

## NanoPower Supervisory Circuits

### FEATURES

- **Supply Current: 220 nA (typical)**
- **Precision Supply Voltage Supervision Range: 1.8 V, 2.5 V, 3.0 V, and 3.3 V**
- **Power-On Reset Generator With Selectable Delay Time: 10 ms or 200 ms**
- **Push/Pull  $\overline{\text{RESET}}$  Output (TPS3836),  $\overline{\text{RESET}}$  Output (TPS3837), or Open-Drain  $\overline{\text{RESET}}$  Output (TPS3838)**
- **Manual Reset**
- **SOT23-5 and 2x2 SON-6 Packages**
- **Temperature Range:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$**

### APPLICATIONS

- **Applications Using Low-Power DSPs, Microcontrollers, or Microprocessors**
- **Portable- and Battery-Powered Equipment**
- **Intelligent Instruments**
- **Wireless Communication Systems**
- **Notebook Computers**
- **Automotive Systems**
- **Applications Using the MSP430™**

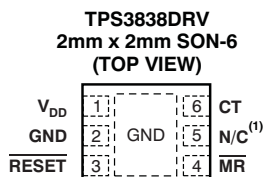
### DESCRIPTION

The TPS3836, TPS3837, and TPS3838 families of supervisory circuits provide circuit initialization and timing supervision, primarily for DSP and processor-based systems.

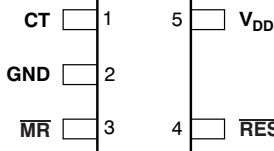
During power-on,  $\overline{\text{RESET}}$  is asserted when the supply voltage  $V_{\text{DD}}$  becomes higher than 1.1 V. Thereafter, the supervisory circuit monitors  $V_{\text{DD}}$  and keeps the  $\overline{\text{RESET}}$  output active as long as  $V_{\text{DD}}$  remains below the threshold voltage of  $V_{\text{IT}}$ . An internal timer delays the return of the output to the inactive state (high) to ensure proper system reset. The delay time starts after  $V_{\text{DD}}$  has risen above the threshold voltage  $V_{\text{IT}}$ .

When CT is connected to GND, a fixed delay time of typical 10 ms is asserted. When connected to  $V_{\text{DD}}$ , the delay time is typically 200 ms. When the supply voltage drops below the threshold voltage  $V_{\text{IT}}$ , the output becomes active (low) again. All the devices of this family have a fixed-sense threshold voltage ( $V_{\text{IT}}$ ) set by an internal voltage divider.

The TPS3836 has an active-low, push-pull  $\overline{\text{RESET}}$  output. The TPS3837 has an active-high, push-pull  $\overline{\text{RESET}}$ , and the TPS3838 integrates an active-low, open-drain  $\overline{\text{RESET}}$  output. The product spectrum is designed for supply voltages of 1.8 V, 2.5 V, 3.0 V, and 3.3 V. The circuits are available in either a SOT23-5 or 2x2 SON-6 package. The TPS3836, TPS3837, and TPS3838 families are characterized for operation over a temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

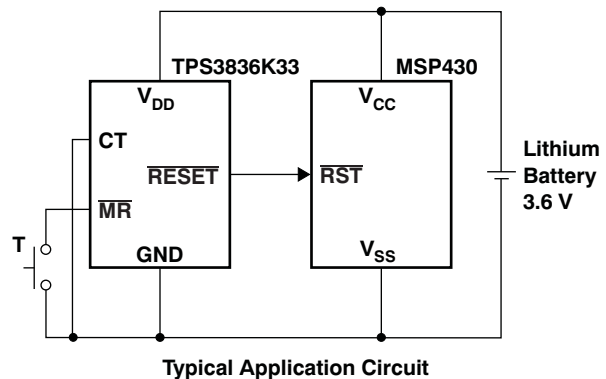
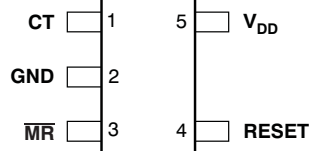


TPS3836, TPS3838  
DBV PACKAGE  
(TOP VIEW)



(1) N/C: Not connected.

TPS3837  
DBV PACKAGE  
(TOP VIEW)



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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    | NOMINAL SUPPLY VOLTAGE | THRESHOLD VOLTAGE ( $V_{IT}$ ) <sup>(2)</sup> |
|------------|------------------------|---|
| TPS383xE18 | 1.8 V                  | 1.71 V  |
| TPS383xJ25 | 2.5 V                  | 2.25 V  |
| TPS383xH30 | 3.0 V                  | 2.79 V  |
| TPS383xL30 | 3.0 V                  | 2.64 V  |
| TPS383xK33 | 3.3 V                  | 2.93 V  |

- (1) 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 [www.ti.com](http://www.ti.com).
- (2) Custom threshold voltages are available. Minimum order quantities apply. Contact factory for details and availability.

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

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

|  | TPS383xx                                      | UNIT |
|--|---|------|
| Supply voltage, $V_{DD}$ <sup>(2)</sup>                        | 7   | V    |
| All other pins <sup>(2)(3)</sup>                               | –0.3 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 $V_I > V_{DD}$ )  | ±10   | mA   |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{DD}$ ) | ±10   | mA   |
| Continuous total power dissipation                             | See <a href="#">Dissipation Ratings Table</a> |      |
| Operating temperature range, $T_A$                             | –40 to +85                                    | °C   |
| Storage temperature range, $T_{STG}$                           | –65 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.
- (3) If RESET or  $\overline{\text{RESET}}$  are pulled above  $V_{DD}$ , the internal ESD structure will present an effective 1.5 kΩ resistor between these pins, causing leakage current to flow into the RESET or  $\overline{\text{RESET}}$  pin.

### DISSIPATION RATINGS

| PACKAGE                   | $T_A < +25^\circ\text{C}$<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 |
|---------------------------|---|--|---|---|
| DBV                       | 437 mW                                    | 3.5 mW/°C  | 280 mW                                    | 227 mW                                    |
| DRV Low-K <sup>(1)</sup>  | 715 mW                                    | 7.1 mW/°C  | 395 mW                                    | 285 mW                                    |
| DRV High-K <sup>(2)</sup> | 1540 mW                                   | 15.4 mW/°C   | 845 mW                                    | 615 mW                                    |

- (1) The JEDEC low-K (1s) board used to derive this data was a 3in x 3in, two-layer board with 2-ounce copper traces on top of the board.
- (2) The JEDEC high-K (2s2p) board used to derive this data was a 3in x 3in, multilayer board with 1-ounce internal power and ground planes and 2-ounce copper traces on the top and bottom of the board.

## RECOMMENDED OPERATING CONDITIONS

|  | MIN                 | MAX                 | UNIT |
|--|---------------------|---------------------|------|
| Supply voltage, $V_{DD}$   | 1.6                 | 6                   | V    |
| Voltage range, CT, $\overline{MR}$ , RESET, and $\overline{RESET}$ pins      | 0                   | $V_{DD} + 0.3$      | V    |
| High-level input voltage, $V_{IH}$   | $0.7 \times V_{DD}$ |                     | V    |
| Low-level input voltage, $V_{IL}$  |                     | $0.3 \times V_{DD}$ | V    |
| Input transition rise and fall rate at $\overline{MR}$ , $\Delta t/\Delta V$ |                     | 100                 | ns/V |
| Operating temperature range, $T_A$   | -40                 | +85                 | °C   |

## ELECTRICAL CHARACTERISTICS

Over recommended operating conditions, unless otherwise noted.

| PARAMETER |   | TEST CONDITIONS                       | MIN  | TYP                 | MAX  | UNIT       |               |
|-----------|---|---------------------------------------|--|---------------------|------|------------|---------------|
| $V_{OH}$  | High-level output voltage                             | $\overline{RESET}$ (TPS3836)          | $V_{DD} = 3.3\text{ V}$ , $I_{OH} = -2\text{ mA}$              | $0.8 \times V_{DD}$ |      | V          |               |
|           |   |                                       | $V_{DD} = 6\text{ V}$ , $I_{OH} = -3\text{ mA}$                |                     |      |            |               |
|           |   | $\overline{RESET}$ (TPS3837)          | $V_{DD} = 1.8\text{ V}$ , $I_{OH} = -1\text{ mA}$              |                     |      |            |               |
|           |   |                                       | $V_{DD} = 3.3\text{ V}$ , $I_{OL} = -2\text{ mA}$              |                     |      |            |               |
| $V_{OL}$  | Low-level output voltage                              | $\overline{RESET}$ (TPS3836, TPS3838) | $V_{DD} = 1.8\text{ V}$ , $I_{OL} = 1\text{ mA}$               |                     | 0.4  | V          |               |
|           |   |                                       | $V_{DD} = 3.3\text{ V}$ , $I_{OL} = 2\text{ mA}$               |                     |      |            |               |
|           |   | $\overline{RESET}$ (TPS3837)          | $V_{DD} = 3.3\text{ V}$ , $I_{OL} = 2\text{ mA}$               |                     |      |            |               |
|           |   |                                       | $V_{DD} = 6\text{ V}$ , $I_{OL} = 3\text{ mA}$                 |                     |      |            |               |
|           | Power-up reset voltage <sup>(1)</sup>                 | TPS3836, TPS3838                      | $V_{DD} \geq 1.1\text{ V}$ , $I_{OL} = 50\text{ }\mu\text{A}$  |                     | 0.2  | V          |               |
|           |   | TPS3837                               | $V_{DD} \geq 1.1\text{ V}$ , $I_{OL} = -50\text{ }\mu\text{A}$ | $0.8 \times V_{DD}$ |      | V          |               |
| $V_{IT}$  | Negative-going input threshold voltage <sup>(2)</sup> | TPS383xE18                            | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$                | 1.66                | 1.71 | 1.74       | V             |
|           |   | TPS383xJ25                            |  | 2.18                | 2.25 | 2.29       |               |
|           |   | TPS383xH30                            |  | 2.70                | 2.79 | 2.85       |               |
|           |   | TPS383xL30                            |  | 2.56                | 2.64 | 2.69       |               |
|           |   | TPS383xK33                            |  | 2.84                | 2.93 | 2.99       |               |
| $V_{HYS}$ | Hysteresis at $V_{DD}$ input                          |                                       | $1.7\text{ V} < V_{IT} < 2.5\text{ V}$                         | 30                  |      | mV         |               |
|           |   |                                       | $2.5\text{ V} < V_{IT} < 3.5\text{ V}$                         | 40                  |      |            |               |
|           |   |                                       | $3.5\text{ V} < V_{IT} < 5\text{ V}$                           | 50                  |      |            |               |
| $I_{IH}$  | High-level input current                              | $\overline{MR}$ <sup>(3)</sup>        | $\overline{MR} = 0.7 \times V_{DD}$ , $V_{DD} = 6\text{ V}$    | -40                 | -60  | -100       | $\mu\text{A}$ |
|           |   | CT                                    | $CT = V_{DD} = 6\text{ V}$                                     | -25                 |      | +25        | nA            |
| $I_{IL}$  | Low-level input current                               | $\overline{MR}$ <sup>(3)</sup>        | $\overline{MR} = 0\text{ V}$ , $V_{DD} = 6\text{ V}$           | -130                | -200 | -340       | $\mu\text{A}$ |
|           |   | CT                                    | $CT = 0\text{ V}$ , $V_{DD} = 6\text{ V}$                      | -25                 |      | +25        | nA            |
| $I_{OH}$  | High-level output current                             | TPS3838                               | $V_{DD} = V_{IT} + 0.2\text{ V}$ , $V_{OH} = V_{DD}$           |                     |      | 25         | nA            |
| $I_{DD}$  | Supply current  |                                       | $V_{DD} > V_{IT}$ , $V_{DD} < 3\text{ V}$                      | 220                 |      | 400        | nA            |
|           |   |                                       | $V_{DD} > V_{IT}$ , $V_{DD} > 3\text{ V}$                      | 250                 |      | 450        |               |
|           |   |                                       | $V_{DD} < V_{IT}$  | 10                  |      | 15         | $\mu\text{A}$ |
|           | Internal pull-up resistor at $\overline{MR}$          |                                       |  | 30                  |      | k $\Omega$ |               |
| $C_I$     | Input capacitance at $\overline{MR}$ and CT           |                                       | $V_I = 0\text{ V to } V_{DD}$                                  | 5                   |      | pF         |               |

(1) The lowest voltage at which the  $\overline{RESET}$  output becomes active.  $t_R$ ,  $V_{DD} \geq 15\text{ }\mu\text{s/V}$ .

(2) To ensure best stability of the threshold voltage, a bypass capacitor (ceramic, 0.1  $\mu\text{F}$ ) should be placed near the supply terminal.

(3) If manual reset is unused,  $\overline{MR}$  should be connected to  $V_{DD}$  to minimize current consumption.

## SWITCHING CHARACTERISTICS

At  $T_A = +25^\circ\text{C}$ ,  $R_L = 1\text{ M}\Omega$ , and  $C_L = 50\text{ pF}$ , unless otherwise noted.

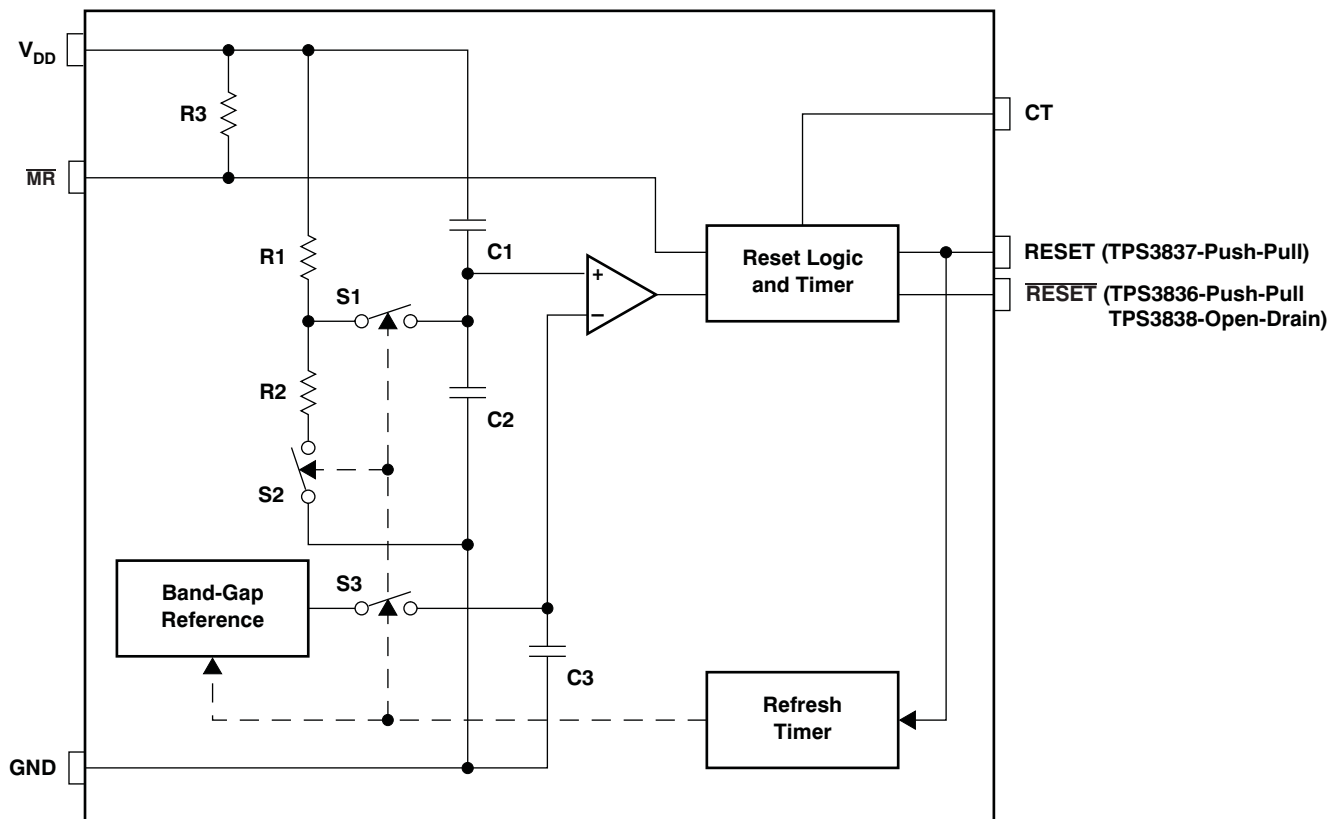
| PARAMETER |   | TEST CONDITIONS   | MIN  | TYP | MAX | UNIT          |
|-----------|---|---|--|-----|-----|---------------|
| $t_D$     | Delay time  | $V_{DD} \geq V_{IT} + 0.2\text{ V}$ , $\overline{MR} = 0.7 \times V_{DD}$ ,<br>CT = GND, See <a href="#">Timing Diagram</a>       | 5  | 10  | 15  | ms            |
|           |   | $V_{DD} \geq V_{IT} + 0.2\text{ V}$ , $\overline{MR} = 0.7 \times V_{DD}$ ,<br>CT = $V_{DD}$ , See <a href="#">Timing Diagram</a> | 100  | 200 | 300 |               |
| $t_{PHL}$ | Propagation (delay) time,<br>high-to-low-level output | $V_{DD}$ to RESET<br>delay (TPS3836,<br>TPS3838)  | $V_{IL} = V_{IT} - 0.2\text{ V}$ , $V_{IH} = V_{IT} + 0.2\text{ V}$                                  |     | 10  | $\mu\text{s}$ |
|           |   |   | $V_{IL} = 1.6\text{ V}$  |     | 50  |               |
| $t_{PLH}$ | Propagation (delay) time,<br>low-to-high-level output | $V_{DD}$ to RESET<br>delay (TPS3837)  | $V_{IL} = V_{IT} - 0.2\text{ V}$ , $V_{IH} = V_{IT} + 0.2\text{ V}$                                  |     | 10  | $\mu\text{s}$ |
|           |   |   | $V_{IL} = 1.6\text{ V}$  |     | 50  |               |
| $t_{PHL}$ | Propagation (delay) time,<br>high-to-low-level output | $\overline{MR}$ to RESET<br>delay (TPS3836,<br>TPS3838)   | $V_{DD} \geq V_{IT} + 0.2\text{ V}$ , $V_{IL} = 0.3 \times V_{DD}$ , $V_{IL} = 0.7 \times V_{DD}$    |     | 0.1 | $\mu\text{s}$ |
| $t_{PLH}$ | Propagation (delay) time,<br>low-to-high-level output | $\overline{MR}$ to RESET<br>delay (TPS3837)   | $V_{DD} \geq V_{IT} + 0.2\text{ V}$ , $V_{IL} = 0.3 \times V_{DD}$ ,<br>$V_{IL} = 0.7 \times V_{DD}$ |     | 0.1 | $\mu\text{s}$ |

## TIMING REQUIREMENTS

At  $T_A = +25^\circ\text{C}$ ,  $R_L = 1\text{ M}\Omega$ , and  $C_L = 50\text{ pF}$ , unless otherwise noted.

| PARAMETER |             | TEST CONDITIONS    | MIN   | TYP | MAX | UNIT          |
|-----------|-------------|--------------------|---|-----|-----|---------------|
| $t_W$     | Pulse width | at $V_{DD}$        | $V_{IH} = V_{IT} + 0.2\text{ V}$ , $V_{IL} = V_{IT} - 0.2\text{ V}$                               |     | 6   | $\mu\text{s}$ |
|           |             | at $\overline{MR}$ | $V_{DD} \geq V_{IT} + 0.2\text{ V}$ , $V_{IL} = 0.3 \times V_{DD}$ , $V_{IH} = 0.7 \times V_{DD}$ |     | 1   |               |

### FUNCTIONAL BLOCK DIAGRAM



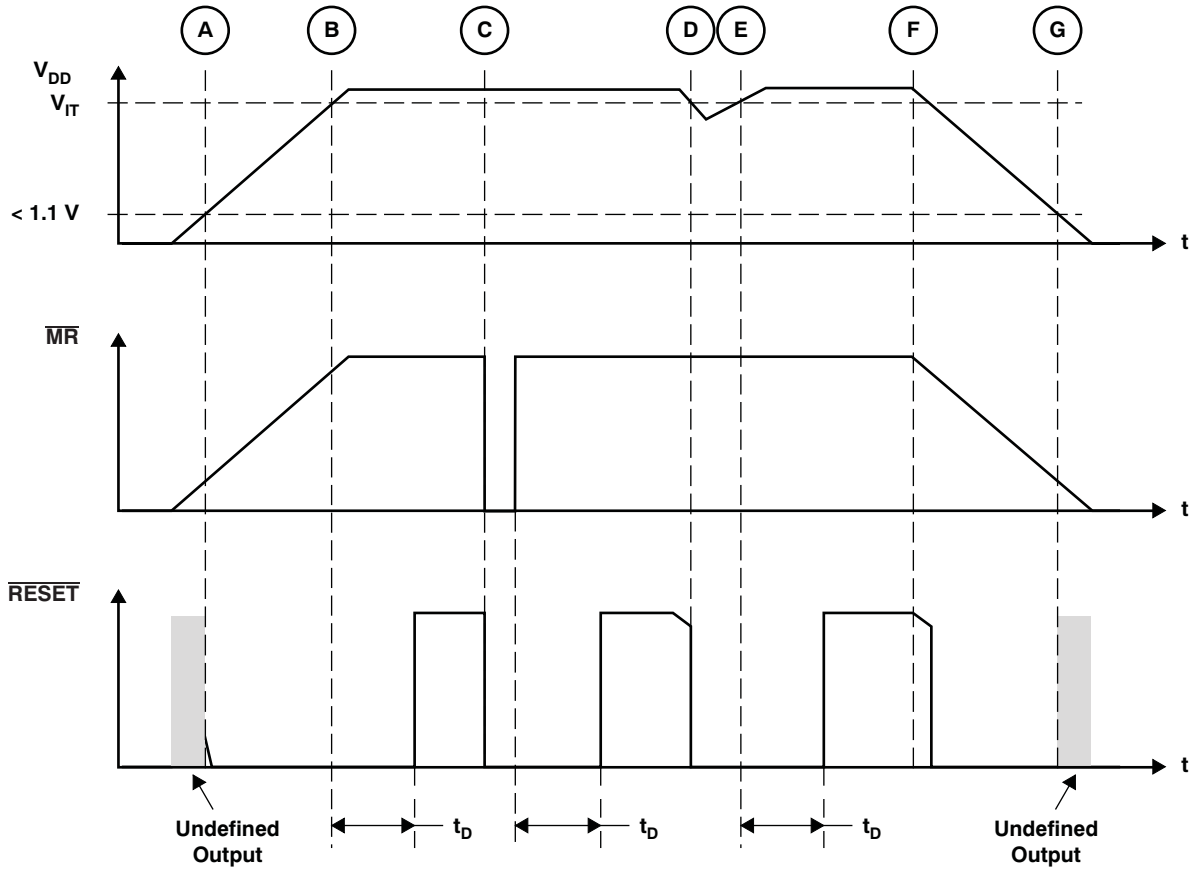
FUNCTION TABLE

| $\overline{MR}$ | $V_{DD} > V_{IT}$ | $\overline{RESET}^{(1)}$ | $RESET^{(2)}$ |
|-----------------|-------------------|--------------------------|---------------|
| L               | 0                 | L                        | H             |
| L               | 1                 | L                        | H             |
| H               | 0                 | L                        | H             |
| H               | 1                 | H                        | L             |

(1) TPS3836 and TPS3838.

(2) TPS3837.

TIMING DIAGRAM



TYPICAL CHARACTERISTICS

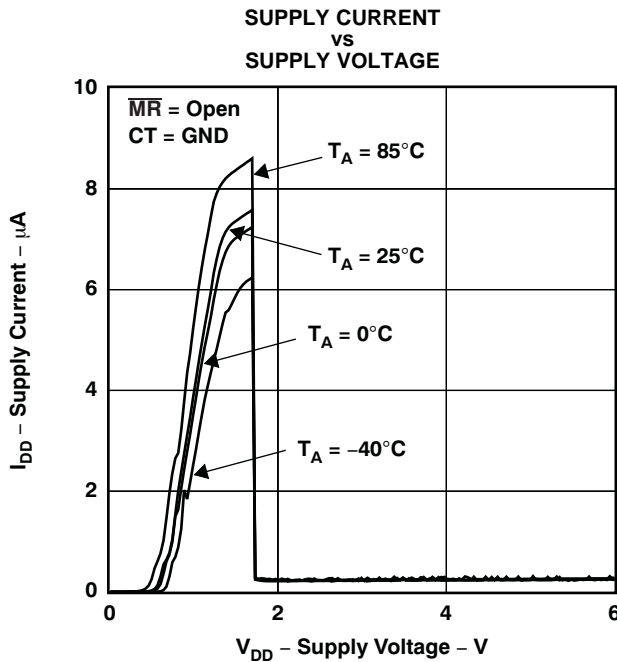


Figure 1.

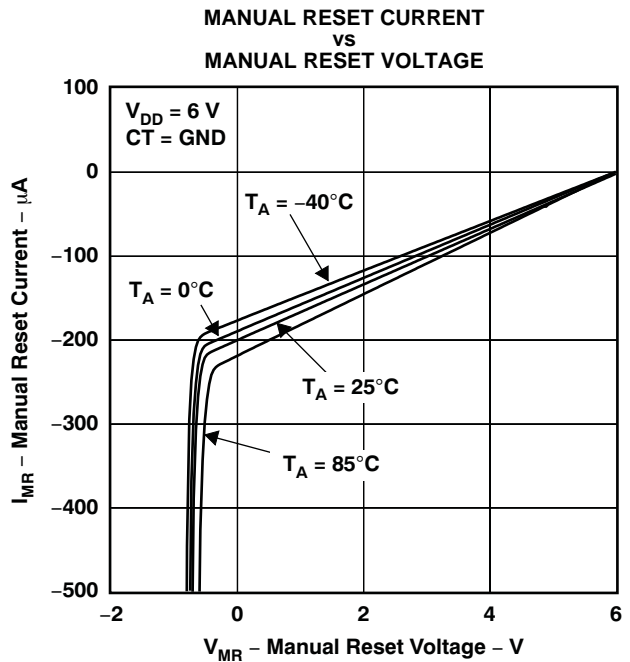


Figure 2.

**TYPICAL CHARACTERISTICS (continued)**

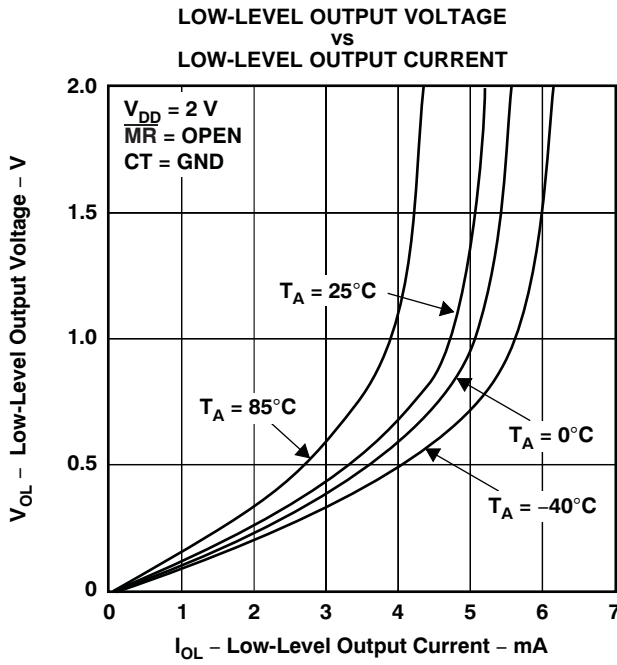


Figure 3.

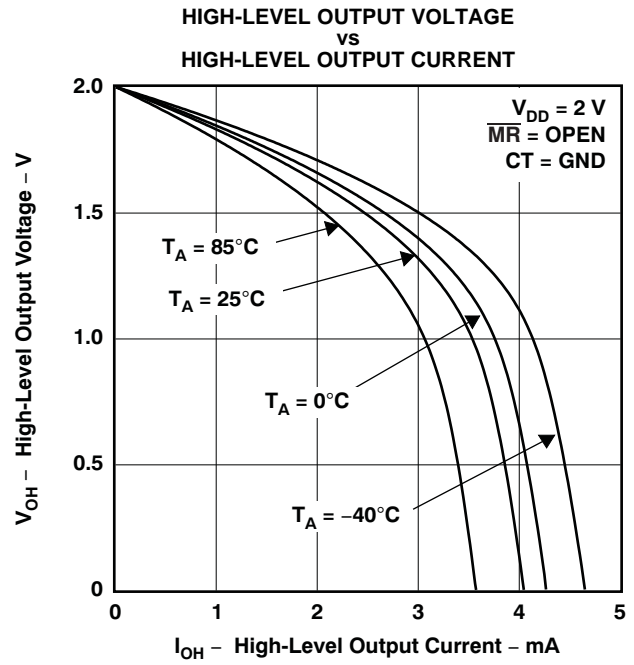


Figure 4.

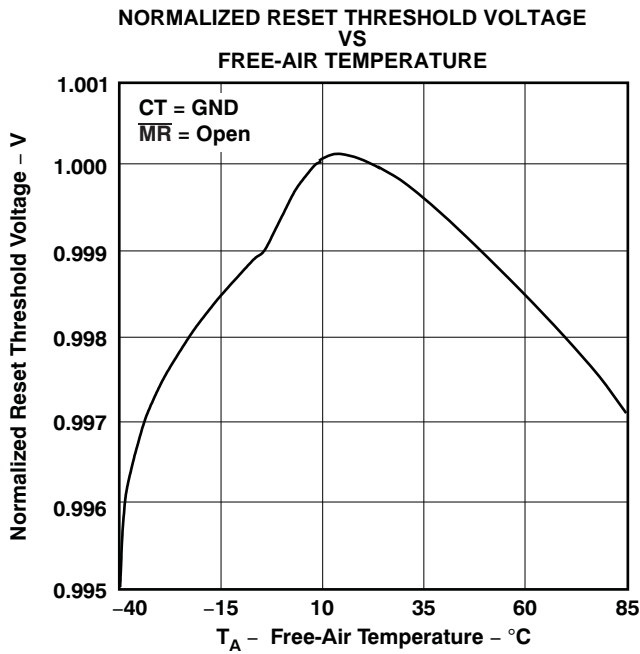


Figure 5.

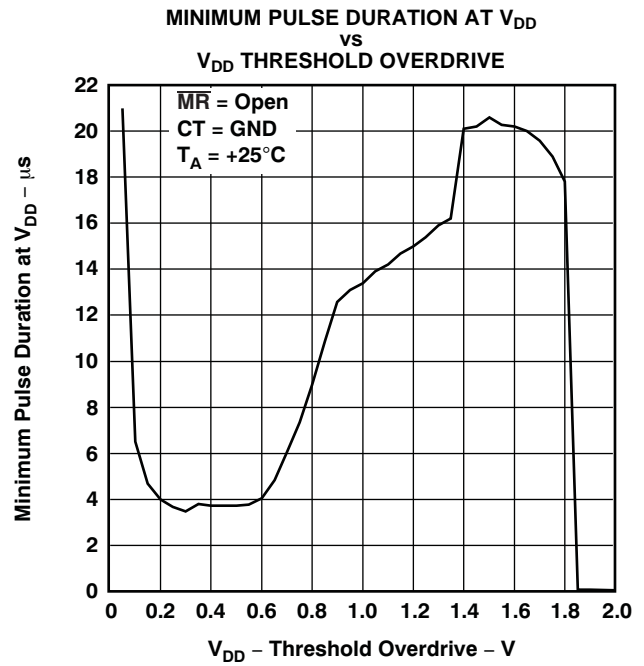


Figure 6.

**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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| HPA00531DBVR     | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836E18DBVR   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836E18DBVRG4 | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836E18DBVT   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836E18DBVTG4 | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836H30DBVR   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836H30DBVRG4 | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836H30DBVT   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836H30DBVTG4 | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836J25DBVR   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836J25DBVRG4 | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836J25DBVT   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836J25DBVTG4 | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836K33DBVR   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836K33DBVRG4 | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836K33DBVT   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836K33DBVTG4 | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836L30DBVR   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836L30DBVRG4 | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836L30DBVT   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3836L30DBVTG4 | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3837E18DBVT   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3837E18DBVTG4 | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3837J25DBVR   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3837J25DBVRG4 | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TPS3837J25DBVT   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3837J25DBVTG4 | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3837K33DBVR   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3837K33DBVRG4 | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3837K33DBVT   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3837K33DBVTG4 | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3837L30DBVR   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3837L30DBVRG4 | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3837L30DBVT   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3837L30DBVTG4 | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838E18DBVR   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838E18DBVRG4 | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838E18DBVT   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838E18DBVTG4 | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838J25DBVR   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838J25DBVRG4 | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838J25DBVT   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838J25DBVTG4 | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838K33DBVR   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838K33DBVRG4 | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838K33DBVT   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838K33DBVTG4 | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838K33DRVR   | ACTIVE                | SON          | DRV             | 6    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838K33DRVRG4 | ACTIVE                | SON          | DRV             | 6    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838K33DRVT   | ACTIVE                | SON          | DRV             | 6    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838K33DRVTG4 | ACTIVE                | SON          | DRV             | 6    | 250         | 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> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| TPS3838L30DBVR   | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838L30DBVRG4 | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838L30DBVT   | ACTIVE                | SOT-23       | DBV             | 5    | 250         | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| TPS3838L30DBVTG4 | ACTIVE                | SOT-23       | DBV             | 5    | 250         | 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.

**OBsolete:** 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 TPS3836E18, TPS3836H30, TPS3836J25, TPS3836K33, TPS3836L30, TPS3837E18, TPS3837J25, TPS3837K33, TPS3837L30, TPS3838E18, TPS3838J25, TPS3838K33, TPS3838L30 :**

- Automotive: [TPS3836E18-Q1](#), [TPS3836H30-Q1](#), [TPS3836J25-Q1](#), [TPS3836K33-Q1](#), [TPS3836L30-Q1](#), [TPS3837E18-Q1](#), [TPS3837J25-Q1](#), [TPS3837K33-Q1](#), [TPS3837L30-Q1](#), [TPS3838E18-Q1](#), [TPS3838J25-Q1](#), [TPS3838K33-Q1](#), [TPS3838L30-Q1](#)
- Enhanced Product: [TPS3836L30-EP](#), [TPS3837K33-EP](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

**TAPE AND REEL INFORMATION**



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

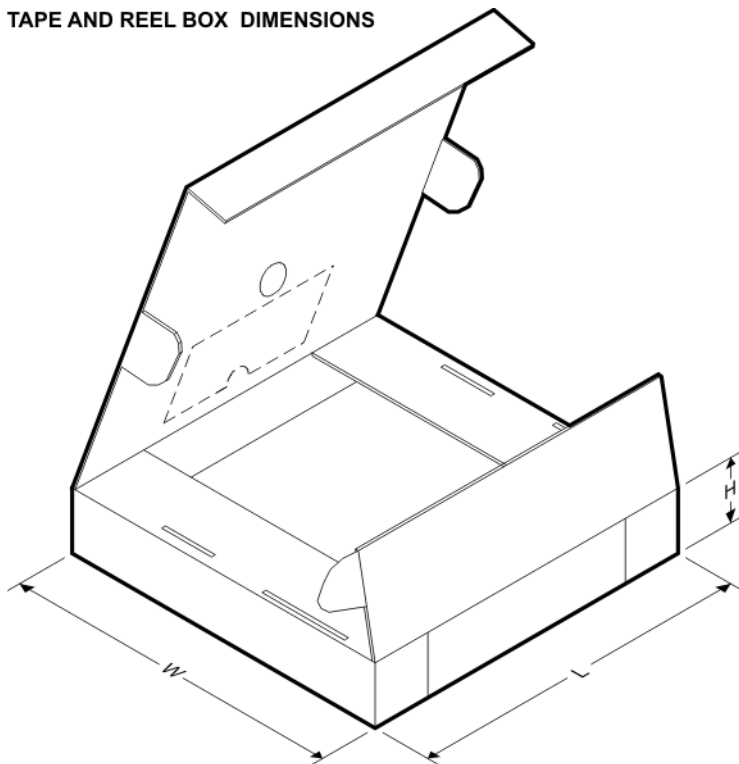


\*All dimensions are nominal

| 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 |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TPS3836E18DBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3836E18DBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3836H30DBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3836H30DBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3836J25DBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3836J25DBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3836K33DBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3836K33DBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3836L30DBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3836L30DBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3837E18DBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3837J25DBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3837J25DBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3837K33DBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3837K33DBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3837L30DBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3837L30DBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3838E18DBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |

| 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 |
|----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| TPS3838E18DBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3838J25DBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3838J25DBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3838K33DBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3838K33DBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3838K33DRVR | SON          | DRV             | 6    | 3000 | 179.0              | 8.4                | 2.2     | 2.2     | 1.2     | 4.0     | 8.0    | Q2            |
| TPS3838K33DRVT | SON          | DRV             | 6    | 250  | 179.0              | 8.4                | 2.2     | 2.2     | 1.2     | 4.0     | 8.0    | Q2            |
| TPS3838L30DBVR | SOT-23       | DBV             | 5    | 3000 | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| TPS3838L30DBVT | SOT-23       | DBV             | 5    | 250  | 180.0              | 9.0                | 3.15    | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

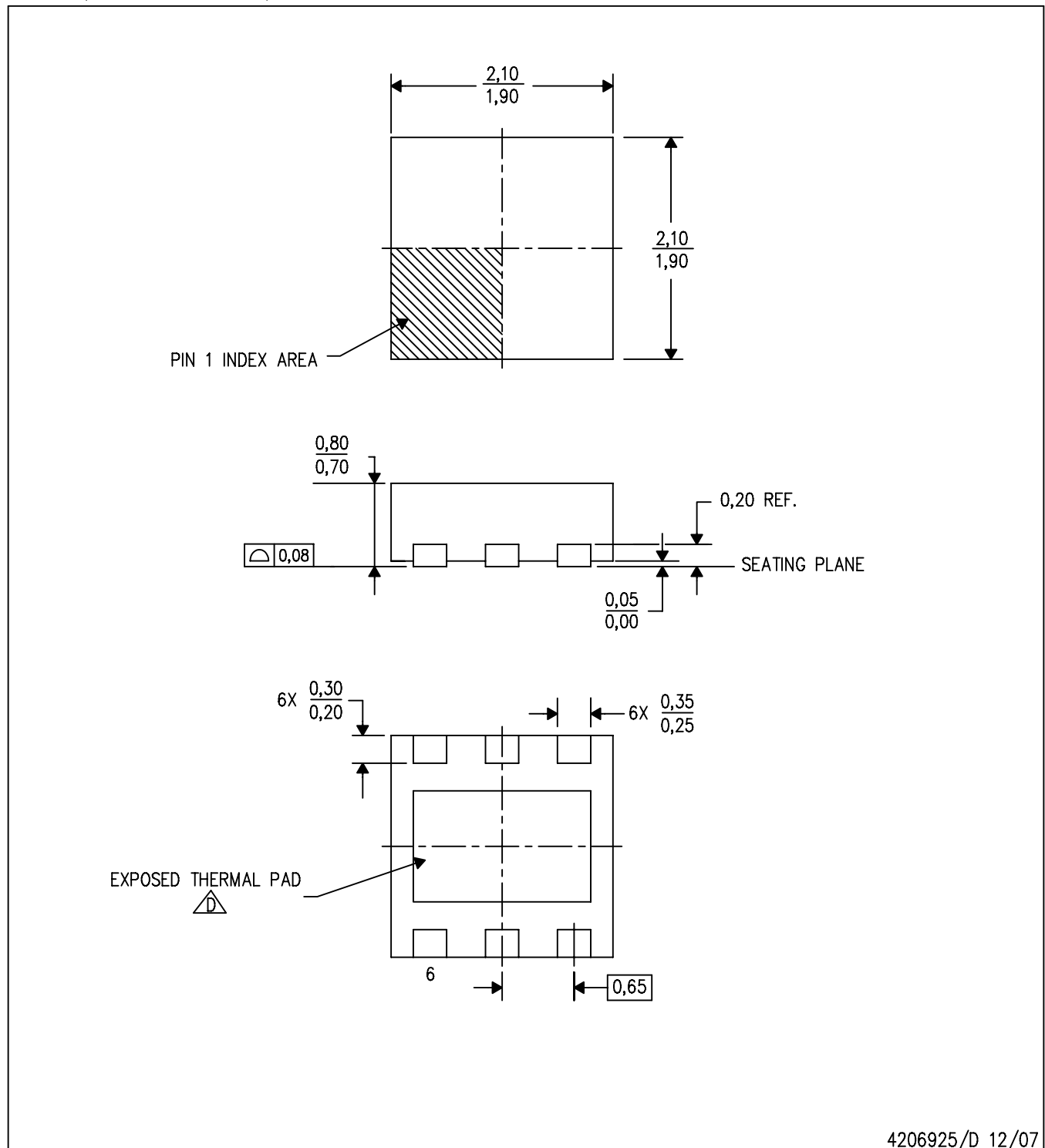
| Device         | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TPS3836E18DBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TPS3836E18DBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |
| TPS3836H30DBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TPS3836H30DBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |
| TPS3836J25DBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TPS3836J25DBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |
| TPS3836K33DBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TPS3836K33DBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |

| Device         | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| TPS3836L30DBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TPS3836L30DBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |
| TPS3837E18DBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |
| TPS3837J25DBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TPS3837J25DBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |
| TPS3837K33DBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TPS3837K33DBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |
| TPS3837L30DBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TPS3837L30DBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |
| TPS3838E18DBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TPS3838E18DBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |
| TPS3838J25DBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TPS3838J25DBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |
| TPS3838K33DBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TPS3838K33DBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |
| TPS3838K33DRVR | SON          | DRV             | 6    | 3000 | 195.0       | 200.0      | 45.0        |
| TPS3838K33DRVT | SON          | DRV             | 6    | 250  | 195.0       | 200.0      | 45.0        |
| TPS3838L30DBVR | SOT-23       | DBV             | 5    | 3000 | 182.0       | 182.0      | 20.0        |
| TPS3838L30DBVT | SOT-23       | DBV             | 5    | 250  | 182.0       | 182.0      | 20.0        |




DRV (S-PDSO-N6)

PLASTIC SMALL OUTLINE



4206925/D 12/07

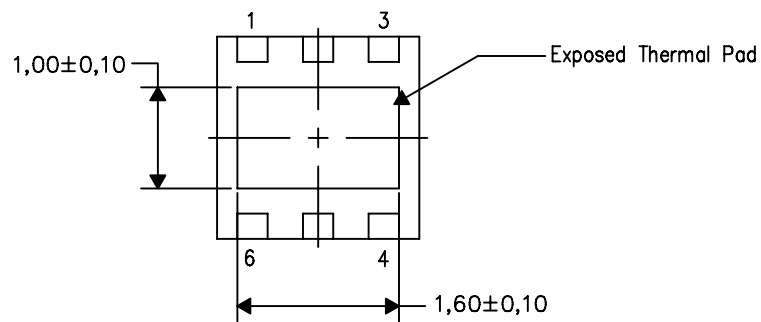
- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Small Outline No-Lead (SON) package configuration.
-  The package thermal pad must be soldered to the board for thermal and mechanical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

**THERMAL INFORMATION**

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, Quad Flatpack No-Lead Logic Packages, Texas Instruments Literature No. SCBA017. This document is available at [www.ti.com](http://www.ti.com).

The exposed thermal pad dimensions for this package are shown in the following illustration.



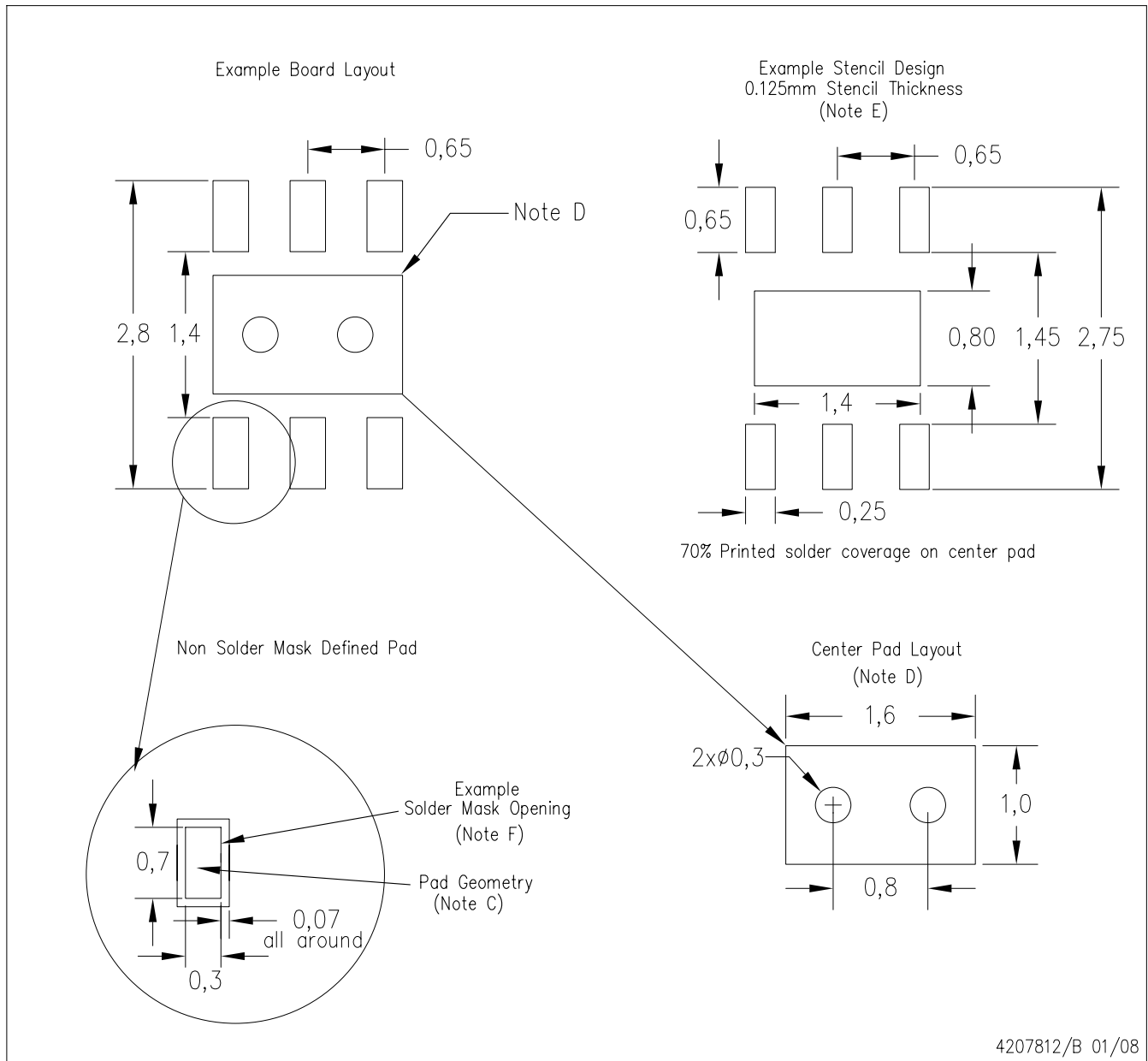
Bottom View

NOTE: All linear dimensions are in millimeters

Exposed Thermal Pad Dimensions



DRV (S-PDSO-N6)



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, QFN Packages, Texas Instruments Literature No. SCBA017, SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at [www.ti.com](http://www.ti.com) <<http://www.ti.com>>.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
  - Customers should contact their board fabrication site for solder mask tolerances.

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| DSP                         | <a href="http://dsp.ti.com">dsp.ti.com</a>                         |
| Clocks and Timers           | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>           |
| Interface                   | <a href="http://interface.ti.com">interface.ti.com</a>             |
| Logic                       | <a href="http://logic.ti.com">logic.ti.com</a>                     |
| Power Mgmt                  | <a href="http://power.ti.com">power.ti.com</a>                     |
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### Applications

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