

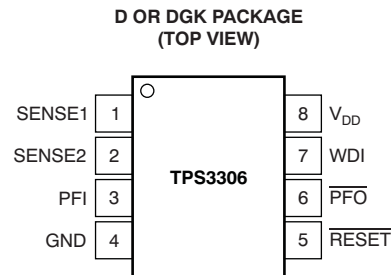
## DUAL PROCESSOR SUPERVISORY CIRCUITS WITH POWER-FAIL

### FEATURES

- 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 Second 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: 7 V to 6 V
- Defined  $\overline{\text{RESET}}$  Output From  $V_{\text{DD}} \geq 1.1$  V
- MSOP-8 and SO-8 Packages
- Temperature Range:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

### APPLICATIONS

- Multivoltage DSPs and Processors
- Portable Battery-Powered Equipment
- Embedded Control Systems
- Intelligent Instruments
- Automotive Systems

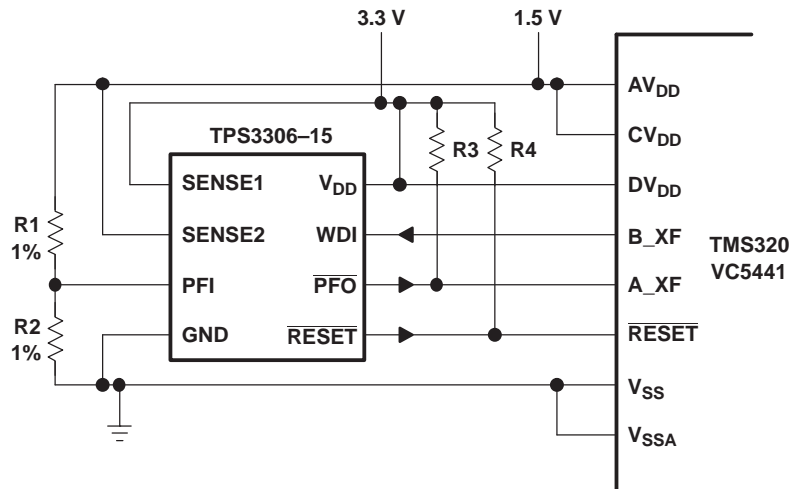


### DESCRIPTION

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.

TYPICAL OPERATING CIRCUIT



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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.

## AVAILABLE OPTIONS

**Table 1. 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 |

For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at [www.ti.com](http://www.ti.com).

## DESCRIPTION (CONTINUED)

The various supervisory circuits are designed to monitor the nominal supply voltage, as shown in the [Supply Voltage Monitoring](#) table.

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,  $t_{d(\text{typ})} = 100$  ms, starts after SENSE1 and SENSE2 inputs have risen above the threshold voltage  $V_{IT}$ . When the voltage at SENSE1 or SENSE2 input drops below the threshold voltage  $V_{IT}$ , 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 WDI. When the supervising system fails to retrigger the watchdog circuit within the time-out interval,  $t_{t(\text{out})} = 0.50$  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 either 8-pin MSOP or standard 8-pin SO packages, and are characterized for operation over a temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

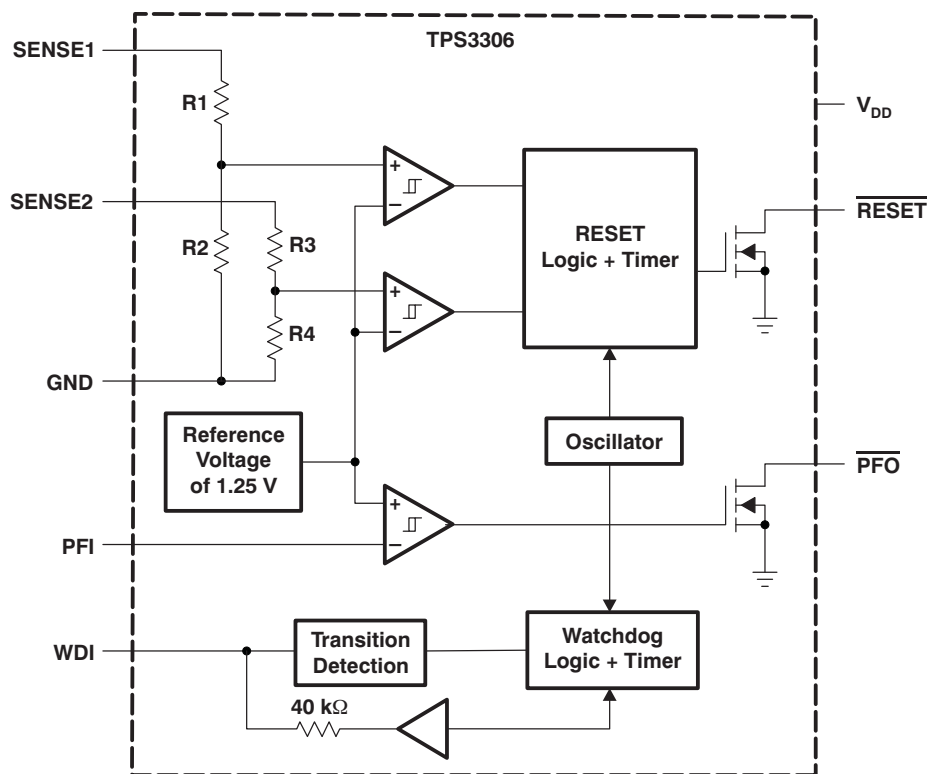
### FUNCTION/TRUTH TABLES

| SENSE1 > V <sub>IT1</sub> | SENSE2 > V <sub>IT2</sub> | RESET |
|---------------------------|---------------------------|-------|
| 0                         | 0                         | L     |
| 0                         | 1                         | L     |
| 1                         | 0                         | L     |
| 1                         | 1                         | H     |

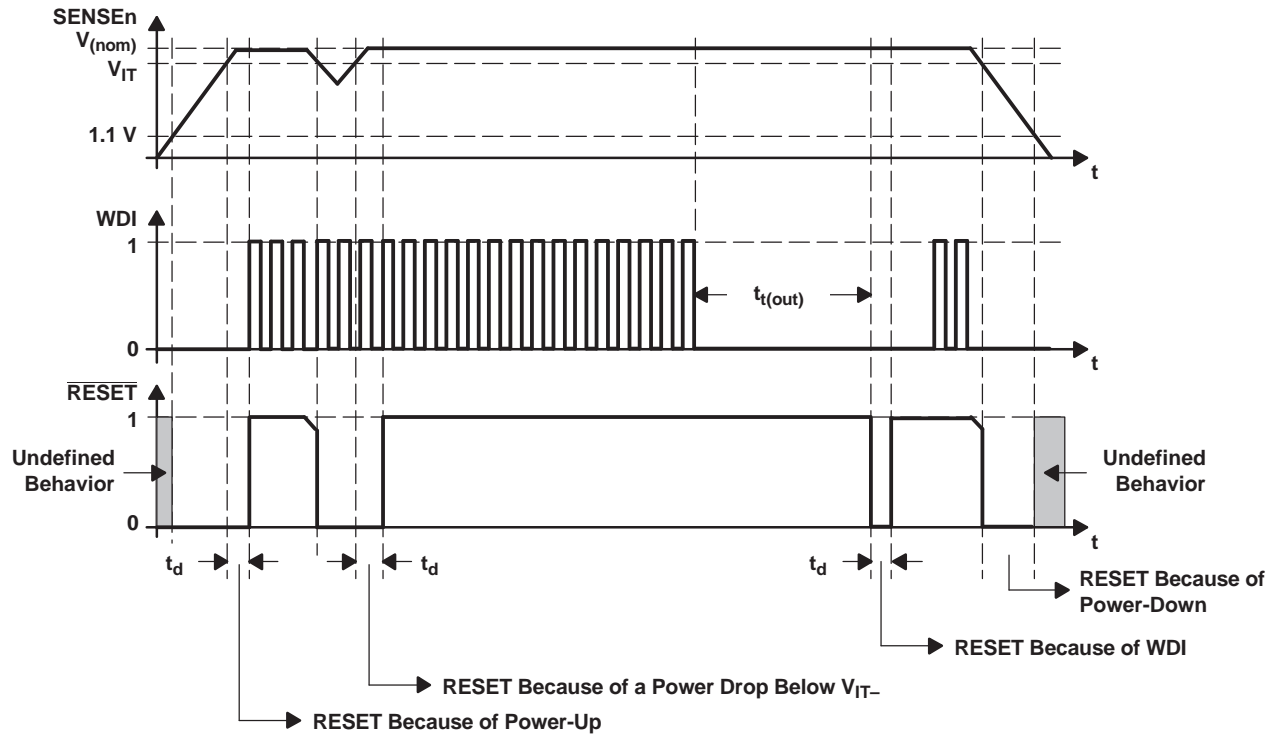
### FUNCTION/TRUTH TABLES

| PFI > V <sub>IT</sub> | PFO |
|-----------------------|-----|
| 0                     | L   |
| 1                     | H   |

### FUNCTIONAL BLOCK DIAGRAM



**TIMING DIAGRAM**



**Table 4. 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 input 1                    |
| SENSE2          | 2   | I   | Sense voltage input 2                    |
| WDI             | 7   | I   | Watchdog timer input                     |
| V <sub>DD</sub> | 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 typically has to toggle the watchdog input 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 will be retriggered internally.

## DETAILED DESCRIPTION (continued)

### Saving Current While Using the Watchdog

The watchdog input 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  $5\text{ V}/40\text{ k}\Omega = 125\text{ }\mu\text{A}$  can flow into WDI.

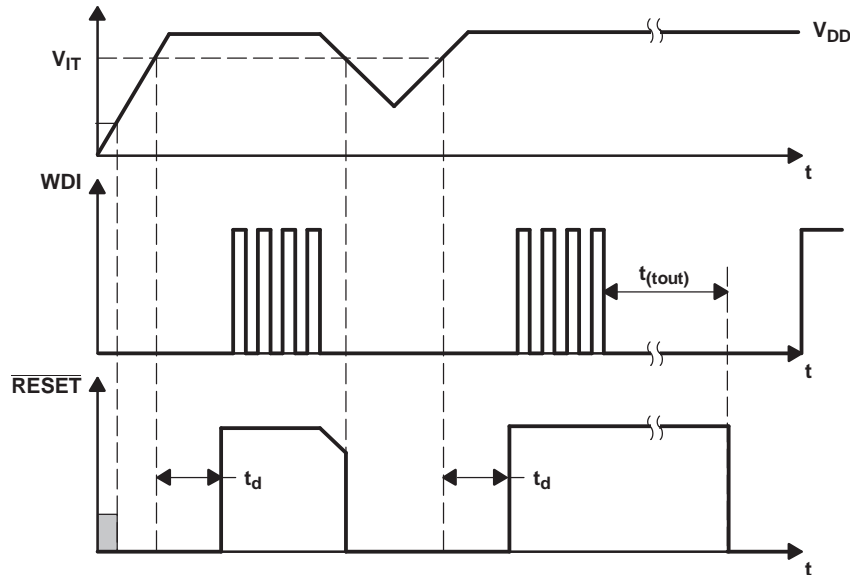
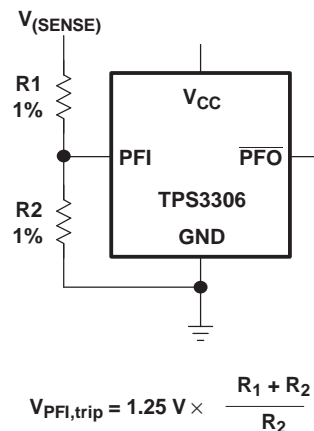


Figure 1. Watchdog Timing

### 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) will be compared with an internal voltage reference of 1.25 V. If the input voltage falls below the power-fail threshold ( $V_{PFI}$ ) of typ. 1.25 V, the power-fail output (PFO) goes low. If it 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 about 1 M $\Omega$ , to minimize power consumption and also to assure 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 PFO unconnected.



## ABSOLUTE MAXIMUM RATINGS

Over operating free-air temperature range (unless otherwise noted).<sup>(1)</sup>

|  | UNIT   |
|--|--|
| Supply voltage, $V_{DD}$ (see <sup>(2)</sup> )                 | 7 V  |
| PFI pin  | -0.3 V to $V_{DD} + 0.3$ V                   |
| All other pins (see <sup>(2)</sup> )                           | -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 <a href="#">Dissipation Rating Table</a> |
| Operating free-air temperature range, $T_A$                    | -40°C to +85°C                               |
| Storage temperature range, $T_{stg}$                           | -65°C to +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 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 |
|---------|--|--|---|---|
| DGK     | 424 mW                                       | 3.4 mW/°C  | 271 mW                                    | 220 mW                                    |
| 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                 | +85                           | °C   |

## 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  | RESET,<br>PFO                                    | 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 <sup>(1)</sup> ) |   | 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<br>(see <sup>(2)</sup> ) | V <sub>SENSE1</sub> ,<br>V <sub>SENSE2</sub>     | V <sub>DD</sub> = 2.7 V to 6 V<br>T <sub>A</sub> = 0°C to +85°C | 1.37  | 1.40                             | 1.43                             | V                           |      |   |
|  |   |  |   | 1.64  | 1.68                             | 1.72                             |                             |      |   |
|  |   |  |   | 1.81  | 1.85                             | 1.89                             |                             |      |   |
|  |   |  |   | 2.20  | 2.25                             | 2.30                             |                             |      |   |
|  |   |  |   | 2.86  | 2.93                             | 3                                |                             |      |   |
|  |   |  |   | 4.46  | 4.55                             | 4.64                             |                             |      |   |
|  | Negative-going input threshold voltage<br>(see <sup>(2)</sup> ) | PFI  | V <sub>SENSE1</sub> ,<br>V <sub>SENSE2</sub>                    | V <sub>DD</sub> = 2.7 V to 6 V<br>T <sub>A</sub> = -40°C to +85°C | 1.22                             | 1.25                             | 1.28                        | V    |   |
|  |   |  |   |   | 1.37                             | 1.40                             | 1.44                        |      |   |
|  |   |  |   |   | 1.64                             | 1.68                             | 1.73                        |      |   |
|  |   |  |   |   | 1.81                             | 1.85                             | 1.90                        |      |   |
|  |   |  |   |   | 2.20                             | 2.25                             | 2.32                        |      |   |
|  |   |  |   |   | 2.86                             | 2.93                             | 3.02                        |      |   |
| V <sub>hys</sub>                             | Hysteresis  | PFI  | V <sub>IT</sub> = 1.25 V  |   |                                  | 10                               | mV                          |      |   |
|  |   |  |   | V <sub>SENSEn</sub>   | V <sub>IT</sub> = 1.40 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  | WDI = V <sub>DD</sub> = 6 V, Time average<br>(dc = 88%) |
| I <sub>L(AV)</sub>                           | Average low-level input current                                 | WDI  | WDI = 0 V, V <sub>DD</sub> = 6 V, Time<br>average (dc = 12%)    |   |                                  |                                  | -15                         |      |   |
|  |   |  |   | I <sub>H</sub>  | High-level input current         | WDI                              | WDI = V <sub>DD</sub> = 6 V |      | 120   |
| SENSE1                                       | V <sub>SENSE1</sub> = V <sub>DD</sub> = 6 V                     |  | 5   |   |                                  |                                  |                             | 8    |   |
|  |   | SENSE2   | V <sub>SENSE2</sub> = V <sub>DD</sub> = 6 V                     |   |                                  |                                  |                             |      | 6   |
| I <sub>L</sub>                               | Low-level input current   |  |   | WDI   | WDI = 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>   |   | -25                              | 25                               | 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                          |      |   |

(1) The lowest supply voltage at which RESET becomes active. t<sub>r</sub>, V<sub>DD</sub> ≥ 15 μs/V.

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

| PARAMETER |             | TEST CONDITIONS | MIN   | TYP | MAX | UNIT          |
|-----------|-------------|-----------------|---|-----|-----|---------------|
| $t_w$     | Pulse width | SENSEn          | $V_{\text{SENSEnL}} = V_{IT} - 0.2\text{ V}$ , $V_{\text{SENSEnH}} = V_{IT} + 0.2\text{ V}$ |     | 6   | $\mu\text{s}$ |
|           |             | WDI             | $V_{IH} = 0.7 \times V_{DD}$ , $V_{IL} = 0.3 \times V_{DD}$                                 |     | 100 | ns            |

## 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           |   | TEST CONDITIONS   | MIN | TYP | MAX | UNIT          |
|---------------------|---|---|-----|-----|-----|---------------|
| $t_{t(\text{out})}$ | Watchdog time-out                                     | $V_{I(\text{SENSEn})} \geq V_{IT} + 0.2\text{ V}$ ,<br>See <a href="#">Timing Diagram</a> | 0.5 | 0.8 | 1.2 | s             |
| $t_d$               | Delay time  | $V_{I(\text{SENSEn})} \geq V_{IT} + 0.2\text{ V}$ ,<br>See <a href="#">Timing Diagram</a> | 70  | 100 | 140 | ms            |
| $t_{\text{PHL}}$    | Propagation (delay) time,<br>high-to-low level output | SENSEn to $\overline{\text{RESET}}$   |     | 1   | 5   | $\mu\text{s}$ |
| $t_{\text{PHL}}$    | Propagation (delay) time,<br>high-to-low level output | PFI to $\overline{\text{PFO}}$  |     | 0.5 | 1   | $\mu\text{s}$ |
| $t_{\text{PLH}}$    | Propagation (delay) time,<br>low-to-high level output |   |     |     |     |               |

## TYPICAL CHARACTERISTICS

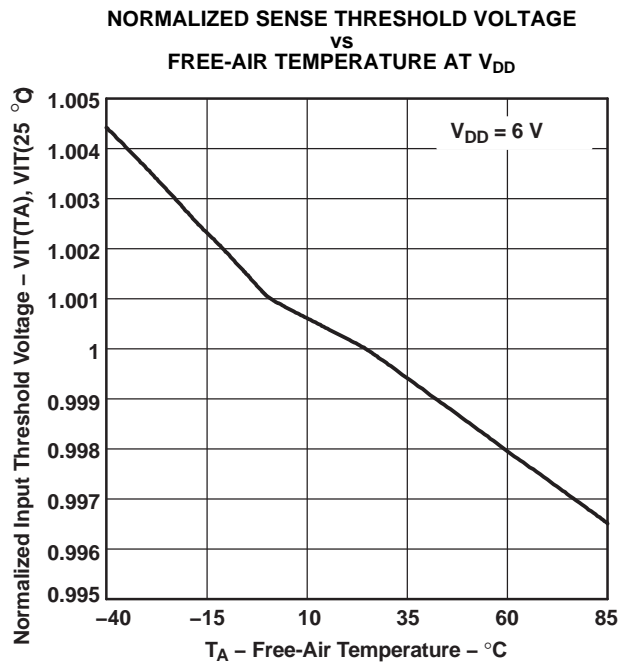


Figure 2.

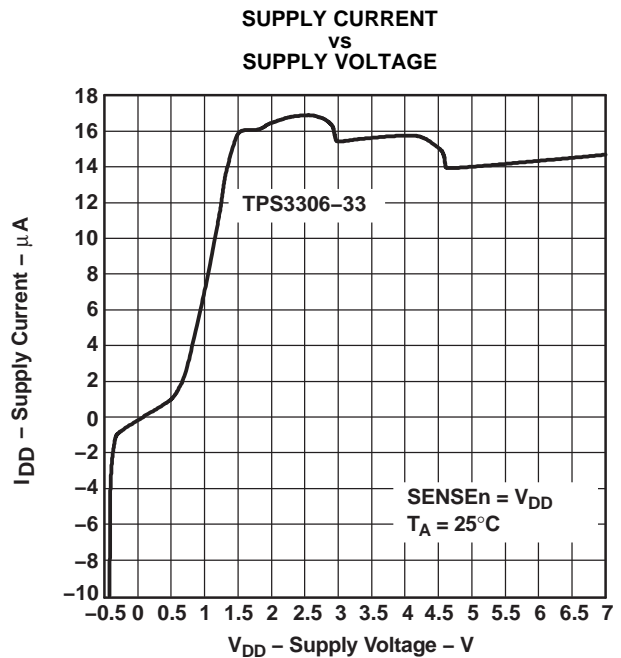


Figure 3.



**TYPICAL CHARACTERISTICS (continued)**

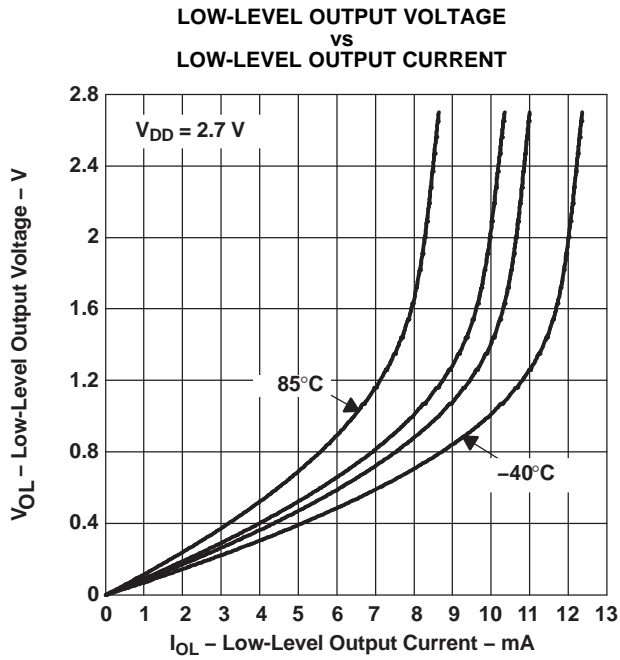


Figure 4.

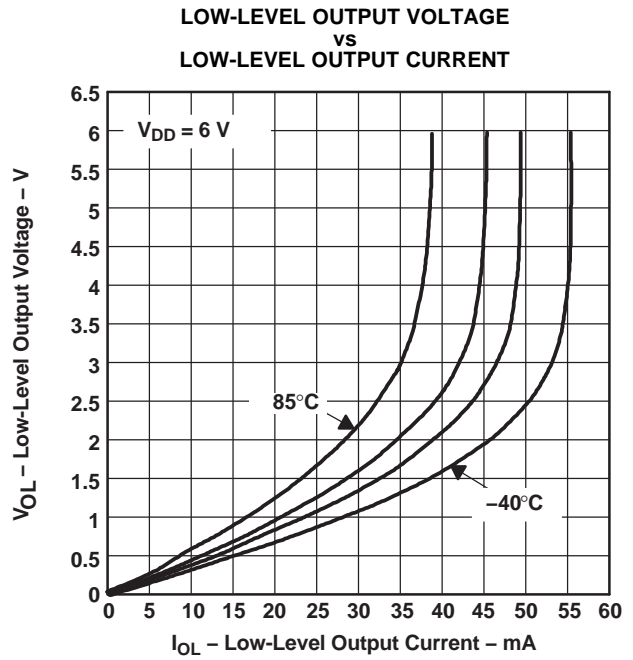


Figure 5.

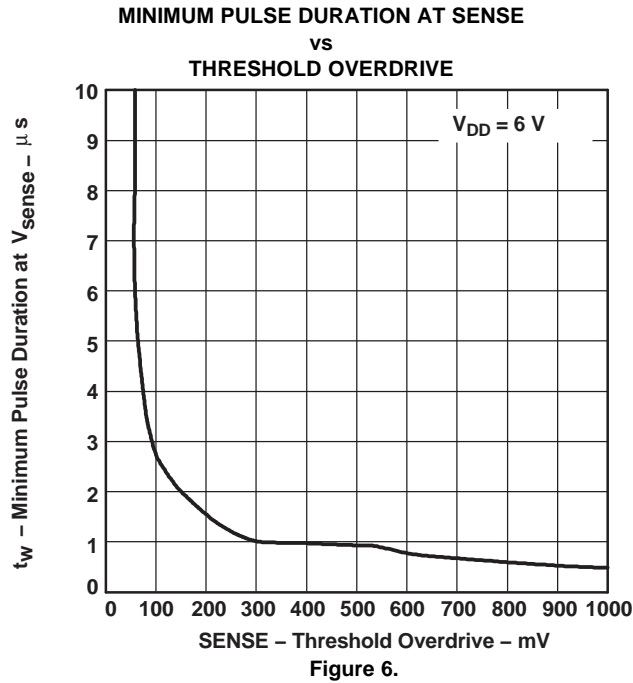


Figure 6.

**PACKAGING INFORMATION**

| 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TPS3306-15D      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-15DG4    | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-15DGK    | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-15DGKG4  | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-15DGKR   | ACTIVE                | MSOP         | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-15DGKRG4 | ACTIVE                | MSOP         | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-15DR     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-15DRG4   | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-18D      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-18DG4    | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-18DGK    | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-18DGKG4  | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-18DGKR   | ACTIVE                | MSOP         | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-18DGKRG4 | ACTIVE                | MSOP         | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-18DR     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-18DRG4   | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-20D      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-20DG4    | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-20DGK    | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-20DGKG4  | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-25D      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-25DG4    | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-25DGK    | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-25DGKG4  | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-25DGKR   | ACTIVE                | MSOP         | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

| 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TPS3306-25DGKRG4 | ACTIVE                | MSOP         | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-25DR     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-25DRG4   | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-33D      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-33DG4    | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-33DGK    | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-33DGKG4  | ACTIVE                | MSOP         | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-33DGKR   | ACTIVE                | MSOP         | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-33DGKRG4 | ACTIVE                | MSOP         | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-33DR     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3306-33DRG4   | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |

<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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**OTHER QUALIFIED VERSIONS OF TPS3306-15, TPS3306-18, TPS3306-20, TPS3306-25, TPS3306-33 :**

- Automotive: [TPS3306-15-Q1](#), [TPS3306-18-Q1](#), [TPS3306-20-Q1](#), [TPS3306-25-Q1](#), [TPS3306-33-Q1](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

## 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 |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TPS3306-15DGKR | MSOP         | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| TPS3306-15DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TPS3306-18DGKR | MSOP         | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| TPS3306-18DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TPS3306-25DGKR | MSOP         | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| TPS3306-25DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| TPS3306-33DGKR | MSOP         | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| TPS3306-33DR   | 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) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TPS3306-15DGKR | MSOP         | DGK             | 8    | 2500 | 358.0       | 335.0      | 35.0        |
| TPS3306-15DR   | SOIC         | D               | 8    | 2500 | 346.0       | 346.0      | 29.0        |
| TPS3306-18DGKR | MSOP         | DGK             | 8    | 2500 | 358.0       | 335.0      | 35.0        |
| TPS3306-18DR   | SOIC         | D               | 8    | 2500 | 346.0       | 346.0      | 29.0        |
| TPS3306-25DGKR | MSOP         | DGK             | 8    | 2500 | 358.0       | 335.0      | 35.0        |
| TPS3306-25DR   | SOIC         | D               | 8    | 2500 | 346.0       | 346.0      | 29.0        |
| TPS3306-33DGKR | MSOP         | DGK             | 8    | 2500 | 358.0       | 335.0      | 35.0        |
| TPS3306-33DR   | SOIC         | D               | 8    | 2500 | 346.0       | 346.0      | 29.0        |

DGK (S-PDSO-G8)

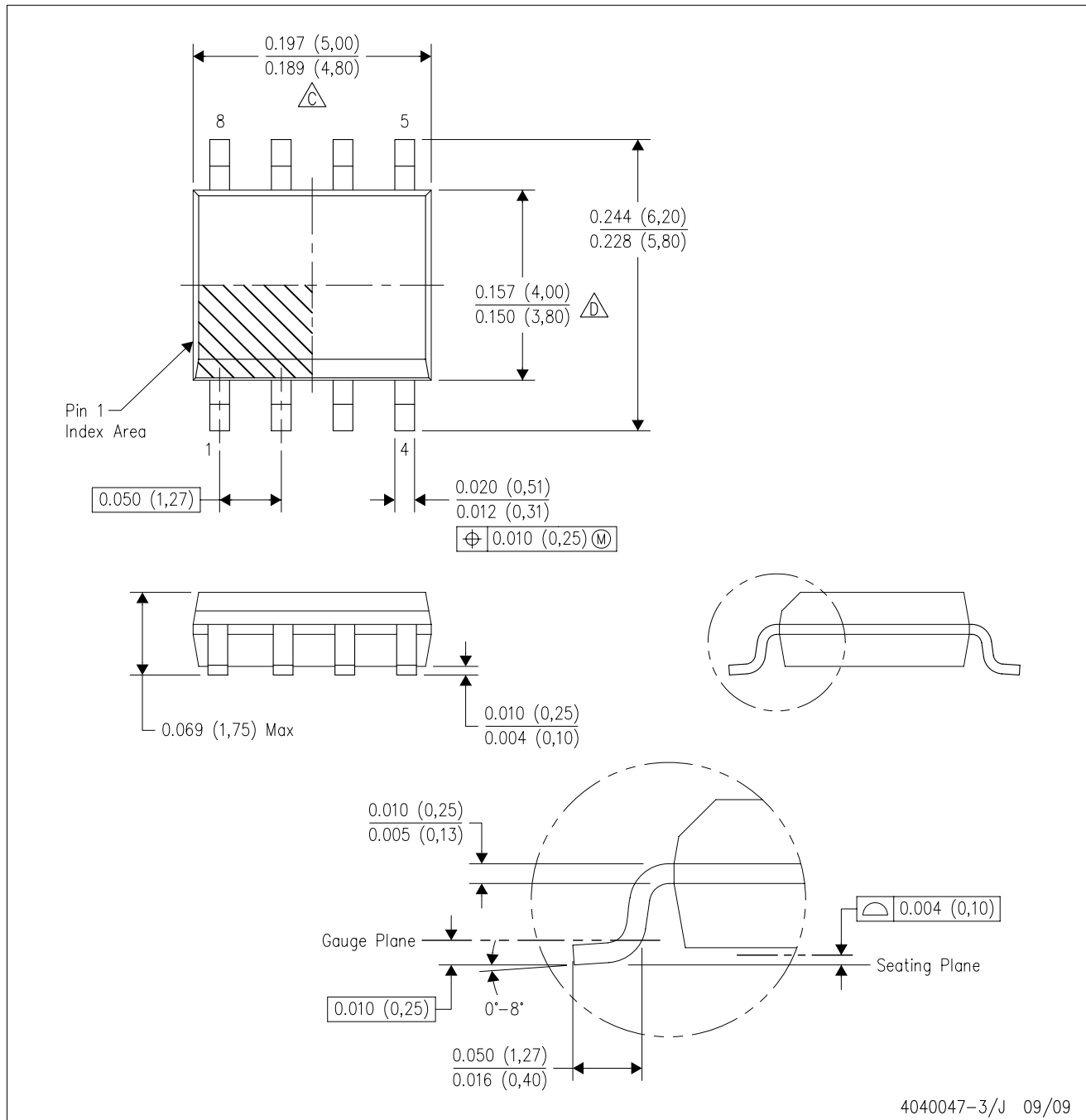
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per end.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
  - E. Falls within JEDEC MO-187 variation AA, except interlead flash.

D (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE





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