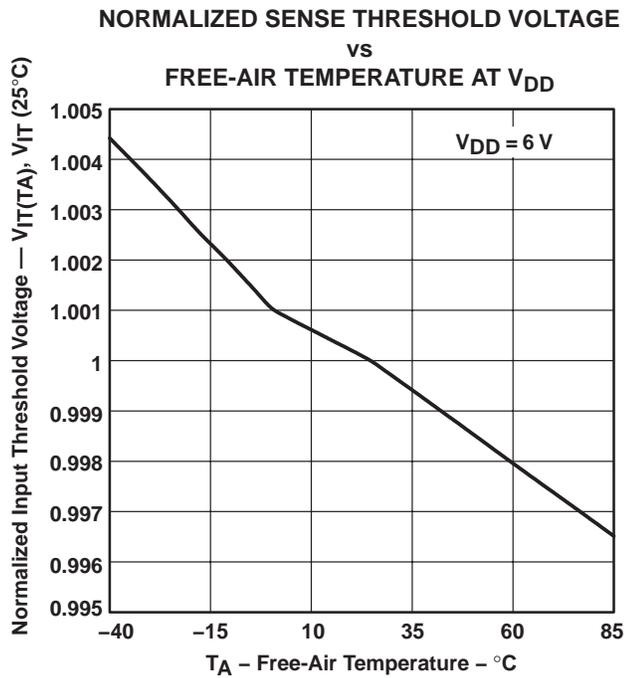


Figure 2

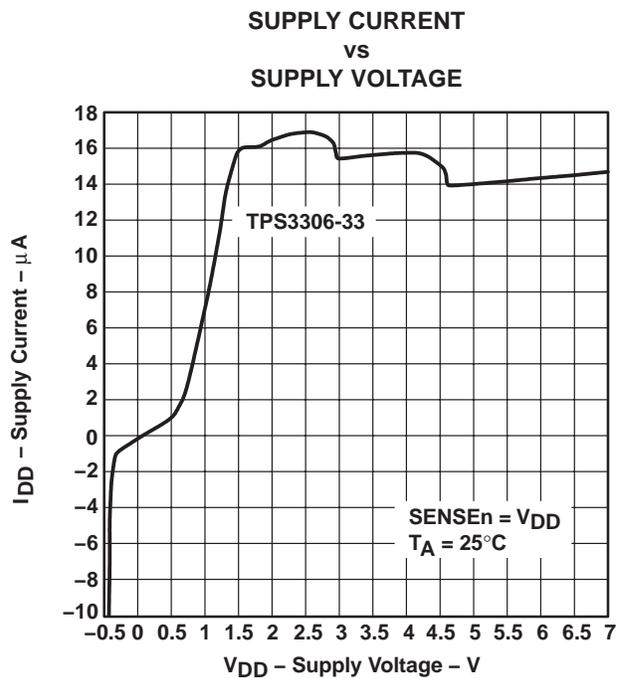


Figure 3

TYPICAL CHARACTERISTICS

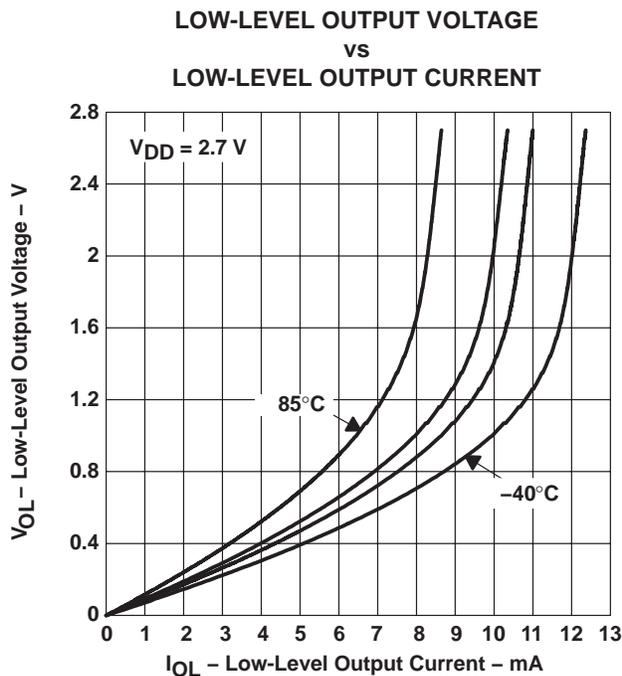


Figure 4

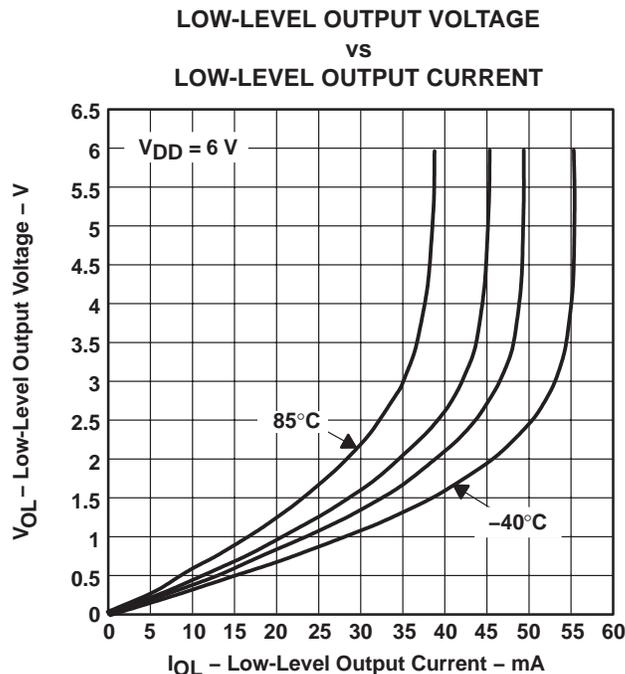


Figure 5

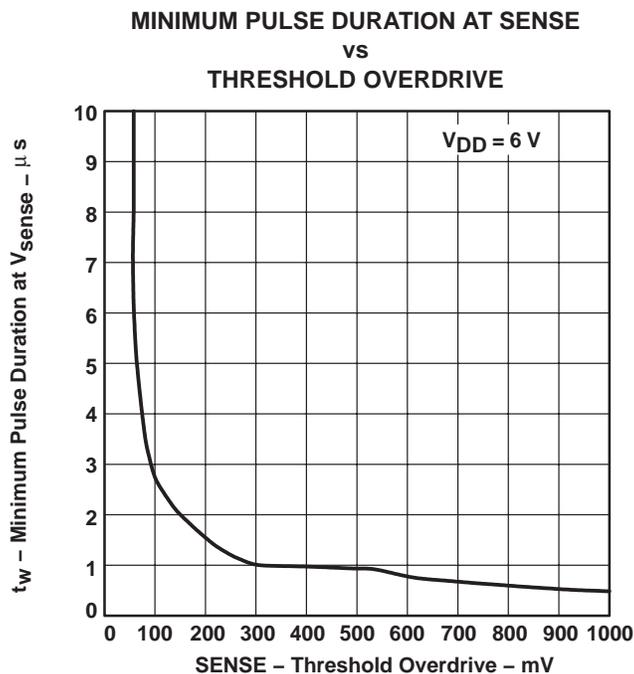


Figure 6

**PACKAGING INFORMATION**

| Orderable Device  | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples |
|-------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|---------|
| TPS3306-15QDRG4Q1 | ACTIVE        | SOIC         | D               | 8    | 2500        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | 615Q1                   | Samples |
| TPS3306-15QDRQ1   | ACTIVE        | SOIC         | D               | 8    | 2500        | RoHS & Green    | NIPDAU                               | Level-2-260C-1 YEAR  | -40 to 125   | 615Q1                   | Samples |
| TPS3306-18QDRG4Q1 | ACTIVE        | SOIC         | D               | 8    | 2500        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | 618Q1                   | Samples |
| TPS3306-18QDRQ1   | ACTIVE        | SOIC         | D               | 8    | 2500        | RoHS & Green    | NIPDAU                               | Level-2-260C-1 YEAR  | -40 to 125   | 618Q1                   | Samples |
| TPS3306-25QDRG4Q1 | ACTIVE        | SOIC         | D               | 8    | 2500        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | 625Q1                   | Samples |
| TPS3306-33QDRG4Q1 | ACTIVE        | SOIC         | D               | 8    | 2500        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | 633Q1                   | Samples |
| TPS3306-33QDRQ1   | ACTIVE        | SOIC         | D               | 8    | 2500        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 125   | 633Q1                   | 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.

<sup>(6)</sup> 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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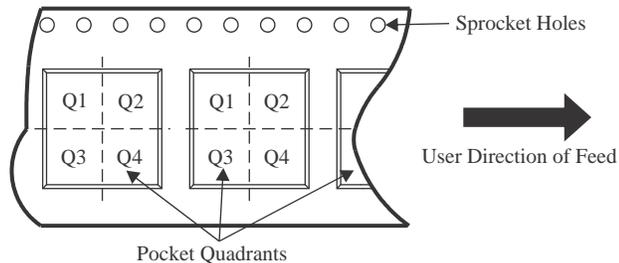
**OTHER QUALIFIED VERSIONS OF TPS3306-Q1 :**

- Catalog : [TPS3306](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

**TAPE AND REEL INFORMATION**

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


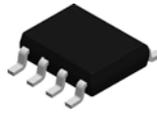
\*All dimensions are nominal

| 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 |
|-------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TPS3306-15QDRG4Q1 | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TPS3306-15QDRQ1   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TPS3306-18QDRG4Q1 | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TPS3306-18QDRQ1   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TPS3306-25QDRG4Q1 | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TPS3306-33QDRG4Q1 | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TPS3306-33QDRQ1   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

| Device            | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TPS3306-15QDRG4Q1 | SOIC         | D               | 8    | 2500 | 350.0       | 350.0      | 43.0        |
| TPS3306-15QDRQ1   | SOIC         | D               | 8    | 2500 | 350.0       | 350.0      | 43.0        |
| TPS3306-18QDRG4Q1 | SOIC         | D               | 8    | 2500 | 350.0       | 350.0      | 43.0        |
| TPS3306-18QDRQ1   | SOIC         | D               | 8    | 2500 | 350.0       | 350.0      | 43.0        |
| TPS3306-25QDRG4Q1 | SOIC         | D               | 8    | 2500 | 350.0       | 350.0      | 43.0        |
| TPS3306-33QDRG4Q1 | SOIC         | D               | 8    | 2500 | 350.0       | 350.0      | 43.0        |
| TPS3306-33QDRQ1   | SOIC         | D               | 8    | 2500 | 350.0       | 350.0      | 43.0        |

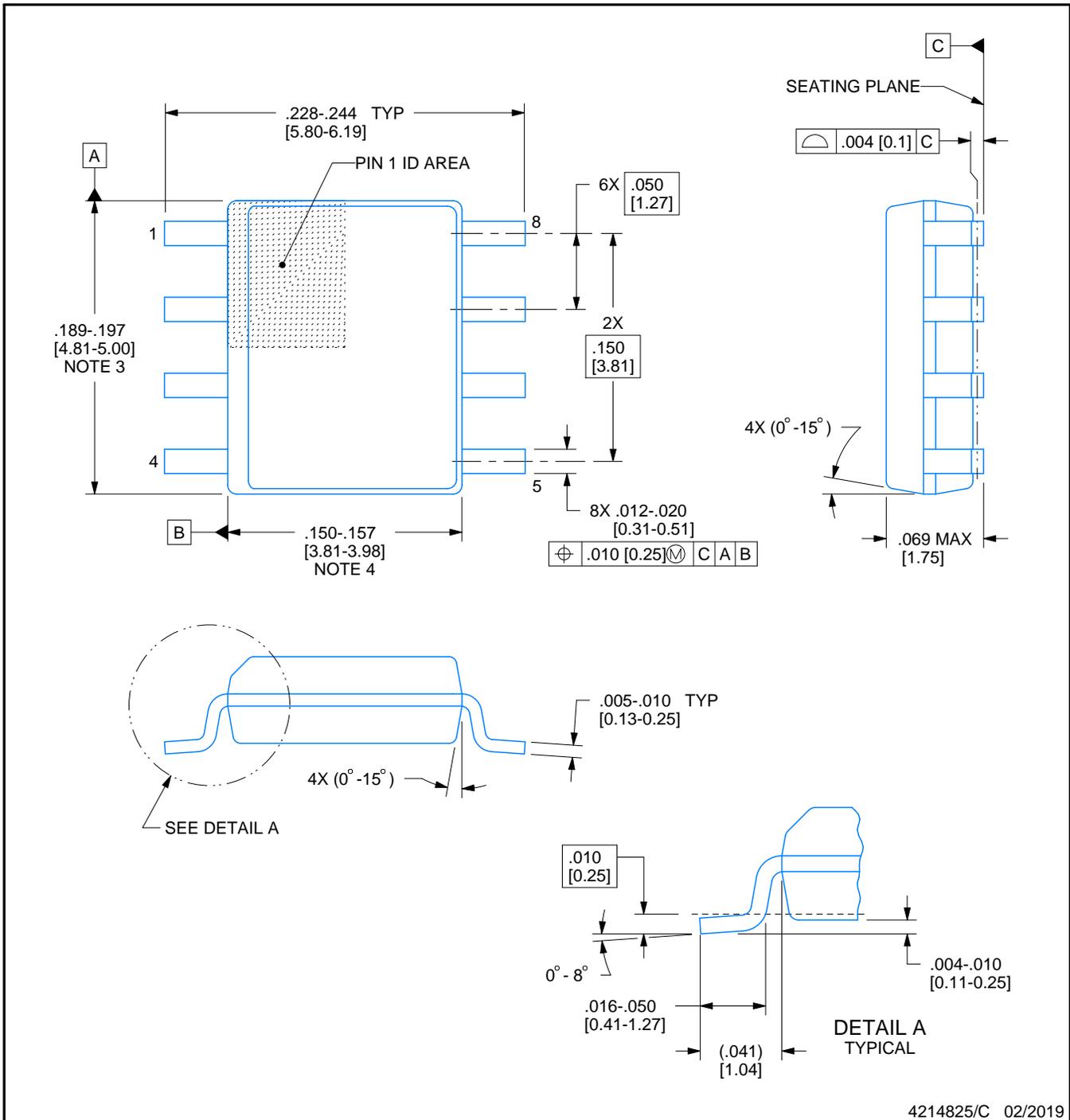


D0008A

# PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

### NOTES:

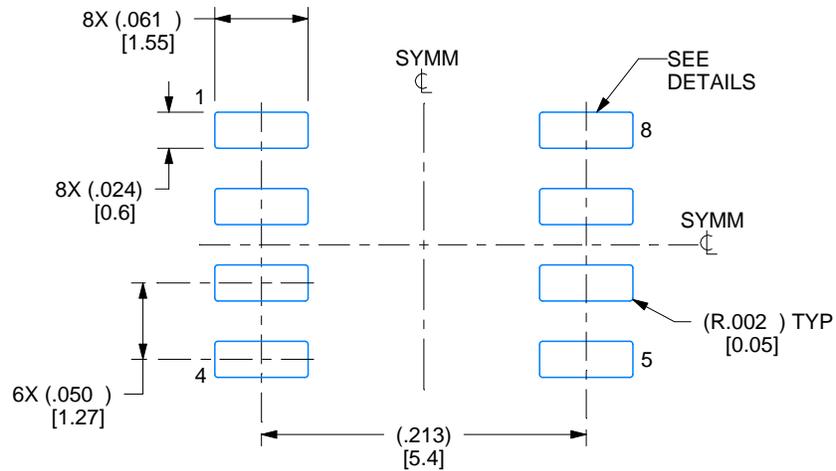
- Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed  $.006$  [0.15] per side.
- This dimension does not include interlead flash.
- Reference JEDEC registration MS-012, variation AA.

# EXAMPLE BOARD LAYOUT

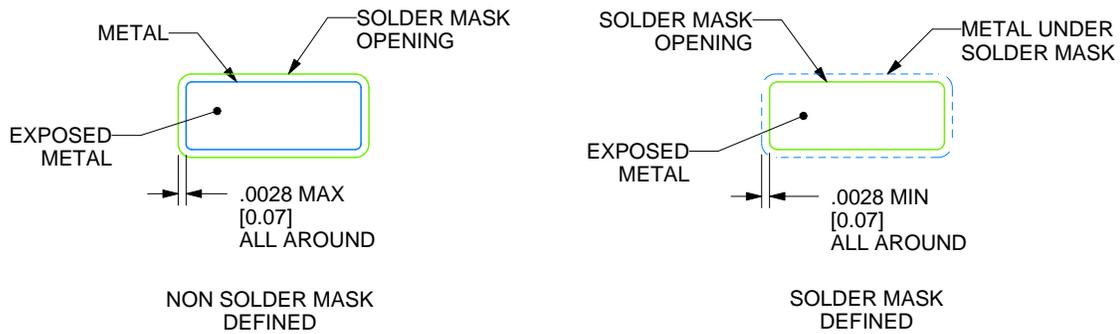
D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:8X



SOLDER MASK DETAILS

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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

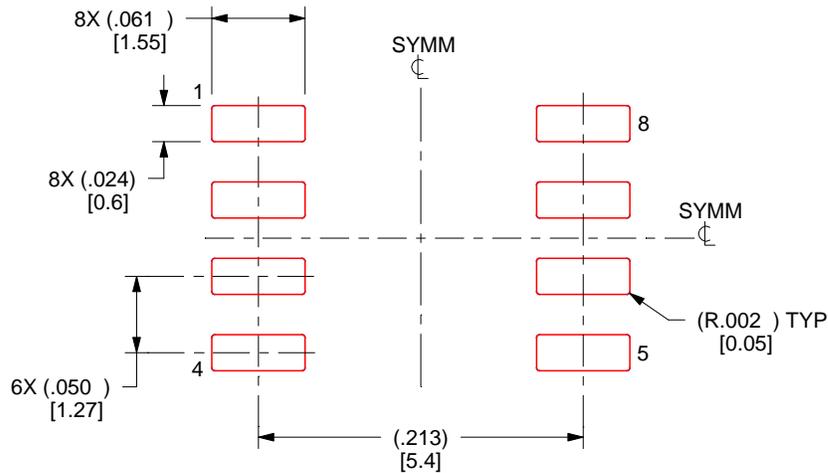
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON .005 INCH [0.125 MM] THICK STENCIL  
SCALE:8X

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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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