A Topical Index of TI Supply Voltage Supervisor (SVS) Application Notes

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ABSTRACT

This document summarizes a collection of application notes from Texas Instruments that discuss supply voltage supervisors (SVSs) and their uses. This report provides a short abstract of each application note and categorizes the series of documents by topic. These application notes are arranged in such an order that less experienced readers can work through these documents from beginning to end without the need to go back and forth.

Each application report reviewed in this document is identified by title and a unique TI literature number. The summary description of the article or report also contains a link to the Texas Instruments web site (www.ti.com). Unless otherwise noted, all materials summarized in this document can be downloaded from www.ti.com.

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1 Introduction

The purpose of this report is to provide a quick reference document for application designers and other users who are interested in TI SVS devices. Each TI application report discussed in this document is identified by title and by a unique TI literature number, as shown in Example 1. If you wish to access a complete version of a given report, click on the document literature number (SBxx### or SLxx###). This tag provides a hyperlink to the document location on www.ti.com, where you can either read the document in its entirety or download it for personal use.

Example 1. Sample Entry

Title (**Sensitivity Analysis for Power Supply Design**)

Abstract (*Understanding how to apply sensitivity analysis in a real circuit design*): Literature Number (SLVA481).

In a power-supply design, tolerance in component values and reference voltages and currents causes deviation to the desired system output. However, the deviation of the system output resulting from a variation of each input variation is different. The output is more sensitive to certain inputs than others. In this application note, sensitivity analysis is explored and a design example is provided using the TPS3808 supply voltage supervisor.

For assistance with supply voltage supervisor (SVS) product selection, refer to the *Supervisors and Reset ICs Quick Reference Guide* (SLYT361), also available on www.ti.com/svs.

This report is divided into these topical areas:

- Basic overview of the SVSs and their uses.
- Technical considerations when designing with SVSs.
- Microcontroller, processor, and digital signal processor (DSP) applications.
- Special use case applications.

If you have an application question, contact the Supervisor and Reset IC Forum on the TI E2E Community. (Note that this link requires a secure log-in.)

2 Basic Overview of Supply Voltage Supervisors

This section reviews several application notes that explain the basics of supply voltage supervisors with a focus on specific product families.

TPS370x Family Application Report

Understanding the TPS370x Family of Supply Voltage Supervisors: SLVA045.

This application report describes the TPS370x-xx SVS family of devices. The report includes a description of the circuit and a discussion of the differences between members of the TPS370x family. In addition, the report describes circuit features in detail and gives application examples. Layout and design issues are also discussed.

TPS312x Series Supervisory Circuits in Ultra-Low-Voltage Applications

Understanding the TPS312x Family of Supply Voltage Supervisors: SLVA077.

Voltage-monitoring circuits are firmly established in microcomputer systems. These circuits perform system initialization, which includes circuit reset, and they monitor the supply voltage during operation. When combined with watchdog circuits, these circuits monitor the proper functioning of a device in safety-relevant circuits. This report describes the TPS312x series of voltage-monitoring integrated circuits that have a low supply voltage of 1.2 V and a low current consumption. These low-voltage monitoring circuits are intended primarily for use in battery-powered devices.

UltraLow-Power Supply Voltage Supervisor Family TPS383xs

Designing with the TPS383x family of UltraLow Power Supervisors: SLVA091.

Supply voltage supervisors have found their solid place in digital systems. These supervisors monitor the system supply voltage and ensure a correct initialization of the circuits connected. The trend with digital integrated circuits with extremely low current consumption requires an equivalent reduction of the power dissipation of analog circuits. This report describes an advanced supply voltage supervisor circuit that distinguishes itself by an extremely low supply current, and therefore finds applications in battery-operated systems.

All Window Watchdog Supervisors

This application report presents the configuration of the window–watchdog in a supervisor circuitry. The report presents analysis for various window settings and their worst-case scenarios.: SLVA365.

The configuration of the window–watchdog in a supervisor is realized by examining the different components of the window–watchdog, the different possible settings, and the calculations required to analyze the worst-case scenario. For example, the TPS3813 supervisor is used to analyze the different settings of the window–watchdog and their worst-case scenarios.

3 Technical Considerations when designing with SVSs

This section provides information on how best to design solutions using supply voltage supervisors.

Optimizing Resistor Dividers at a Comparator

Understanding the affect the resistor divider selection has on SVS accuracy: SLVA450A.

A resistive voltage divider is commonly used at the input to a comparator to set a threshold voltage for sense inputs and power-fail inputs (PFI) on SVSs or low-battery inputs (LBI) on switching regulator devices. The SVS threshold voltage is set by the ratio of the two resistors in the divider. Keeping the ratio constant, there are tradeoffs to consider for selecting the actual resistor values. With higher resistances, the leakage current at the comparator input can affect the threshold voltage accuracy. On the other hand, with lower resistances, the current through the divider is increased. In battery-powered applications, this current can be a significant drain on battery life and run time. This application report discusses several key factors involved with selecting optimally-sized resistors, considering these constraints.

Sensitivity Analysis for Power Supply Design

Understanding how to apply sensitivity analysis in a real circuit design: SLVA481.

In a power-supply design, tolerance in component values and reference voltages and currents causes deviation to the desired system output. However, the deviation of the system output resulting from a variation of each input variation is different. The output is more sensitive to certain inputs than others. In this application note, sensitivity analysis is explored and a design example is provided using the TPS3808 supply voltage supervisor.

Disabling the Watchdog Timer for TI's Family of Supervisors

Application of a simple technique to disable watchdog timers: SLVA145.

In many microprocessor applications where a watchdog supervisor (such as the TPS3306) is required, the watchdog may need to be disabled. This scenario is particularly true when software boot times exceed the watchdog time-out period. This application note describes a circuit that can be used to selectively disable the watchdog timer.

Choosing an Appropriate Pull-up/Pull-down Resistor for Open Drain Outputs

Detailed analysis on how to size external pull-up and pull-down resistors: SLVA485.

Many devices contain digital output pins to indicate certain statuses to the rest of the system. These outputs fall into two categories: open-drain (an open collector for bipolar outputs) or push-pull (also known as *totem pole*) outputs. Open-drain outputs are commonly used because they offer several advantages when compared to push-pull outputs. Unlike push-pull outputs, several open-drain outputs from different devices can be connected directly together to create an OR function. Also, open-drain outputs provide more flexibility to a designer because they can be pulled-up to any voltage found in the system, which can be useful when they serve as inputs to a processor that might require a lower voltage level than the push-pull output provides. Examples of open-drain outputs commonly found on devices include power good (PG) and low battery (LBO) on switching regulators, reset and power fail (PFO) on supply voltage supervisors (SVSs), and low battery, power fail, and reset on power management units. All open-drain outputs require the use of an external pull-up or pull-down resistor to keep the digital output in a defined logic state. This application report discusses when to use a pull-up or pull-down resistor, the factors to consider when selecting a pull-up or pull-down resistor, and how to calculate a valid range for the value of the resistor.

Setting the SVS Voltage Monitor Threshold

Understanding how to set SVS thresholds for robust microprocessor designs: SLVA521.

The power-supply voltage for powering a microprocessor core must fall within a given accuracy range in order for the processor to perform to its best specifications. If this input supply voltage drifts near to the operational boundary, then the microprocessor wants to gracefully shutdown, or reset, before presumably losing its data or resulting in improper operation in some way. This application report discusses this issue in some detail in order to arrive at a reasonable approach for adjusting the SENSE, or reset, threshold of the SVS circuit to assure that the microprocessor is reset properly, while accounting for the various inaccuracies of the voltage monitor or supervisor system. In most of these systems, the lower voltage boundary is of paramount concern and, therefore, this report only focuses on the lower trip threshold.

4 Microcontroller, Processor, and DSP Applications

This section reviews several application notes that focus on monitoring voltage rails for digital loads.

Using the TPS3619 with MSP430 Microcontrollers Can Reduce System Power Consumption

Reducing power consumption with the TPS3619 during system sleep modes: SBVA014A.

The MSP430 series of microcontrollers are ideal in applications where battery life is critical. These microcontrollers require only 0.1 µA of current in low-power RAM retention mode. In this mode, the microcontroller must have power to retain volatile memory. In some systems with charge pumps, the TPS3619 can be used to shut down the charge pump, saving system power consumption.

TPS382x Microprocessor Supervisory Circuits with Watchdog Function

Provides an overview of the TPS382x family with watchdog functionality: SLVA039.

This application report introduces micropower SVSs, discusses their benefits, and describes design methods and precautions for their use.

TPS330x Supervising DSP and Processor Applications

Overview of the TPS330x family for monitoring DSP and processor voltage rails: SLVA056a.

This application report describes the TPS330x–xx SVS families of devices. The report gives a general introduction on generator resetting, followed by an overview of the technical parameters and the special features of the TPS330x. Each feature is discussed separately. Measurements make it easy to understand SVS principles of operation. Typical applications that increase system reliability, such as supervising a dual-voltage DSP, are included. Layout and design issues are also discussed.

TPS3801/09 - Smallest SVS for Monitoring DSPs and Processors

TPS3901/09 overview with emphasis on DSP and processor monitoring: SLVA075.

This application report describes the TPS3801 and TPS3809 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.

5 Special Use Case Applications

This section reviews several application notes that present several design techniques on how SVSs can be used in unique application configurations.

Using the TPS3839/1yxx as an Adjustable Supply Voltage Supervisor

Adapting fixed threshold supervisors to monitor additional voltage rails: SLAA414.

The TPS3839 is a family of ultra-low quiescent current SVSs that monitor a single voltage rail.

Because this device is a fixed-voltage monitor, designers must implement different voltage versions of the TPS3839 for specific voltage rails in their system. However, its low quiescent current of 150 nA makes the device suitable for use as an adjustable SVS. This application report describes a simple solution and design considerations for using the TPS3839 as an adjustable SVS for monitoring different voltage rails and implements a design example using the TPS3839A09.

Monitoring Five Different Voltage Rails Using the TPS3103 and TPS3306

Featured solution can monitor five external rails and includes a watchdog timer: SLVA147.

As portable power designs become more complex, the number of power-supply rails increase. Finding a simple supervisor circuit to monitor all the voltage rails can be complicated because of the number of different rail voltages and desired SVS trip voltages. To provide a solution for the more complex designs, the TPS3103 and TPS3306 can be used to monitor up to five different voltage rails. This design also features a watchdog timer that can be easily disabled. This report explains how to check feedback loop stability on a target application board.

Using Voltage Supervisor for Input Over-Voltage Protection in LED Drivers

Over-voltage protection using the TLV809: SLVA594.

Lighting electronics meant for ac-dc applications tend to get subjected to input line variations leading to sustained over-voltage on the driving circuitry. Metal oxide varistors (MOVs) meant for suppressing the transients fail at such sustained over-voltage, leading to system failure and hence the need for incorporation of separate circuitry for the input over-voltage protection. The TLV809 family of supervisory circuits that provide circuit initialization and timing supervision, primarily for DSPs and processor-based systems, can be used for the over-voltage protection in LED drivers and other ac-dc power-supply applications.

Using the TPS3700 as a Negative Rail Over- and Undervoltage Detector

Simple Solution for negative voltage UV and OV monitoring: SLVA600

The TPS3700 is a wide voltage window comparator that can be used in overvoltage (OV) and undervoltage (UV) detection. This application note describes a simple approach to use the TPS3700 for negative voltage monitoring applications, such as the negative rail on op amps, DACs, ADCs, and other high-precision analog circuitry that may need UV or OV protection.

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