

## features

- 5-Pin SC-70 (SOT-323) Package
- Supply Current of 9  $\mu\text{A}$  (Typ)
- Power-On Reset Generator With Fixed Delay Time
  - TPS3800 = 100 ms
  - TPS3801 = 200 ms
  - TPS3802 = 400 ms
- Precision Supply Voltage Monitor 1.8 V, 2.5 V, 2.7 V, 3 V, 3.3 V, 5 V, and Adjustable
- Manual Reset Input (Except TPS3801–01)
- Temperature Range . . .  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$

## description

The TPS380x family of supervisory circuits provide circuit initialization and timing supervision, primarily for DSPs 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  $V_{\text{DD}}$  (or SENSE) and keeps  $\overline{\text{RESET}}$  active as long as  $V_{\text{DD}}$  (or SENSE) remains below the threshold voltage ( $V_{\text{IT}}$ ). An internal timer delays the return of the output to the inactive state (high) to ensure proper system reset. The delay time ( $t_d$ ) starts after  $V_{\text{DD}}$  (or SENSE) has risen above the threshold voltage ( $V_{\text{IT}}$ ). When the supply voltage drops below the threshold voltage ( $V_{\text{IT}}$ ) the output becomes active (low) again. No external components are required. All the devices of this family have a fixed sense-threshold voltage ( $V_{\text{IT}}$ ) set by an internal voltage divider, except for the TPS3801–01, which can be customized with two external resistors at the SENSE input.

The TPS380x devices, except the TPS3801–01, incorporate a manual reset input ( $\overline{\text{MR}}$ ). A low level at  $\overline{\text{MR}}$  causes  $\overline{\text{RESET}}$  to become active.

The product spectrum is designed for supply voltages of 1.8 V, 2.5 V, 2.7 V, 3 V, 3.3 V, and 5 V. The circuits are available in a 5-pin SC-70 (SOT-323) package, which is only about half the size of a 5-pin SOT-23 package.

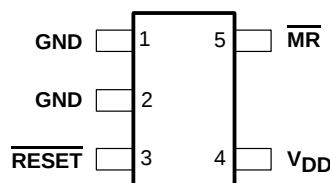
The TPS3801–01 can monitor voltages as low as 1.14 V, depending on the configuration of the external resistor divider.

The TPS380x devices are characterized for operation over a temperature range of  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

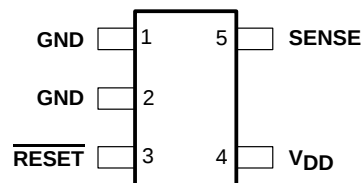
## applications

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

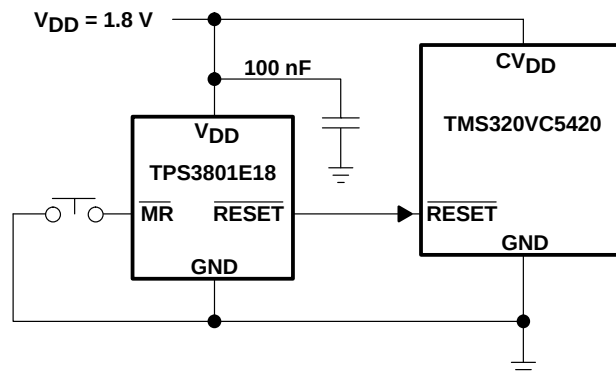
TPS380x . . . DCK PACKAGE  
(TOP VIEW)



TPS3801–01 . . . DCK PACKAGE  
(TOP VIEW)



## typical applications



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**TEXAS  
INSTRUMENTS**

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# TPS3800-xx, TPS3801-xx, TPS3802-xx

## ULTRA-SMALL SUPPLY VOLTAGE SUPERVISORS

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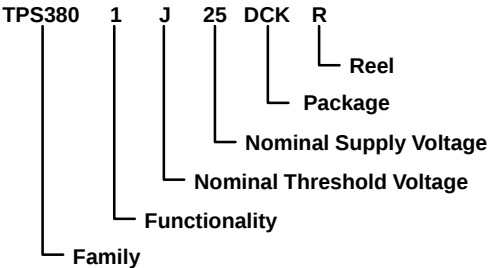
AVAILABLE OPTIONS

| T <sub>A</sub> | DEVICE NAME   | THRESHOLD VOLTAGE | TYP DELAY TIME | MARKING |
|----------------|---------------|-------------------|----------------|---------|
| –40°C to 85°C  | TPS3801-01DCK | 1.14 V            | 200 ms         | ARF     |
|                | TPS3801E18DCK | 1.71 V            | 200 ms         | ARE     |
|                | TPS3801J25DCK | 2.25 V            | 200 ms         | NJA     |
|                | TPS3800G27DCK | 2.5 V             | 95 ms          | ARI     |
|                | TPS3801L30DCK | 2.64 V            | 200 ms         | NPA     |
|                | TPS3801K33DCK | 2.93 V            | 200 ms         | NWA     |
|                | TPS3802L30DCK | 2.64 V            | 380 ms         | ASA     |
|                | TPS3802K33DCK | 2.93 V            | 380 ms         | ARK     |
|                | TPS3801T50DCK | 4 V               | 25 ms          | AVI     |
|                | TPS3801I50DCK | 4.55 V            | 200 ms         | NSA     |

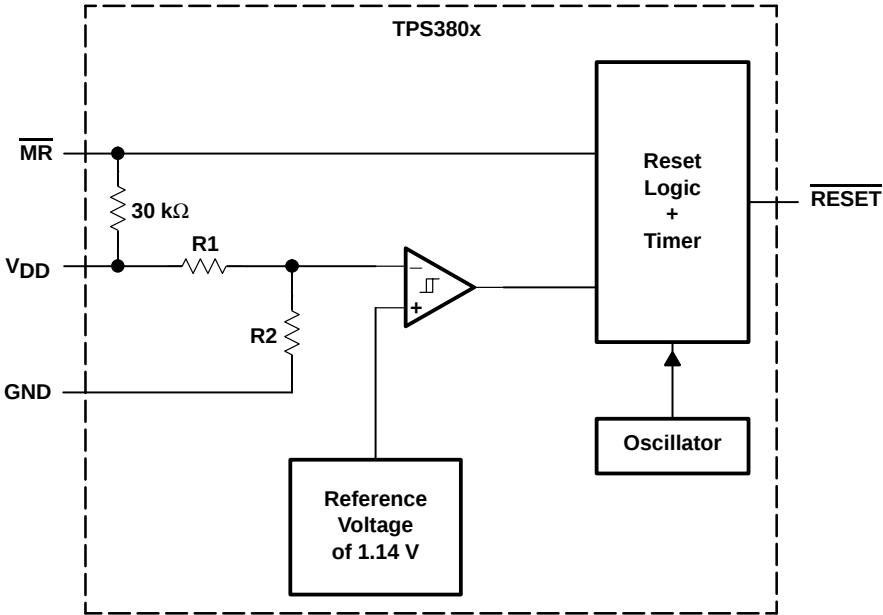
FUNCTION/TRUTH TABLE, TPS380x

| $\overline{\text{MR}}$ | V <sub>DD</sub> >V <sub>IT</sub> | $\overline{\text{RESET}}$ |
|------------------------|----------------------------------|---------------------------|
| L                      | 0                                | L                         |
| L                      | 1                                | L                         |
| H                      | 0                                | L                         |
| H                      | 1                                | H                         |

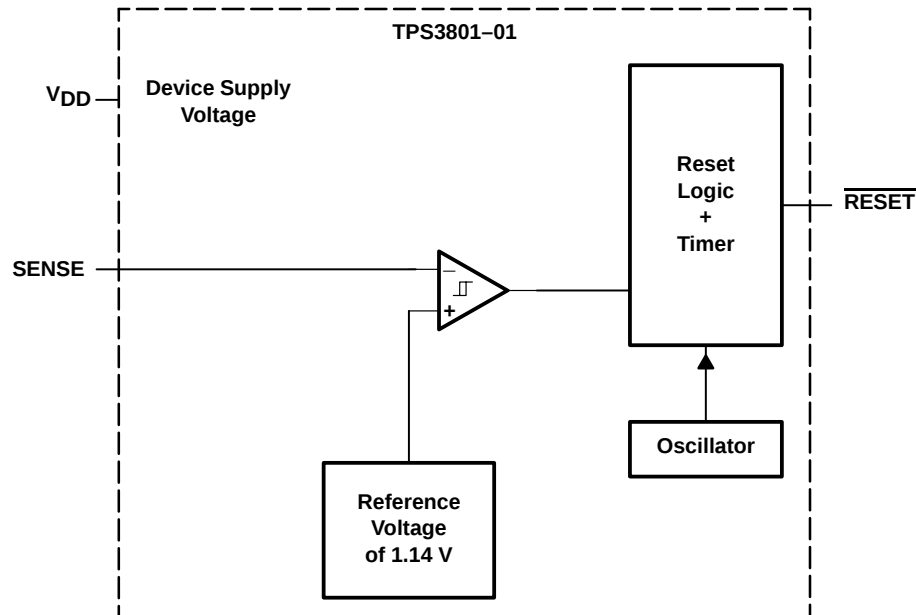
ORDERING INFORMATION



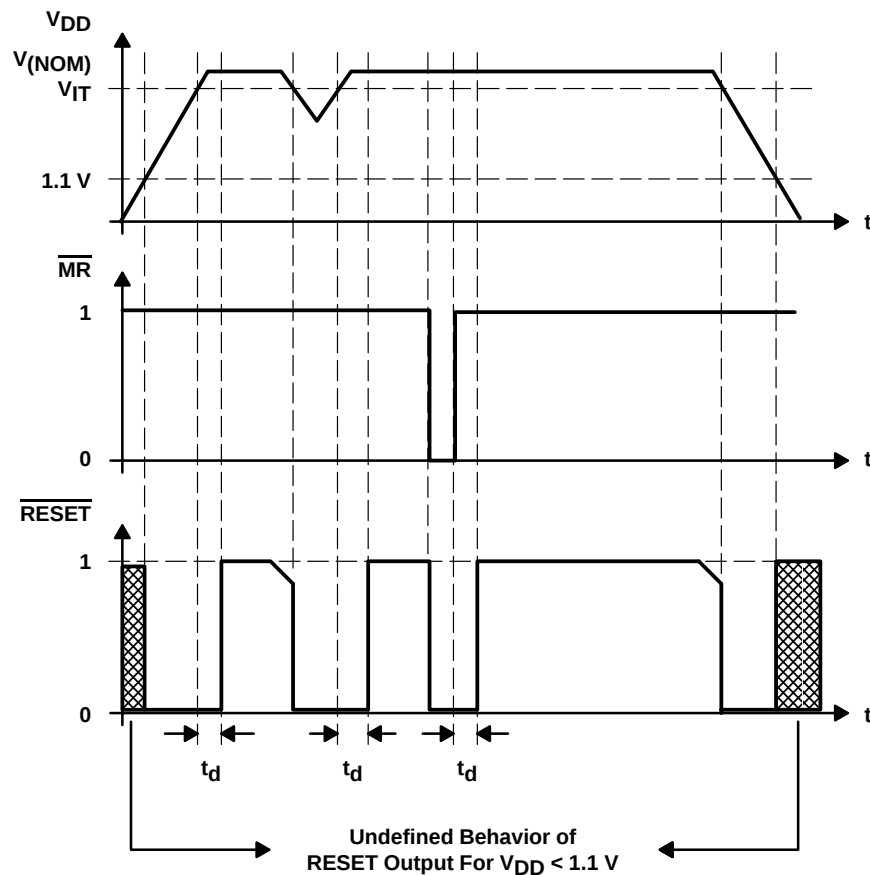
### functional block diagram



functional block diagram (continued)



timing diagram



NOTE:  $\overline{RESET}$  should not be forced high during the power-up sequence (until  $V_{DD} > 1.1\text{ V}$ ).

# TPS3800-xx, TPS3801-xx, TPS3802-xx ULTRA-SMALL SUPPLY VOLTAGE SUPERVISORS

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## absolute maximum ratings over operating free-air temperature (unless otherwise noted)<sup>†</sup>

|                                                                |                              |
|----------------------------------------------------------------|------------------------------|
| Supply voltage, $V_{DD}$ (see Note1)                           | 7 V                          |
| All other pins (see Note 1)                                    | –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 $V_I > V_{DD}$ )  | ±20 mA                       |
| Output-clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{DD}$ ) | ±20 mA                       |
| Continuous total power dissipation                             | See Dissipation Rating Table |
| 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                        |

<sup>†</sup> 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 should not be operated at 7 V for more than  $t=1000h$  continuously.

DISSIPATION RATING TABLE

| 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 |
|---------|------------------------------------------|---------------------------------------------------|------------------------------------------|------------------------------------------|
| DCK     | 321 mW                                   | 2.6 mW/°C                                         | 206 mW                                   | 167 mW                                   |

## recommended operating conditions at specified temperature range

|                                                                              |                                                                  | MIN                 | MAX                 | UNIT |
|------------------------------------------------------------------------------|------------------------------------------------------------------|---------------------|---------------------|------|
| Supply voltage, $V_{DD}$                                                     | TPS3801J25, TPS3801L30,<br>TPS3801K33, TPS3801I50,<br>TPS3801T50 | 2                   | 6                   | V    |
|                                                                              | All other devices                                                | 1.6                 | 4                   | V    |
| Input voltage, $V_I$                                                         |                                                                  | 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 free-air temperature range, $T_A$                                  |                                                                  | –40                 | 85                  | °C   |



# TPS3800-xx, TPS3801-xx, TPS3802-xx ULTRA-SMALL SUPPLY VOLTAGE SUPERVISORS

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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>OH</sub>                     | High-level output voltage                           | V <sub>DD</sub> = 1.6 V to 6 V I <sub>OH</sub> = –500 μA   |                                                                              | V <sub>DD</sub> –0.2 |      |       | V    |
|                                     |                                                     | V <sub>DD</sub> = 3.3 V I <sub>OH</sub> = –2 mA            |                                                                              | V <sub>DD</sub> –0.4 |      |       |      |
|                                     |                                                     | V <sub>DD</sub> = 6 V I <sub>OH</sub> = –4 mA (see Note 4) |                                                                              | V <sub>DD</sub> –0.4 |      |       |      |
| V <sub>OL</sub>                     | Low-level output voltage                            | V <sub>DD</sub> = 1.6 V to 6 V, I <sub>OL</sub> = 500 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> = 4 mA (see Note 4) |                                                                              | 0.4                  |      |       |      |
| Power-up reset voltage (see Note 2) |                                                     | V <sub>DD</sub> ≥ 1.1 V, I <sub>OL</sub> = 50 μA           |                                                                              | 0.2                  |      |       | V    |
| V <sub>IT–</sub>                    | Negative-going input threshold voltage (see Note 3) | TPS380x-01                                                 | T <sub>A</sub> = –40°C to 85°C                                               | 1.117                | 1.14 | 1.163 | V    |
|                                     |                                                     | TPS380xE18                                                 |                                                                              | 1.67                 | 1.71 | 1.75  |      |
|                                     |                                                     | TPS380xJ25                                                 |                                                                              | 2.2                  | 2.25 | 2.3   |      |
|                                     |                                                     | TPS380xG27                                                 |                                                                              | 2.45                 | 2.5  | 2.55  |      |
|                                     |                                                     | TPS380xL30                                                 |                                                                              | 2.58                 | 2.64 | 2.7   |      |
|                                     |                                                     | TPS380xK33                                                 |                                                                              | 2.87                 | 2.93 | 2.99  |      |
|                                     |                                                     | TPS380xI50                                                 |                                                                              | 4.45                 | 4.55 | 4.65  |      |
|                                     |                                                     | TPS380xT50                                                 |                                                                              | 3.92                 | 4    | 4.08  |      |
| V <sub>hys</sub>                    | Hysteresis                                          | TPS380x-01                                                 |                                                                              | 15                   |      |       | mV   |
|                                     |                                                     | TPS380xx18                                                 |                                                                              | 25                   |      |       |      |
|                                     |                                                     | TPS380xx25                                                 |                                                                              | 30                   |      |       |      |
|                                     |                                                     | TPS380xx27                                                 |                                                                              | 35                   |      |       |      |
|                                     |                                                     | TPS380xx30                                                 |                                                                              | 35                   |      |       |      |
|                                     |                                                     | TPS380xx33                                                 |                                                                              | 40                   |      |       |      |
|                                     |                                                     | TPS380xx50                                                 |                                                                              | 60                   |      |       |      |
| I <sub>IH</sub>                     | High-level input current                            | $\overline{\text{MR}}$                                     | $\overline{\text{MR}}$ = 0.7×V <sub>DD</sub> , V <sub>DD</sub> = 6 V         | –40                  | –60  | –100  | μA   |
| I <sub>IL</sub>                     | Low-level input current                             |                                                            | $\overline{\text{MR}}$ = 0 V, V <sub>DD</sub> = 6 V                          | –130                 | –200 | –340  |      |
| I <sub>I</sub>                      | Input current                                       | SENSE                                                      |                                                                              | –25                  |      | 25    | nA   |
| I <sub>DD</sub>                     | Supply current                                      | TPS3801J25, TPS3801L30, TPS3801K33, TPS3801I50, TPS3801T50 | V <sub>DD</sub> = 2 V, $\overline{\text{MR}}$ and output unconnected         | 9 12                 |      |       | μA   |
|                                     |                                                     | TPS3801I50, TPS3801T50                                     | V <sub>DD</sub> = 6 V, $\overline{\text{MR}}$ and output unconnected         | 20 25                |      |       |      |
|                                     |                                                     | TPS3801-01                                                 | V <sub>DD</sub> = 1.6 V, SENSE = 0 V to V <sub>DD</sub> , output unconnected | 7 10                 |      |       |      |
|                                     |                                                     |                                                            | V <sub>DD</sub> = 4 V, SENSE = 0 V to V <sub>DD</sub> , output unconnected   | 9 12                 |      |       |      |
|                                     |                                                     | TPS3801E18, TPS3800G27, TPS3802K33, TPS3802L30             | V <sub>DD</sub> = 1.6 V, $\overline{\text{MR}}$ and output unconnected       | 8 11                 |      |       |      |
|                                     |                                                     |                                                            | V <sub>DD</sub> = 4 V, $\overline{\text{MR}}$ and output unconnected         | 13 18                |      |       |      |
| C <sub>i</sub>                      | Input capacitance                                   | V <sub>I</sub> = 0 V to V <sub>DD</sub>                    |                                                                              | 5                    |      |       | 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 the best stability of the threshold voltage, a bypass capacitor (0.1-µF ceramic) should be placed near the supply terminals.  
4. Only valid for the TPS3801J25, TPS3801L30, TPS3801K33, TPS3801I50, and TPS3801T50.



# TPS3800-xx, TPS3801-xx, TPS3802-xx ULTRA-SMALL SUPPLY VOLTAGE SUPERVISORS

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timing requirements at  $R_L = 1\text{ M}\Omega$ ,  $C_L = 50\text{ pF}$ ,  $T_A = 25^\circ\text{C}$

| PARAMETER         |             | TEST CONDITIONS                                                                                    | MIN | TYP | MAX | UNIT          |
|-------------------|-------------|----------------------------------------------------------------------------------------------------|-----|-----|-----|---------------|
| $t_w$ Pulse width | at SENSE    | $V_{DD} = 1.6\text{ V}$ , $V_{IH} = 1.1 \times V_{IT-}$ , $V_{IL} = 0.9 \times V_{IT-}$            | 1   |     |     | $\mu\text{s}$ |
|                   | at $V_{DD}$ | $V_{DD} = V_{IT-} + 0.2\text{ V}$ , $V_{DD} = V_{IT-} - 0.2\text{ V}$                              | 3   |     |     |               |
|                   | at MR       | $V_{DD} \geq V_{IT-} + 0.2\text{ V}$ , $V_{IL} = 0.3 \times V_{DD}$ , $V_{IH} = 0.7 \times V_{DD}$ | 100 |     |     | ns            |

switching characteristics at  $R_L = 1\text{ M}\Omega$ ,  $C_L = 50\text{ pF}$ ,  $T_A = 25^\circ\text{C}$

| PARAMETER                                                    |                         | TEST CONDITIONS                                                                                          | MIN | TYP | MAX | UNIT          |
|--------------------------------------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------|-----|-----|-----|---------------|
| $t_d$ Delay time                                             | TPS3801T50              | $V_{DD} \geq V_{IT-} + 0.2\text{ V}$ ,<br>$MR \geq 0.7 \times V_{DD}$<br>See timing diagram              | 15  | 25  | 35  | ms            |
|                                                              | TPS3800                 |                                                                                                          | 60  | 95  | 140 |               |
|                                                              | TPS3801                 |                                                                                                          | 120 | 200 | 280 |               |
|                                                              | TPS3802                 |                                                                                                          | 240 | 380 | 560 |               |
| $t_{PHL}$ Propagation (delay) time, high-to-low-level output | MR to RESET delay       | $V_{DD} \geq V_{IT-} + 0.2\text{ V}$ ,<br>$V_{IL} = 0.3 \times V_{DD}$ ,<br>$V_{IH} = 0.7 \times V_{DD}$ |     | 15  |     | ns            |
|                                                              | $V_{DD}$ to RESET delay | $V_{IL} = V_{IT-} - 0.2\text{ V}$ ,<br>$V_{IH} = V_{IT-} + 0.2\text{ V}$                                 |     | 1   |     | $\mu\text{s}$ |
|                                                              | SENSE to RESET          |                                                                                                          |     |     |     |               |

## TYPICAL CHARACTERISTICS

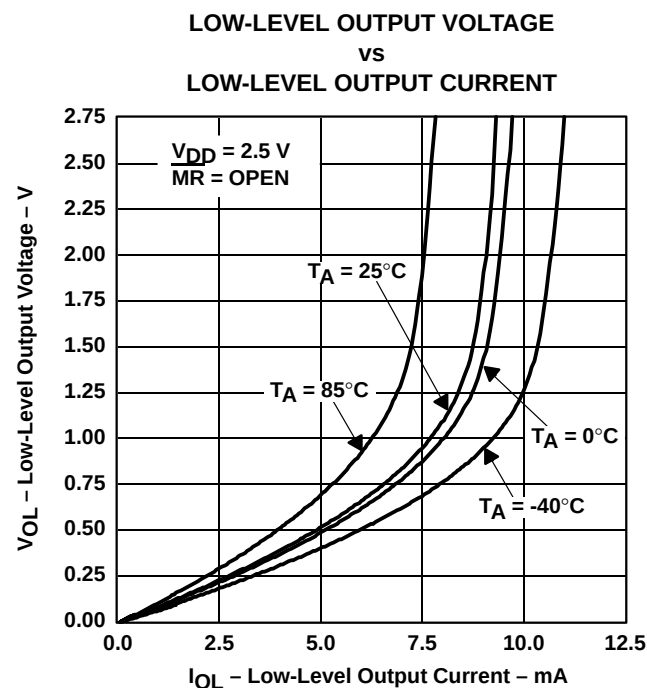


Figure 1

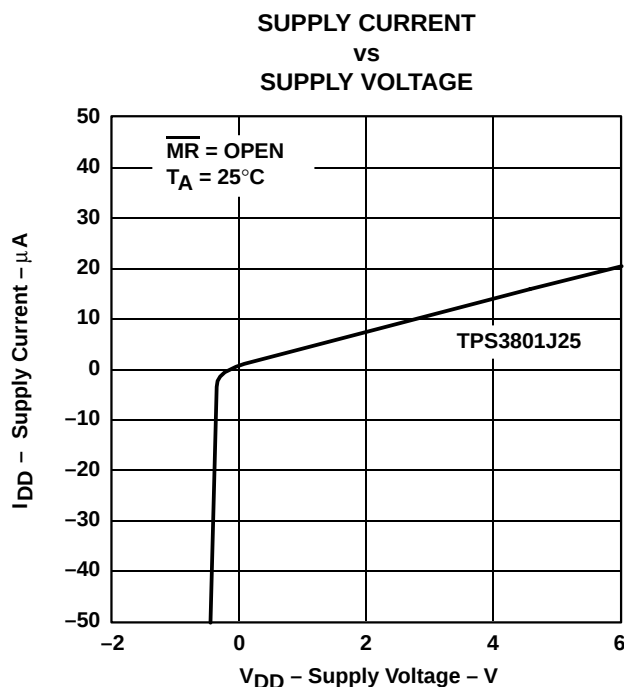


Figure 2

# TYPICAL CHARACTERISTICS

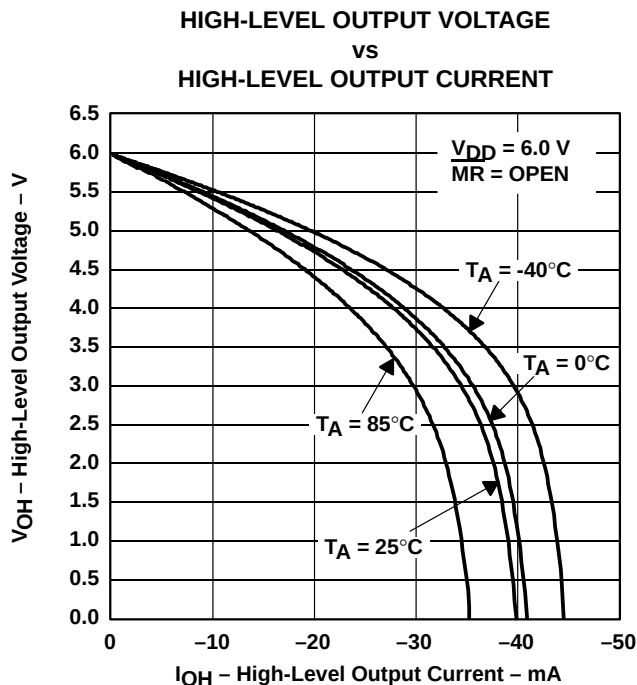


Figure 3

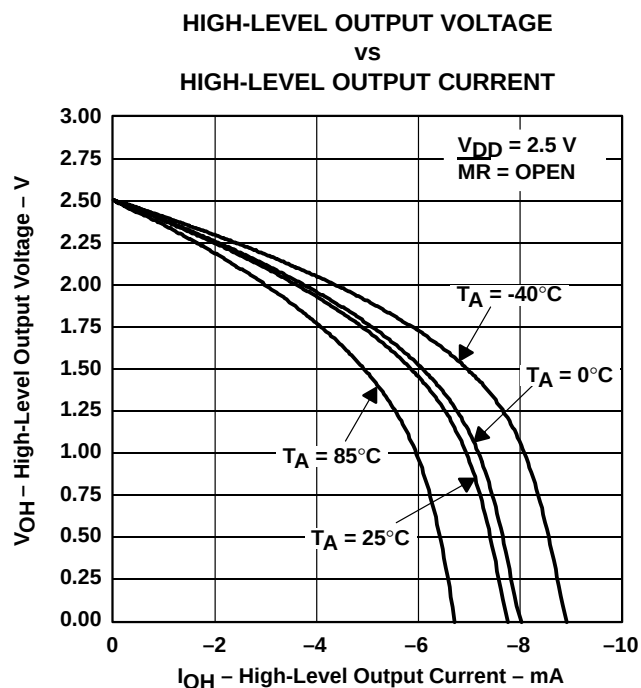


Figure 4

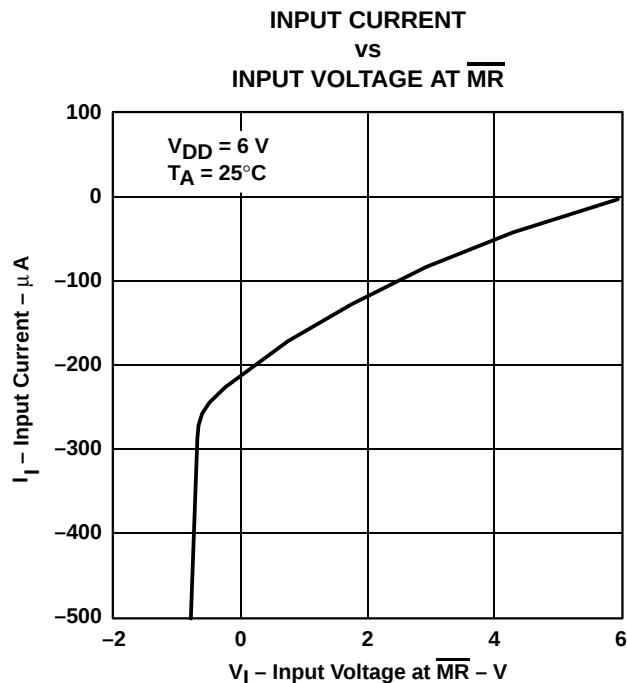


Figure 5

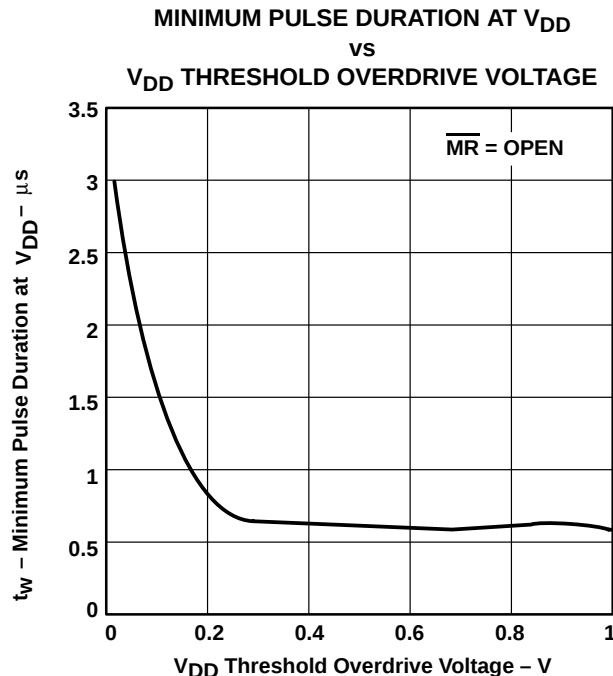


Figure 6

TPS3800-xx, TPS3801-xx, TPS3802-xx  
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TYPICAL CHARACTERISTICS

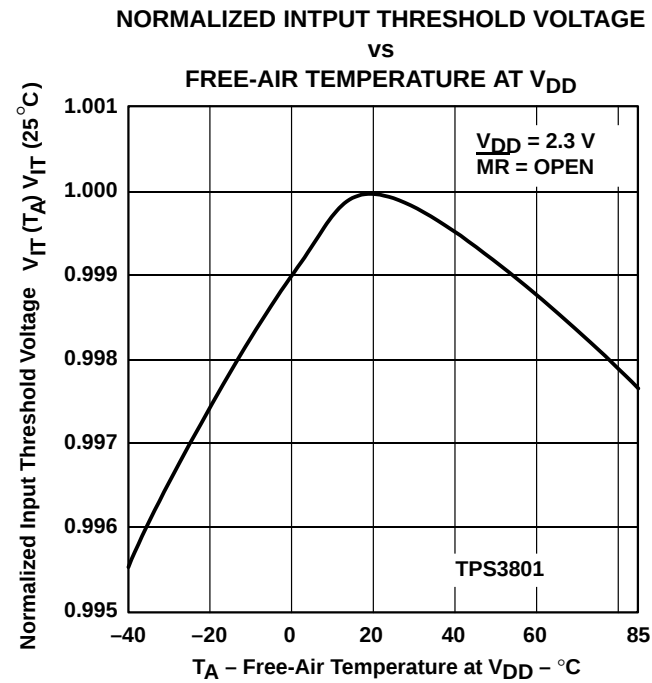


Figure 7

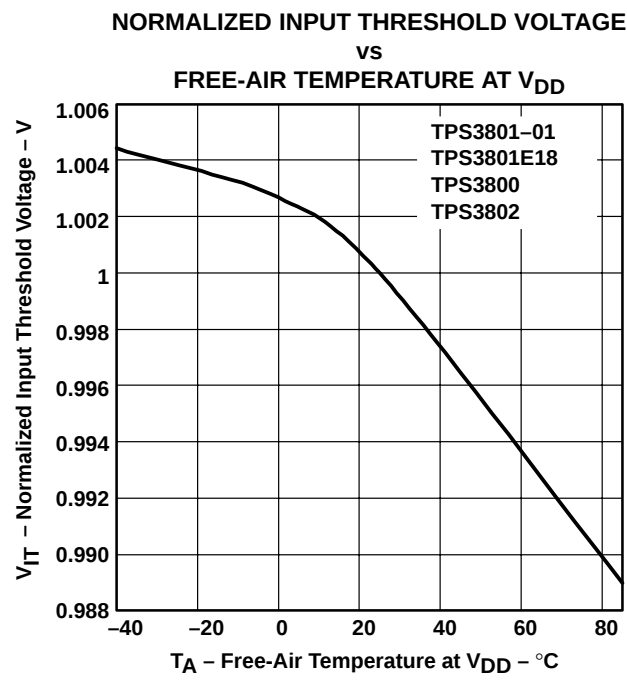


Figure 8

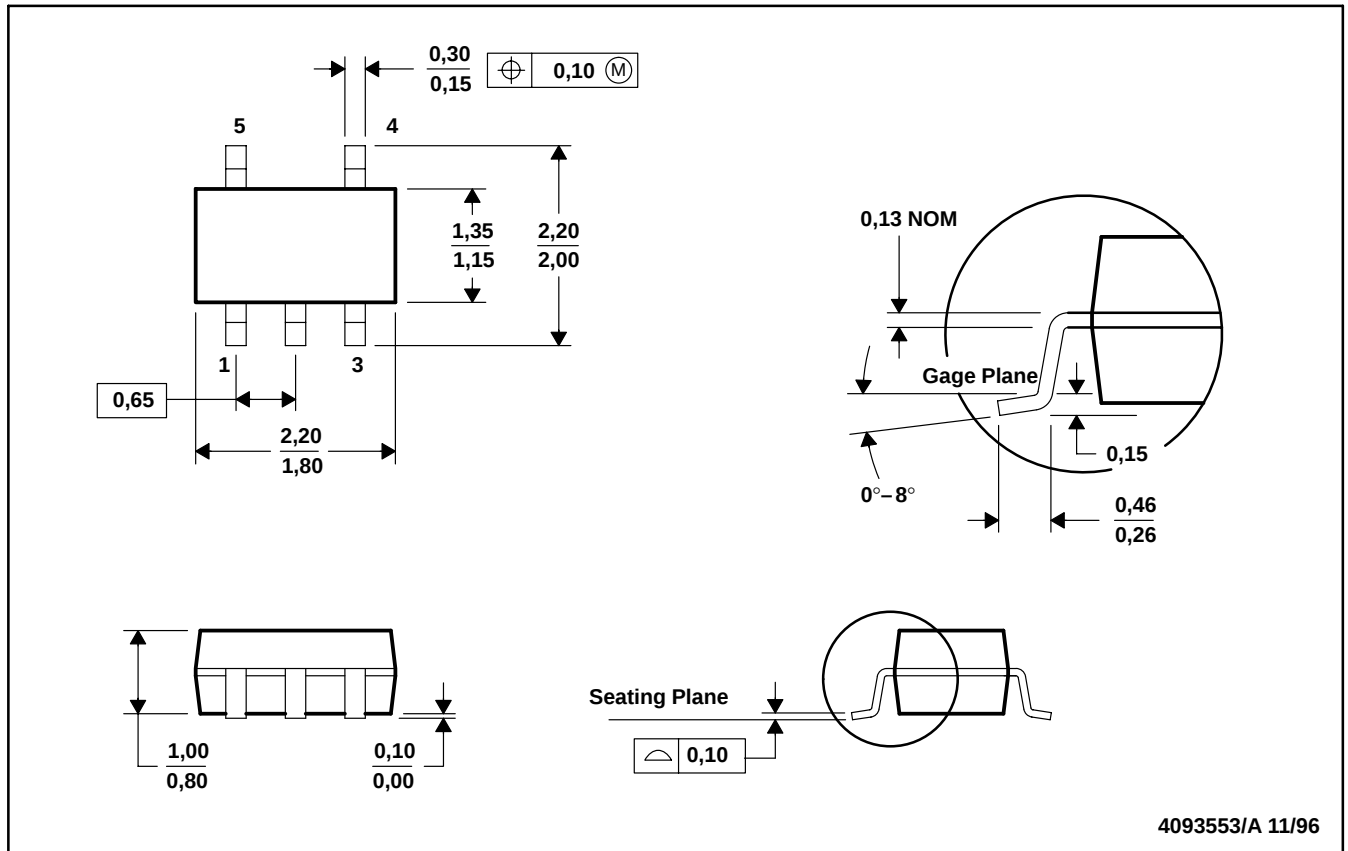
TPS3800-xx, TPS3801-xx, TPS3802-xx  
ULTRA-SMALL SUPPLY VOLTAGE SUPERVISORS

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MECHANICAL DATA

DCK (R-PDSO-G5)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES: A. All linear dimensions are in millimeters.  
B. This drawing is subject to change without notice.  
C. Body dimensions include mold flash or protrusion.

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