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TPS3801/09 - Smallest SVS for Monitoring DSPs and Processors

Application Report

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TPS3801/09 – Smallest SVS for Monitoring DSPs and Processors

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ABSTRACT

This application report describes the TPS3801 and TPS3809 supply voltage supervisor (SVS) families of devices. The report gives a general introduction to reset generators followed by an overview of the technical parameters and the special features of the TPS380x. Each feature is discussed separately. Measurements make it easy to understand SVS principles of operation. Typical applications that increase system reliability are included. Layout considerations and design issues help in the system integration of the TPS3801 and TPS3809.

1 Introduction

After power-on, a digital system must be forced into a definite initial state. Digital signal processors (DSPs), microcontrollers, and microprocessors have a reset input for this purpose. In the simple application shown in Figure 1, an RC network is connected to the RESET input to deliver the necessary reset pulse. After switching on the power supply, this circuit keeps the logic level at the RESET input low for a time determined by the capacitor and resistor values. This delay time, required by the system to complete the initialization, allows the power supply to become stable.

However, this circuit has some disadvantages. In cases of brief reductions of the supply voltage, it does not work correctly. It does not recognize spikes, because the voltage at the RESET input does not decrease as fast as the supply voltage due to the capacitor. Malfunction is thus possible. Only if V_{DD} decreases by more than 0.7 V, the capacitor can be discharged quickly through the diode. Because of tolerances of discrete components (especially capacitors), the delay time can not be calculated very precisely.

The problem is that this solution does not deliver a proper low to high transition at reset input. It is a charge curve of a capacitor, which is for a certain period of time undefined between low and high.
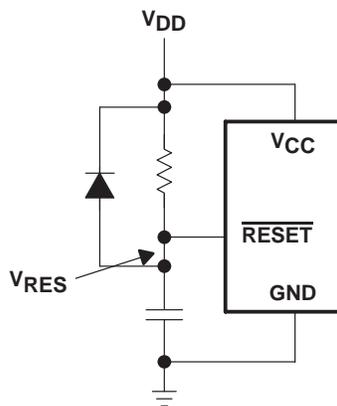

Figure 1. A Simple Reset Solution

The reliability of a computer system is very important, several features are offered to prevent errors: power-fail interrupts can signal dangerous conditions in time, a battery back-up can protect the content of the memory, and so on. In smaller systems this may be too expensive, and, in most applications, it is not required. It is usually sufficient to force the microcomputer into a defined state after a serious voltage drop.

To implement these functions while preventing problems, the following circuit features are required:

- Accurate detection of a voltage drop below the critical voltage
- Generation of a reset signal when the supply voltage is below the device specific threshold voltage
- Keeping the reset signal active for a defined time after the supply voltage has returned to its nominal value to ensure proper initialization of the microprocessor or DSP

The Texas Instruments TPS3801 and TPS3809 families of integrated circuits fulfill the requirements described above without requiring additional external components.

2 Circuit Description

This section describes the TPS3801 and TPS3809 devices and features.

2.1 Overview of Features

Figure 2 is an overview of the features of TPS3801 and TPS3809.
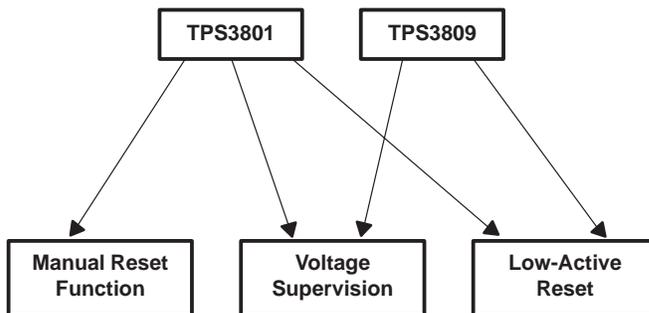

Figure 2. Features Overview

2.2 Supervised Supply Voltages

Table 1 gives an overview of the nominal supply voltages, which can be supervised by the TPS3801 and TPS3809. The values in the column of threshold voltage are the negative-going threshold voltages. The differences between positive-going and negative-going threshold voltage is explained in Chapter 3.

Table 1. The Nominal Supply Voltages and Their Threshold Voltages

DEVICES	NOMINAL SUPPLY VOLTAGE	THRESHOLD VOLTAGE
TPS3801J25, TPS3809J25	2.5 V	2.25 V
TPS3801L30, TPS3809L30	3.0 V	2.64 V
TPS3801K33, TPS3809K33	3.3 V	2.93 V
TPS3801I50, TPS3809I50	5.0 V	4.55 V

2.3 Terminals

The TPS3801 is available in a 5-pin SOT323 package, the TPS3809 in a 3-pin SOT23 package. More information about the package dimensions are in Chapter 6.

Figure 3. Terminal Assignment

2.4 Terminal Functions

Terminal functions lists and describes the functions of the TPS3801 and TPS3809 terminals.

Table 2. Terminal Functions

TERMINAL			I/O	Description
NAME	NO.			
	TPS3801	TPS3809		
GND	1, 2	1	Negative power supply	Ground. Connects the circuit with ground and zero-volt reference for manual reset input $\overline{MR}$.
$\overline{MR}$	5	–	Digital input, low-active	Manual reset. Input to trigger a Reset pulse by an external component or an external signal source.
$\overline{RESET}$	3	2	Digital output, low-active	Output for triggering a reset at the connected controller or DSP, shows the state of the internal reset logic.
V_{DD}	4	3	Positive power supply	Supplies the circuit with voltage and input for the voltage supervision.

2.5 Block Diagram

Figure 4 shows a block diagram of the TPS3801 and TPS3809. One important block is the stable voltage reference which has a voltage of 1.137 V. The supply voltage is divided by two internal resistors and compared with the reference voltage by a comparator. If the divided voltage is below the threshold voltage, the reset logic lets the reset output become active. Otherwise the reset output is inactive.

The values of the two internal resistors depend on the nominal supply voltage. In sum the resistors have a typical value of 660 kΩ. The ratio of the resistors is fixed, but the absolute values of the resistors vary up to 20% because of process variations. The typical resistor values are shown in Table 3.

Table 3. Typical Values of Internal Voltage Divider

DEVICES	R_1 TYPICAL	R_2 TYPICAL
TPS3801I50, TPS3809I50	165 kΩ	495 kΩ
TPS3801K33, TPS3809K33	256 kΩ	404 kΩ
TPS3801L30, TPS3809L30	284 kΩ	376 kΩ
TPS3801J25, TPS3809J25	334 kΩ	326 kΩ

The TPS3801 has in addition to the TPS3809 a manual reset input. This input has an internal pullup resistor of 30 kΩ to V_{DD}. Therefore an external resistor is not necessary if the function is not used.

The oscillator clocks the reset logic to generate the delay time of about 200ms.
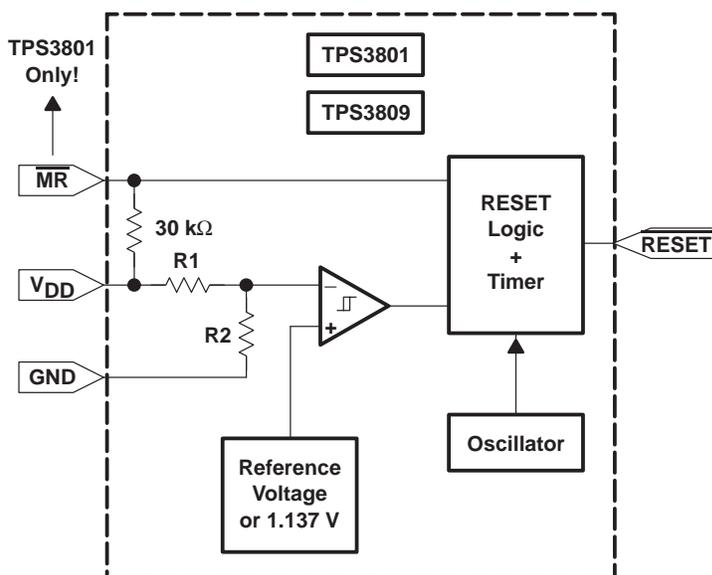
Figure 4. Block Diagram of TPS3801 and TPS3809

2.6 Basic Timings

Figure 5 summarizes the two reasons for an active reset at a TPS3801. The behavior of the TPS3809 is the same without the manual reset input.

If the supply voltage is below 1.1 V, there is no defined reset signal. If the supply voltage increases above 1.1 V, the reset output has a stable low signal. The reset gets inactive one delay time after the supply voltage has increased the threshold voltage.

A logical zero at the manual reset input triggers the same as a breaking-in of the supply voltage: the reset becomes active. One delay time after the manual reset input gets a logical high signal again, the reset output becomes inactive.

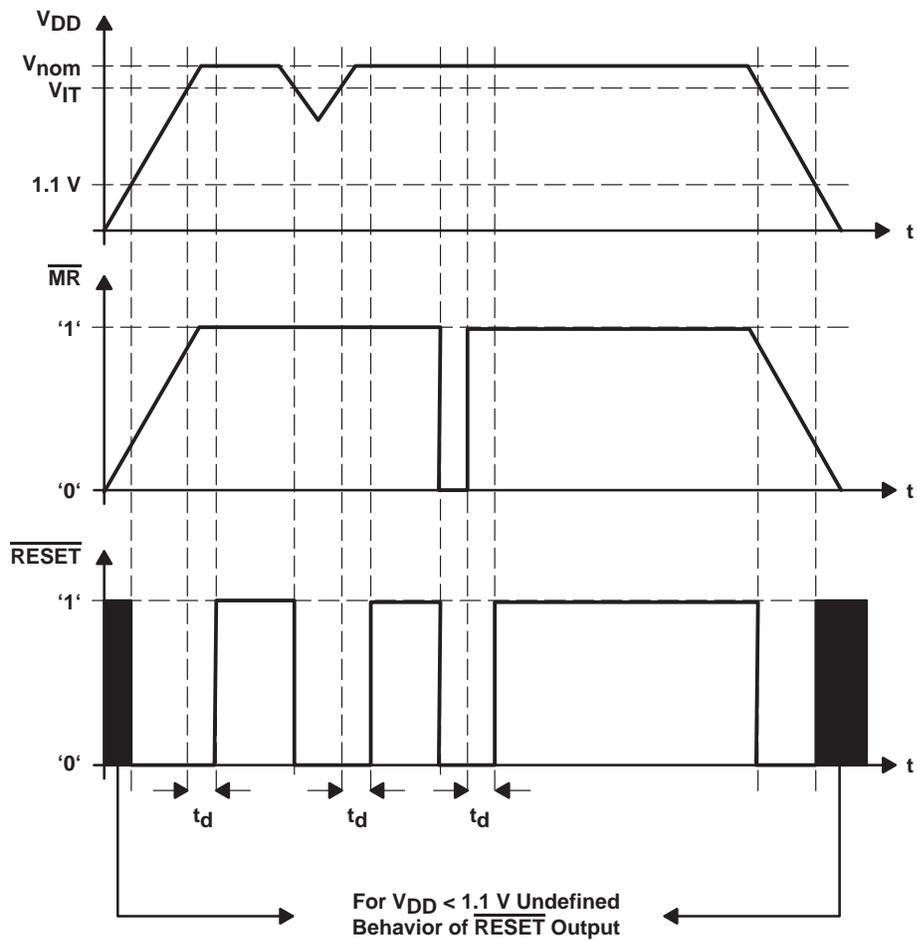**Figure 5. Timing Diagram of TPS3801**

3   Voltage Supervision at the V$_{DD}$ Terminal

3.1   Functional Description

The main function of an SVS is to supervise a supply voltage and to trigger a reset signal if necessary.

If the supply voltage falls below the negative-going threshold voltage V$_{IT-}$, the device has to assert a reset. The reset returns to the inactive state, about 200 ms after the voltage again exceeds the positive-going threshold voltage V$_{IT+}$. This delay time t$_d$ of 200 ms is necessary to ensure that the crystal oscillator works stable after a power-on reset and that the processor initialization could be completed.

The difference between the negative-going and the positive-going threshold voltage is called hysteresis V$_{hys}$:

$$V_{IT+} = V_{IT-} + V_{hys} \tag{1}$$

The reason for the hysteresis is to avoid toggling of the reset output if the voltage is noisy.

For a better understanding, a timing diagram with these parameters is given:
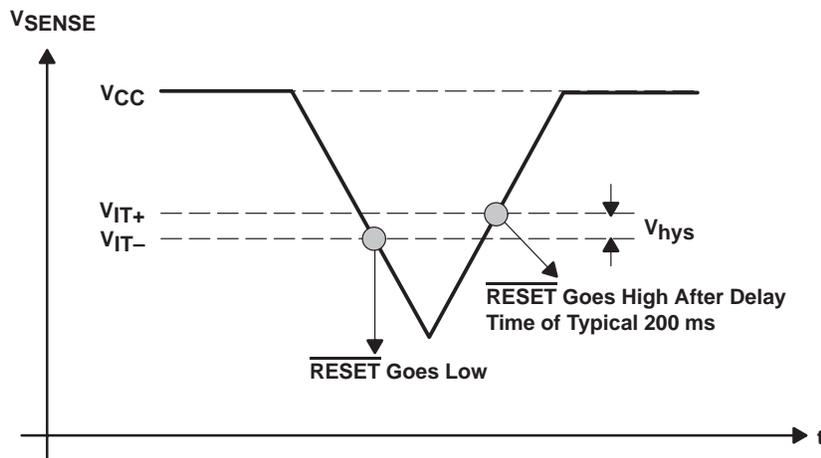
Figure 6. Relations Between V$_{IT+}$, V$_{IT-}$, and V$_{hys}$

The devices are specified in a temperature range of −40°C to +85°C and for an input voltage range of 2 V to 6 V. Due to the wide range of temperature and input voltage and because of process variations the threshold voltages vary a little. The minimum, typical and maximum values of the negative-going threshold voltages and the typical hysteresis can be taken from Table 4.

Table 4. The Specified Values of V$_{IT-}$ and the Hysteresis, V$_{hys}$

DEVICES	V$_{IT-}$ – MIN	V$_{IT-}$ – TYP	V$_{IT-}$ – MAX	V$_{hys}$ – TYP
TPS3801I50 TPS3809I50	4.45 V	4.55 V	4.65 V	60 mV
TPS3801K33 TPS3809K33	2.87 V	2.93 V	2.99 V	40 mV
TPS3801L30 TPS3809L30	2.58 V	2.64 V	2.70 V	35 mV
TPS3801J25 TPS3809J25	2.20 V	2.25 V	2.30 V	30 mV

3.2   Measurement of a Voltage Drop on the Supply Line

To demonstrate the typical operation of an SVS the following measurement has been made. The measurement circuit of Figure 7 has been used.
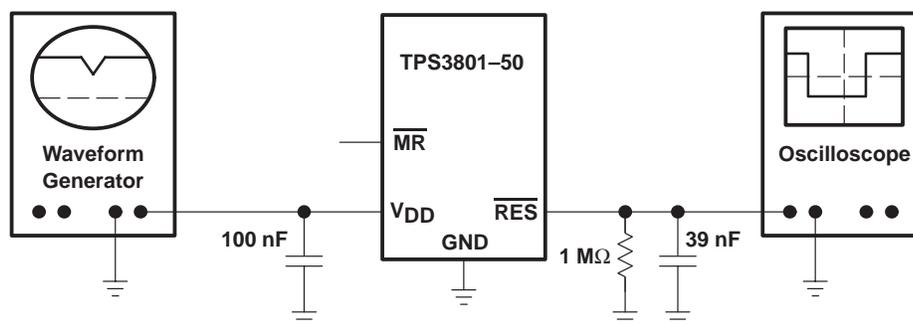
Figure 7. Measurement Circuit for Measuring the Reaction of a Voltage Drop

The waveform generator supplies the supervisor and generates the voltage drop to trigger a reset pulse. The 1 MΩ resistor and the 39 pF capacitor are to simulate a CMOS load. The 100 nF capacitor at the V$_{DD}$ pin of the TPS3801 is recommended for all applications. The oscilloscope records the measurement data for the plot.
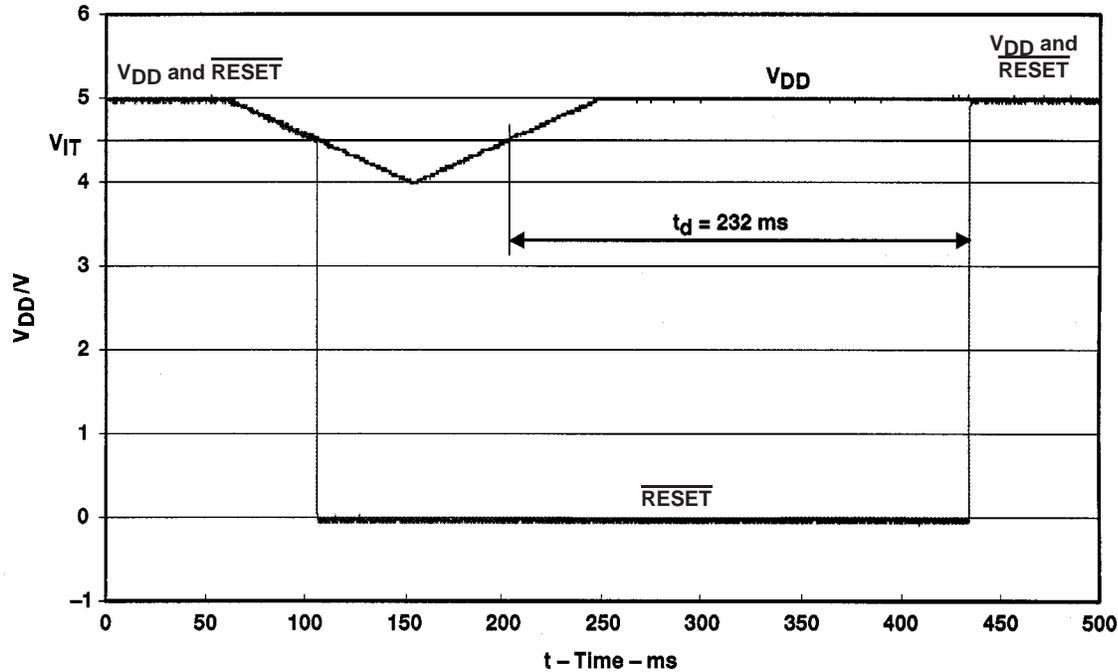
Figure 8. Measurement of the Voltage Drop at V_{DD}

A delay time of 232 ms is measured. This parameter is specified between 120 ms minimum value and 280 ms maximum value with a typical value of 200 ms. This wide range is because of variations in the process. The oscillator is built up internally with an RC network.

3.3 Threshold Overdrive Versus Pulsewidth

The datasheet specifies, that a voltage drop of 3 μs to at least 200 mV below the negative-going threshold voltage V_{IT-} must trigger a reset pulse. But what happens with a shorter, but deeper drop? This question is answered with the measurements shown in Figure 9 and Figure 10.

The x-axis shows the duration of the voltage drop, the y-axis shows the breakdown voltage of the drop down from 5 V respectively 2.5 V.
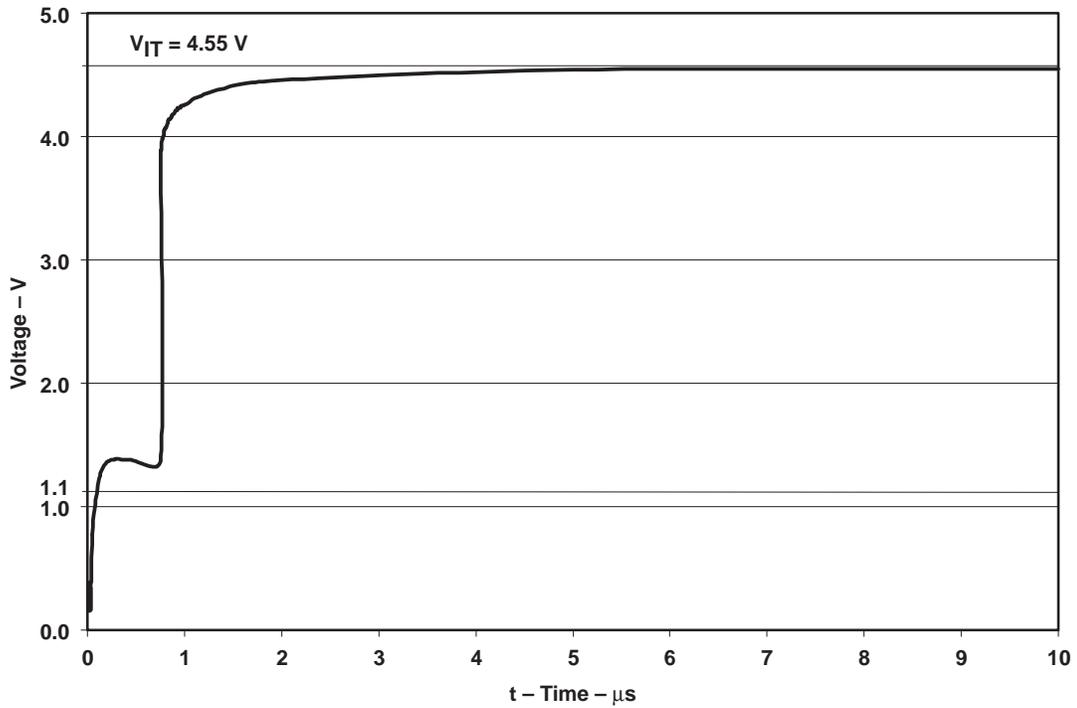
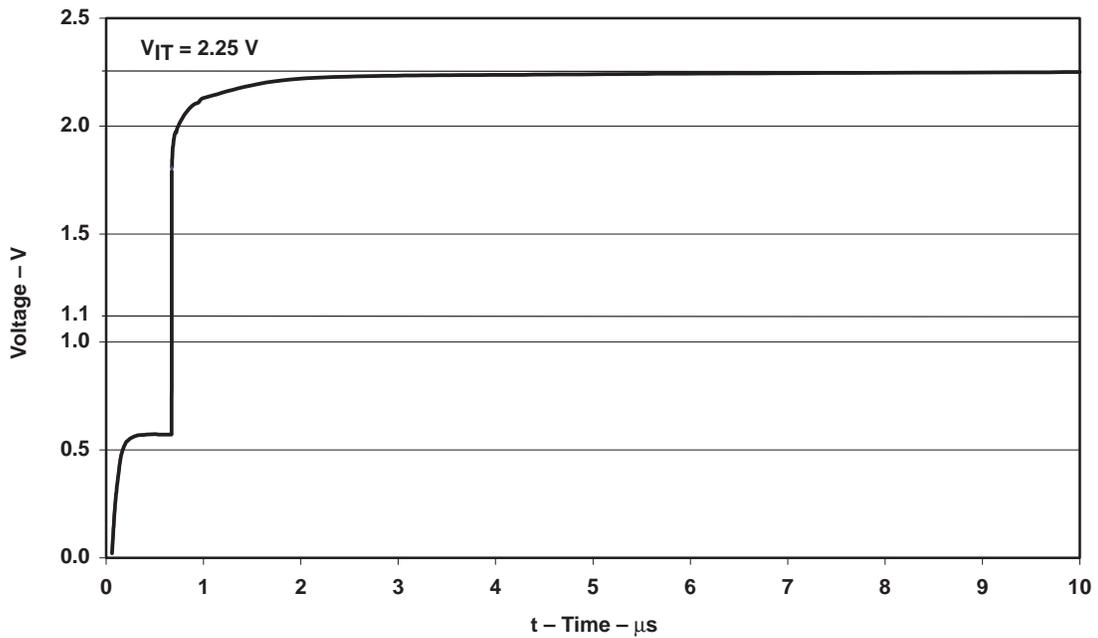**Figure 9. Breakdown Voltage versus Pulsewidth at a TPS380xI50**

Figure 10. Breakdown Voltage versus Pulsewidth at a TPS380xJ25

3.4 Making the Supervisor Circuit Less Sensitive

Supply voltage supervisors are designed to detect small voltage drops below the threshold voltage. The datasheet of TPS380x specifies, that a reset pulse from 200 mV above the threshold voltage V_{IT} to 200 mV below V_{IT} with a duration of 3 μs suffices to trigger a reset pulse. But not every system requires the detection of such small spikes, because these spikes do not influence the functionality of the system. In this case, it is possible to reduce the sensitivity of the undervoltage recognition.

A simple solution to this problem is to add a low pass filter in front of the V_{DD} input. The recommended capacitor at V_{DD} works as a part of the RC network.
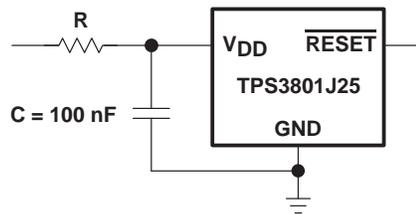

Figure 11. TPS3801 With a Low Pass Filter at V_{DD} Terminal

Care has to be so taken that the additional resistor does not alter the threshold voltage too much. The threshold voltage is determined by the internal voltage divider, like shown in the block diagram in Chapter 2. A resistor of $R_1 = 10$ kΩ in the RC combination raises the threshold voltage by 1.5% independent of the voltage version of the device. A R =1 kΩ resistor causes a rise in the threshold voltage of 0.15%, so that it can be ignored.

Figure 12 shows a measurement with different RC networks. The value of the capacitor is C = 100 nF, the resistor values are 100 Ω, 1 kΩ, and 10 kΩ. The device is a TPS3801J25 with a threshold voltage of 2.25 V.
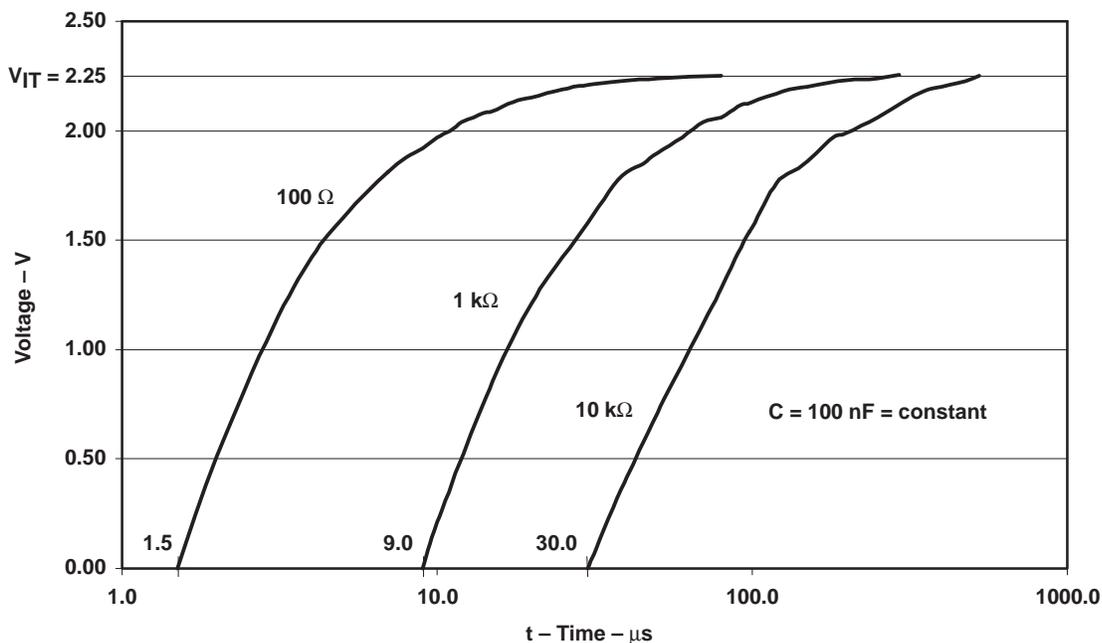

Figure 12. Breakdown Voltage versus Pulsewidth With a Low Pass Filter

4 Manual Reset

4.1 Functional Description

The manual reset is an input for triggering a reset by an external component. As an example, a pushbutton switch or a microcontroller or a DSP port can provide the manual reset. The reset will be asserted for the time of a low signal at manual reset input plus delay time t_d.

An internal pullup resistor of 30 kΩ between manual reset input and V_{DD} makes an external pullup resistor unnecessary. This input can be left floating, if it is not used.

4.2 A Measurement of Low Pulse at the Manual Reset Input

For a better illustration, a measurement of a low pulse of 100 ms at manual reset and the resulting reset pulse is shown in Figure 13. The measurement has been made at a TPS3801I50.
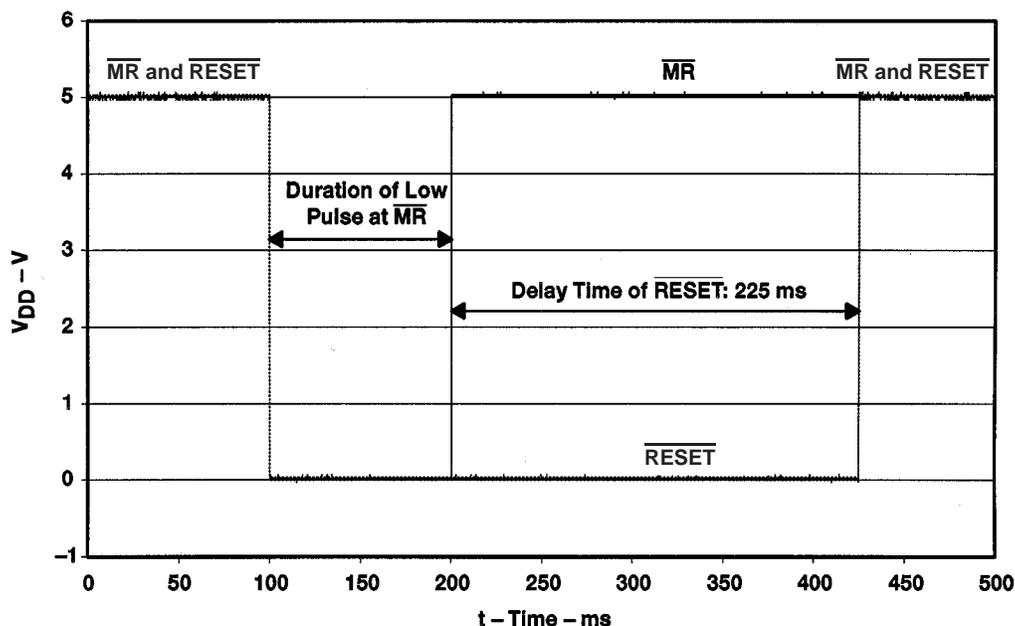

Figure 13. Reset Pulse, Triggered by Manual Reset

4.3 Minimum Conditions for Triggering a Manual Reset

As specified in the datasheet, a high-to-low transition from $0.7 \times V_{DD}$ to $0.3 \times V_{DD}$ with a duration of at least 100ns is enough to trigger a reset. For shorter signals at manual reset input, the triggering of a reset can not be assured.
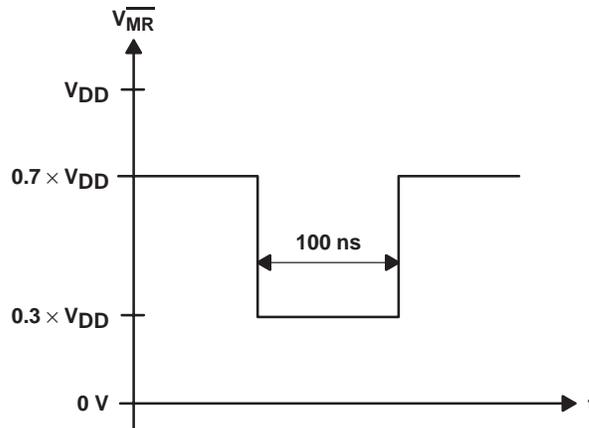
Figure 14. Minimum Conditions for Triggering a Reset at Manual Reset Input

4.4 Saving Current While Using the Manual Reset Function

4.4.1 Current Flow Off the Manual Reset Input

Figure 15 illustrates the internal structure of the manual reset input. It shows the internal pullup resistor of 30 kΩ, which causes a steady current flow, if $V\overline{MR} \neq V_{DD}$. If it is important to keep the current consumption as low as possible, the following two points are important to considerate:

- In normal operation $V\overline{MR}$ should be equal to V_{DD}. Thereby a steady current flow can be avoided.
- If a reset should be triggered with a low pulse at manual reset, it should be a short pulse.
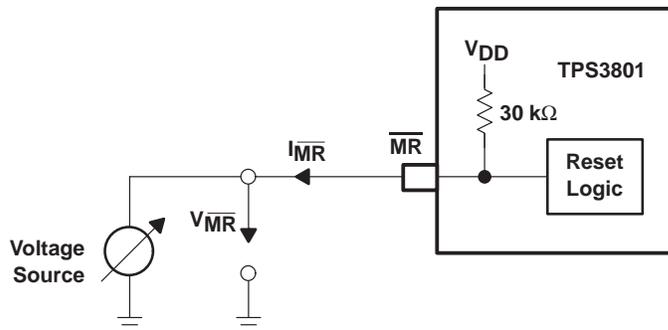
Figure 15. Internal Realization of the Manual Reset Circuit

The current out of the manual reset terminal depends on the difference between V_{DD} and $V\overline{MR}$ and can be easily calculated with equation 2.

$$I_{\overline{MR}} = \frac{V_{DD} - V_{\overline{MR}}}{30 \ k\Omega} \tag{2}$$

4.4.2 Lateral Current From V_{DD} to GND

There is another possibility to reduce power consumption while using the manual reset. During a transition at $\overline{MR}$ from high-to-low or low-to-high, there is a lateral current of more than 300 μA at a voltage of 2.5 V. Power consumption is important in a battery powered system and a steep edge in both directions helps to minimize power consumption. The following Figure 16 shows the lateral current in dependence of the voltage at manual reset input.

Figure 16. Lateral Current in Dependence of the Voltage at a CMOS Input Stage

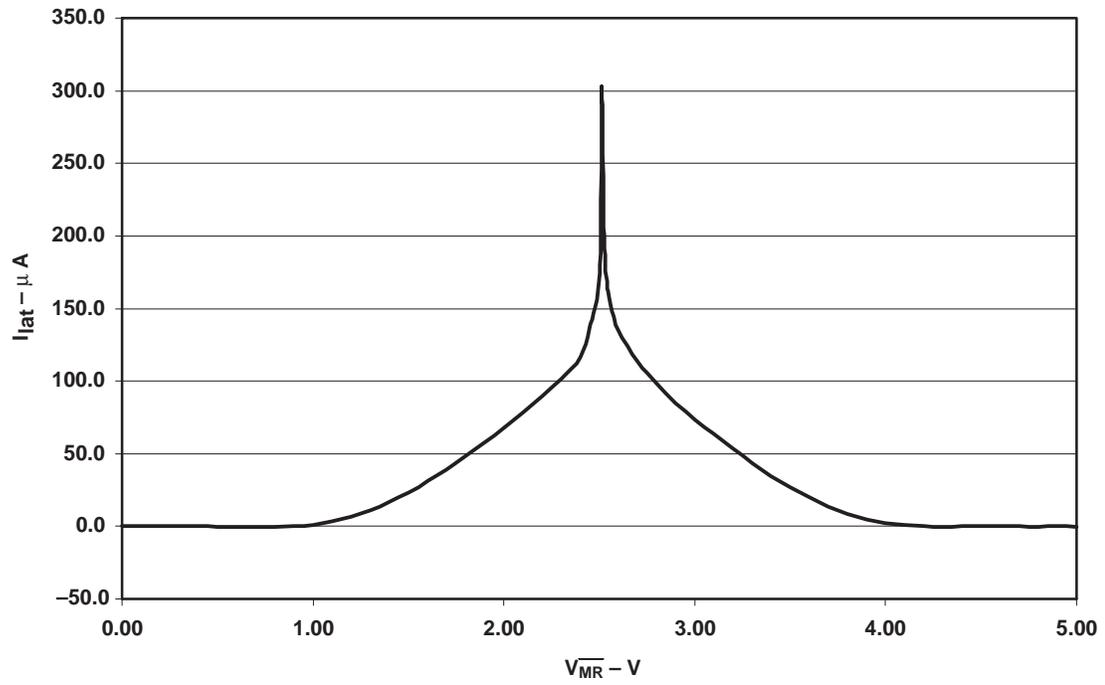# 5 Applications

5.1 A TPS3801 Supervises a DSP

The standard task of a supply voltage supervisor is supervising a processor supply voltage and triggering a reset, if this voltage falls below the threshold voltage. The application example of Figure 17 shows a TPS3801K33, which supervises the 3.3 V power line of the DSP TMS320LC542. This DSP has the same supply voltage for the core and the I/O part. If the supply voltage falls below 2.93 V, which is the typical threshold voltage of a TPS3801K33, a reset is asserted. The reset output keeps active until the supply voltage increases again above the threshold voltage plus 200 ms of delay time.

A push button can be used to trigger a reset manually, a pullup resistor is not needed. A capacitor of 100 nF between the V_{DD} terminal of the supervisor and GND ensures proper operation of the supervisor and is recommended.
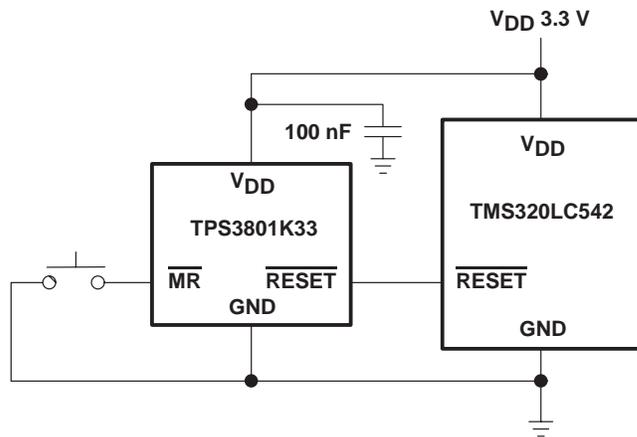

Figure 17. TPS3801 Supervises the TMS320LC542-DSP

5.2 Switching the Power Supply With a TPS3801

Figure 18 illustrates an application to turn system power on and off with a TPS3801. The TPS2051, a power distribution switch of Texas Instruments has a high-active enable input, so that it can be directly connected to the reset output of the supervisor.

Typically, the TPS2051 has R_{DSon} of less than 100 mΩ. To keep the on-state resistance low, the device has two input terminals and three output terminals.

The manual reset input of the TPS3801 allows a remote power control. This input can be connected with an output of a DSP, which turns the power of a subsystem on ($\Rightarrow$ with a logical high signal) and off ($\Rightarrow$ with a logical low signal). The low-active OC terminal signals overcurrent or overtemperature conditions. The output will remain asserted until the overcurrent or overtemperature condition is removed. Due to the open-drain output, a resistor must be placed between the OC terminal and the supply voltage.

When V_{in} is below V_{IT}, the reset output of the TPS3801 is low and the power distribution switch is disabled. When V_{in} is above V_{IT}, the reset output is high and the TPS2051 is enabled.
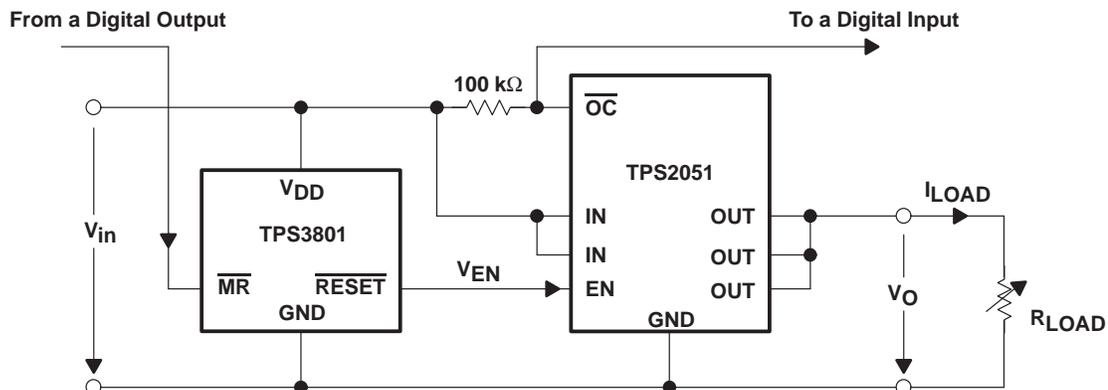
Figure 18. System Power Control With the TPS3801

Technical Data of the TPS2051

	MIN	MAX	UNIT
Input voltage V_{in}	2.7	5.5	V
Continuous output current		500	mA
On-state-resistance, r_{DSon} (V_{in}=5 V; T_J=25°C)		95	mΩ
Turnon time, t_{on}		20	ms
Turnoff time, t_{off}		40	ms
Standby current		10	µA

For more detailed information:

> The datasheet can be found on the WWW at the address:
>
> > http://www–s.ti.com/sc/psheets/slvs172a/slvs172a.pdf
>
> An application report with the title *TPS202x/3x and TPS204x/5x USB Power Distribution* is available at http://www–s.ti.com/sc/psheets/slva049/slva049.pdf

Figure 19 shows the three most important voltages of the application example. The load was a 3.3 kΩ resistor. Normally a resistor up to 10 Ω can be used, which causes a current flow of 500 mA. For the measurement , a function generator with a limited output current was used to generate the shape of input voltage. Therefore the output current was limited to 1.5 mA with the 3.3 kΩ resistor .
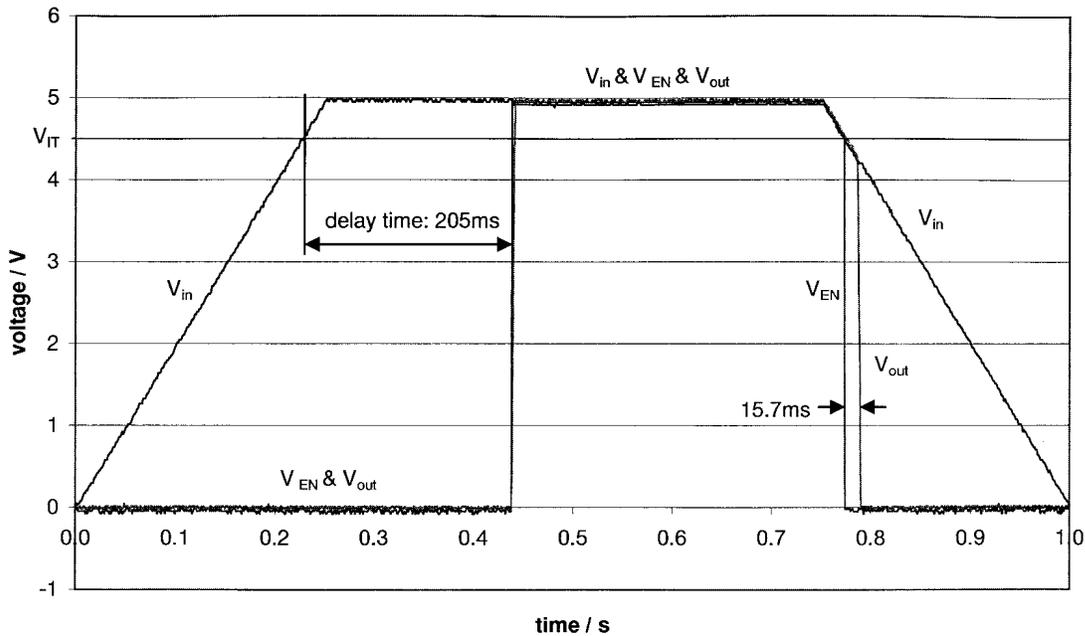
Figure 19. Measurements of Switching Power With A TPS2051

5.3   Keeping a Low Signal at Reset Output for Voltages Below 1.1 V

The reset output is defined for supply voltages above 1.1 V. Below this voltage, a low level at RESET cannot be assured, because the internal transistors need a certain voltage level to pull down the output to ground. When the supply voltage is below this voltage level, the reset input of the connected device is floating and this state should be avoided. Although most microcontrollers and DSPs do not work at voltages below 1.1 V, there are systems, that requires a correct reset signal down to 0 V.

To solve this problem, a pulldown resistor of 100 kΩ is placed between the reset output and ground. The disadvantage of this solution is a steady current flow during inactive state. At a supply voltage of 2.5 V, a current of 25 μA has to be taken into the account.
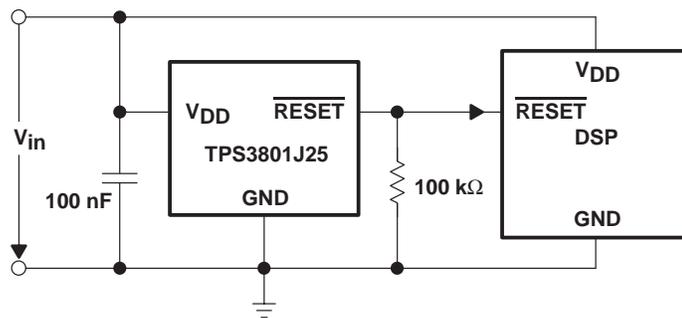

Figure 20. An Additional Resistor Ensures a Valid Reset Down to 0 V

5.4   Supervising a Customer Defined Threshold Voltage

Both families, TPS3801 and TPS3809, are available with four different fixed threshold voltages, which are 2.25 V, 2.64 V, 2.93 V, and 4.55 V typically. If the customer needs another threshold voltage, it can be adjusted with two external resistors. The new threshold voltage has to be higher than the device specific threshold voltage. There are two possibilities to realize the supervision. The first possibility is explained in application 1, which is a solution with a higher accuracy and a higher current consumption. Application 2 shows a solution with less current consumption and less accuracy. The difference between both applications is the resistance of the external voltage divider. Both application examples supervise an adjusted threshold voltage of 3.6 V.

5.4.1   Threshold Voltage Change Application 1

In the following descriptions and calculations, the threshold voltage of V_{in} is called V_{trip}. The fixed threshold voltages of the devices are named as V_{IT}.

Resistors of the E96 series with a tolerance of 1% should be taken to achieve an optimum accuracy for the threshold voltage.

A hundred times higher current through the voltage divider than the current into the device has been chosen, so that the device current can be neglected. The device current, which flows at $V_{DD} = V_{IT}$ into the supervisor is taken, because this current influences the threshold voltage of V_{in}. For a TPS3809 I_{DEVICE} at $V_{DD} = 2.25$ V is typically about $10\,\mu A$, what results in a current through the voltage divider of $I_Q = 1$ mA.

So R_4 and R_3 can be calculated as follows:

$$R_4 = \frac{V_{IT}}{I_Q} = \frac{2.25\ V}{1\ mA} = 2250\ \Omega$$

$$R_3 = \frac{V_{trip} - V_{IT}}{I_Q} = \frac{3.6\ V - 2.25\ V}{1\ mA} = 1350\ \Omega$$

The following resistor values are from the E96 series. They are well-suited, because they have nearly the same ratio like the calculated values.

$$R_3 = 1330\ \Omega$$
$$R_4 = 2210\ \Omega$$

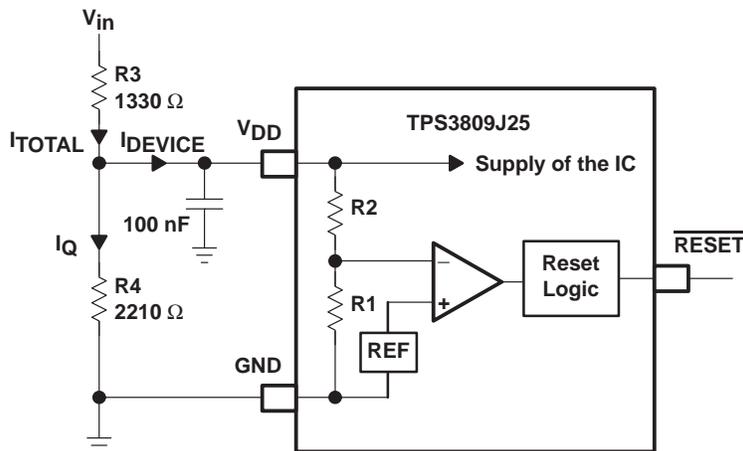The calculations lead to the application of Figure 21.

Figure 21. Higher Accuracy Supervision of 3.6 V

This application has been built up and tested. The result of the evaluation is the measurement plot in Figure 22. The threshold voltage of V_{in} has been at 3.61 V.
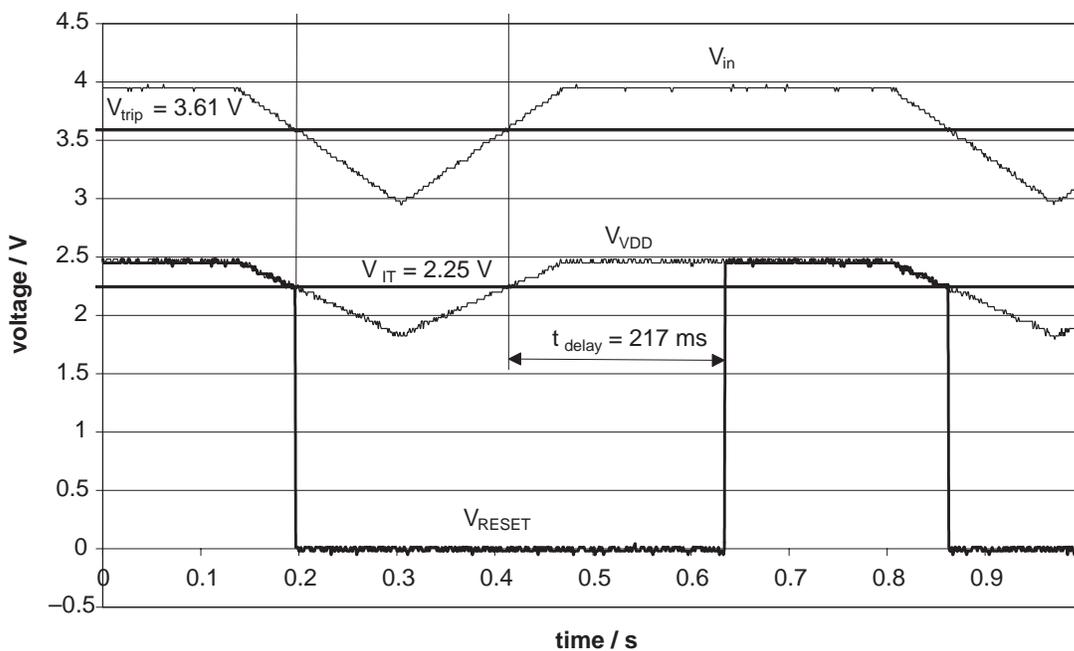
Measurements:

Figure 22. Measurement Plot of the 3.6 V Voltage Supervision

5.4.2 Worst Case Considerations for Application 1

The following assumptions have been made:

Resistors with 1% tolerance are used and the device current can be neglected.

PARAMETER	MINIMUM	TYPICAL	MAXIMUM
R_3	1317 Ω	1330 Ω	1343 Ω
R_4	2188 Ω	2210 Ω	2232 Ω
V_{IT-}	2.20 V	2.25 V	2.30 V
V_{trip}	3.50 V	3.60 V	3.71 V

Worst case 1:

$$V_{trip\ min} = \frac{R_{3min} + R_{4max}}{R_{4max}} \times V_{IT\ min} = \frac{1317\ \Omega + 2232\ \Omega}{2232\ \Omega} \times 2.20\ V = 3.50\ V$$

Worst case 2:

$$V_{trip\ max} = \frac{R_{3max} + R_{4min}}{R_{4min}} \times V_{IT\ max} = \frac{1343\ \Omega + 2188\ \Omega}{2188\ \Omega} \times 2.30\ V = 3.71\ V$$

RESULT: The adjusted threshold voltage has a tolerance of −2.8% to 3.1%.

5.4.3 Threshold Voltage Change Application 2

Now, the current through R_4 is only ten times higher than the device current at V_{DD}=2.25 V, it is 100 µA. Therefore the device current cannot be neglected in the calculation. The adjusted threshold voltage should be again 3.6 V. R_4 can be calculated as follows:

$$R_4 = \frac{V_{IT}}{I_Q} = \frac{2.25\ V}{100\ \mu A} = 22.5\ k\Omega$$

To choose a E96 series value:

$$R_4 = 22.6\ k\Omega$$

The current into the device is 10 µA at V_{DD}=2.25 V, so that for further calculations the resistor R_{DEVICE}= 225 kΩ parallel to R_4 must be taken into account. The resulting resistor value $R_{4equivalent}$ of the two parallel resistors is

$$R_{4equivalent} = \left(R_4 \parallel R_{Device}\right) = \frac{225\ k\Omega \times 22.6\ k\Omega}{225\ k\Omega + 22.6\ k\Omega} = 20.54\ k\Omega$$

Now R_3 can be determined to

$$R_3 = \frac{V_{trip} - V_{IT}}{I_Q + I_{Device}} = \frac{3.6\ V - 2.25\ V}{100\ \mu A + 10\ \mu A} = 12.3\ k\Omega$$

Values with 1% tolerance are recommended, so the following resistor of the E96 series is well-suited:
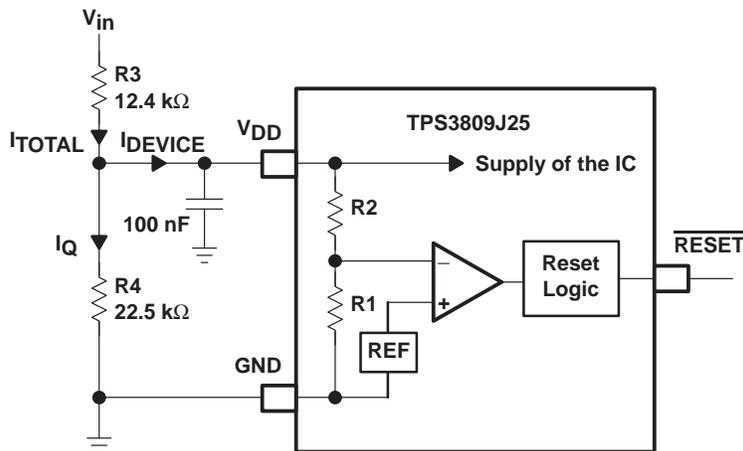
$$R_3 = 12.4\ k\Omega$$

Figure 23. Supervision of 3.6 V With Less Current Consumption

5.4.4   *Worst Case Considerations for Application 2*

The following assumptions have been made:

Resistors with 1% tolerance are used and a supply current over process and temperature of 7 µA to 13 µA.

PARAMETER	MINIMUM	TYPICAL	MAXIMUM
I_{Supply}	7 µA	10 µA	13 µA
R_{DEVICE}	173 kΩ	225 kΩ	321 kΩ
R_3	12.28 kΩ	12.4 kΩ	12.52 kΩ
R_4	22.37 kΩ	22.6 kΩ	22.83 kΩ
$R_{4equivalent}$	19.81 kΩ	20.54 kΩ	21.31 kΩ
V_{IT-}	2.20 V	2.25 V	2.30 V
V_{trip}	3.47 V	3.60 V	3.76 V

Worst case 1:

$$V_{tripmin} = \frac{R_{3\ min} + R_{4equivalent\ max}}{R_{4equivalent\ max}} \times V_{IT\ min} = \frac{12.28\ k\Omega + 21.31\ k\Omega}{21.31\ k\Omega} \times 2.20\ V = 3.47\ V$$

Worst case 2:

$$V_{tripmax} = \frac{R_{3\ max} + R_{4equivalent\ min}}{R_{4equivalent\ min}} \times V_{ITmax} = \frac{12.52\ k\Omega + 19.81\ k\Omega}{19.81\ k\Omega} \times 2.30\ V = 3.75\ V$$

RESULT: The adjusted threshold voltage has a tolerance of −3.7% to 4.3%.

6 Mechanical Data and Layout Considerations

6.1 Mechanical Data

This chapter contains mechanical information about the two packages of TPS3801 and TPS3809. The TPS3801 is available in the SOT323-package (DCK). All linear dimensions are in millimeters.
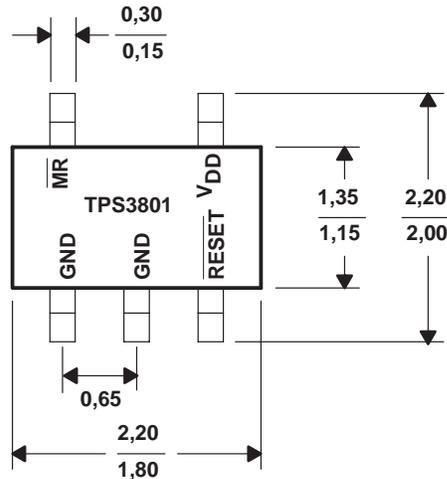

Figure 24. Linear Dimensions of SOT323 Package

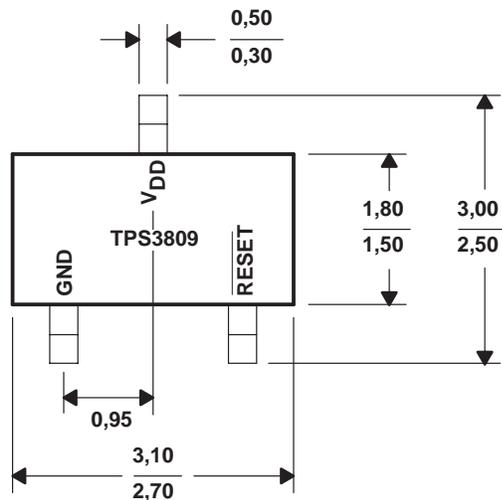The TPS3809 is available in the SOT23-3 package (DBV-3).

Figure 25. Linear Dimensions of SOT23-3 Package

More detailed information about mechanical data can be found on the internet on the page: http://www.ti.com/sc/docs/psheets/mechanic/D.htm

Choose DCK for pico package (TPS3801) and DBV – 3 Pins for SOT23-3 package (TPS3809).

6.2 Layout Considerations

The following four points should be followed at the layout to ensure trouble-free operation:

- Use a blocking capacitor of 100 nF between supply voltage and ground.
- Place the external capacitor near the device.
- If the circuit includes a device with a high current consumption, keep the common ground wire small due to the danger of a floating ground. This can be achieved by keeping the ground line separated as long as possible (star-shape connection).
- Locate the supervisor circuit in an interference-free environment.

The following two figures show layouts with the TPS3801 and TPS3809. The used capacitor is in a 0805-package (L x W x H : 2 mm 1.25 mm 0.45 mm).
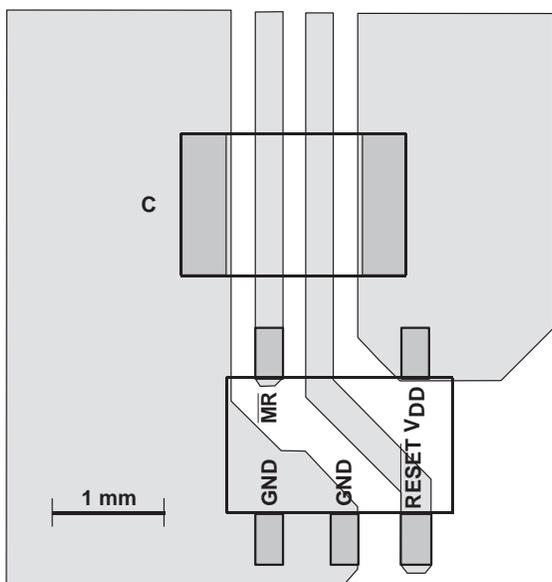
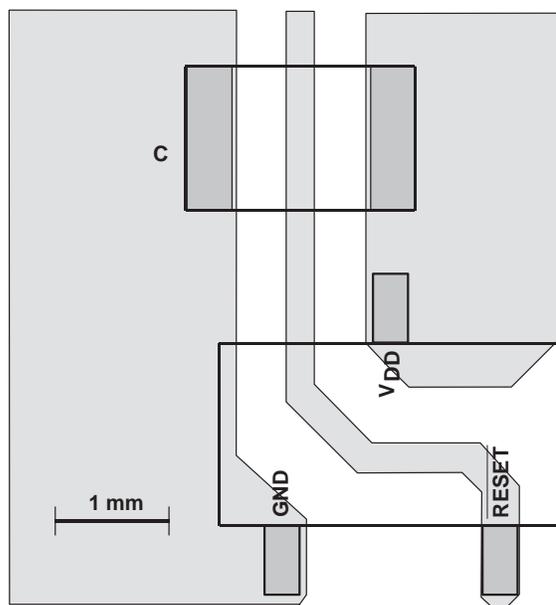**Figure 26. Layout Suggestion Using a TPS3801**

Figure 27. Layout Suggestion Using a TPS3809

7 Summary

The TPS3801 and TPS3809 have a very accurate voltage detection for the most common supply voltages. If the supply voltage falls below a specified threshold voltage the reset output becomes active. A defined reset signal is delivered from $V_{DD} \geq 1.1$ V. Both families have a fixed delay time of 200ms, which delays the reset output at transition from active to inactive state.

The TPS3809 is available in the SOT23-3 package with three pins, the TPS3801 is in the SOT323 package with five pins and is thus the smallest supply voltage supervisor on the market with this functionality. The TPS3801 has an additional feature compared to the TPS3809: the manual reset function, which offers a lot of possibilities in applications.

This device has a typical supply current of less than 20 μA, so that it is well-suited for battery-powered systems. It is characterized for a temperature range from –40°C to 85°C. Apart from the recommended capacitor between V_{DD} and ground, no external components are needed.

8 References

1. Data Sheet of TPS3801xxx, TPS3809xxx, Literature Numbers SLVS219 and SLVS228

2. *TPS382x Microprocessor Supervisory Circuits With Watchdog Function*, Literature Number SLVA039

3. *The TPS370x Family Application Report,* Literature Number SLVA045

4. *TPS3305 and TPS3307 Supervising DSP and Processor Applications*, Literature Number SLVA056

5. *Designer's Guide and Data Book–InfoNavigator CD-ROM*, Literature Number SLYC005C

6. *Power Supply Circuits*, Data Book, Literature Number SLVD002

7. *Linear Design Seminar*, Literature Number SLYD016

8. Internet: http://www.ti.com/sc/docs/products/analog