

Welcome!

Texas Instruments New Product Update

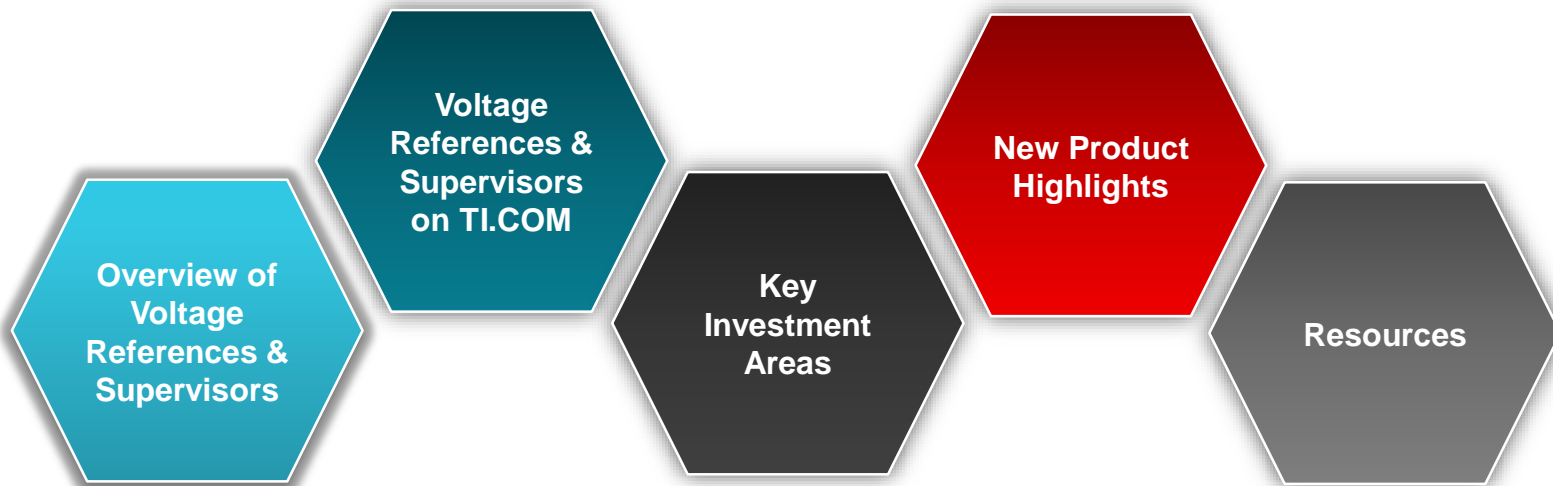
- This webinar will be recorded and available at www.ti.com/npu
- Phone lines will be muted
- Please post questions in the chat or contact your sales person or field applications engineer

New Product Update: **Keep your system safe and accurate through** **Voltage References & Supervisors**

Chonghyuk Kwon

1 October 2020

Agenda



Product Family Overview

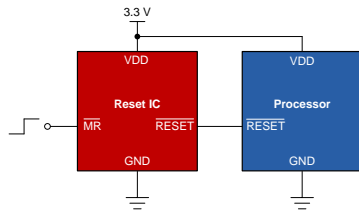
Supervisors & Reset ICs

Product Families

- TPS37xx (window)
- TPS3840/TLV840 (low power)
- TPS385x (watchdog timer)

Sectors/EEs

- ADAS, Infotainment
- Personal Electronics
- FA&C, BA, Grid, MD



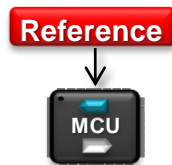
Series References

Product Families

- REF50xx (precision)
- REF33xx/REF4132 (low power)
- REF31xx/34xx (gen. purpose)

Sectors/Customers

- Factory automation - PLC
- Medical - BGM
- Automotive HEV/EV



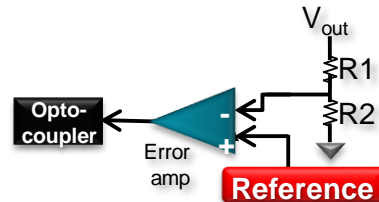
Shunt References

Product Families


- TL/TLV43x (commodity)
- ATL43x (low power)
- LM404x/405x (med accuracy)

Sectors/Customers

- Power Adaptors, Appliances
- Comm/Server power
- Automotive Body Electronics



Voltage References & Supervisors on TI.COM



TEXAS INSTRUMENTS

Products Applications **Design resources**

Browse products

- Amplifiers
- Audio
- Clocks & timing
- Data converters
- Die & wafer services
- DLP® products
- Interface
- Isolation
- Logic
- Microcontrollers (MCU)
- Motor drivers
- Power management**
- Processors
- RF & microwave
- Sensors
- Space & harsh environment
- Switches & multiplexers
- Wireless connectivity

ti.com/svs

Supervisor & reset ICs (166)

ti.com/vref

Voltage references (216)

Current references (4)

Series voltage references
(96)

Shunt voltage references
(116)

Browse by supervisor & reset IC type

Single channel

Monitors a single voltage rail for undervoltage or overvoltage detection

Find your device

Window detector

Monitors overvoltage and undervoltage conditions to alert the system when a voltage rail deviates from the permissible tolerance level

Find your device

Watchdog timer

Prevents freezes or hangs in an MCU and continuously monitors the voltage supply for undervoltage conditions

Find your device

Multichannel

Monitors multiple voltage rails with high precision

Find your device

Push-button reset IC

Monitors user presses and provides a reset after the user holds the button for a given time period

Find your device

Low IQ

Monitors a voltage supply with low-power consumption to achieve longer battery life

Find your device

Product portfolio

High precision

Achieve stability across variable temperatures and voltages with low drift and high initial accuracy

Find your device

Low IQ

Minimize power consumption and extend battery life

Find your device

Small package

Use in space-constrained applications with micro-sized solutions

Find your device

Product portfolio

Low IQ

Reduce current regulation in your design to meet low-power standards

Find your device

High precision

Improve precision on power rails or noncalibrated signal chain conditioning

Find your device

Standard

Simplify your design with industry standard 1.24-V or 2.5-V voltage references

Find your device

Automotive

Leverage AEC-Q100-qualified shunt voltage references for automotive designs

Find your device

Dual output

Reduce errors, cost and solution size with two outputs (VREF and VREF/2)

Find your device

Automotive

Leverage AEC-Q100-qualified series voltage references for automotive designs

Find your device



TEXAS INSTRUMENTS

Key Investment Areas



Automotive

Technology Highlights:

- Wide V_{IN} operation
- Highest accuracy across temperature
- Functional Safety compliant



Industrial

Technology Highlights:

- Lowest quiescent current
- Smallest form factor
- Lowest output noise



Wide V_{IN}

Increase safety with the highest working voltage and reliability



Low IQ

Extend battery and shelf life without compromising system performance



Precision

Enhance power and signal integrity to improve system-level protection



Small Size

Achieve higher performance in smaller spaces, enhancing system functionality

Supervisors & Reset ICs



Wide V_{IN}



Low IQ

Ease-of-use

TLV803E
TLV809E
TLV8x3/09
MCP809
TPS3809
LM809/10
LM3724

TPS3831*/9
LM8364
TPS3847*
LMS33460

TPS3840
TPS3890*
TPS3836*/8*
LM8365
TLV840

TPS3851*
TPS3813
TPS3123*/8*
TPS3820*/3*/8*
UCC2946

TPS3124
TPS3824

TPS3700
TPS3701
TPS3702
TPS3703

TPS3850/2*

TPS3125*/6*
TPS3825*
TPS3837*
TPS3896*/8*
TPS3870

TPS3606*
TPS3817/8
TPS3619*/20*

TPS3600*/10*/13*

TPS3422

TPS3431*

TPS3430*

TPS3779/80
TPS3805
TPS3806
TPS3807
TPS3106*
LMC6953*

TPS3110*

TPS3305*

TPS3103

TPS3707*

TPS3420
TPS3421

TPS3306
TPS3705*

TPS3510
TPS3511
TPS3513
TPS3514

TPS3307*

TPS386000
TPS386040
TPS386596

Bold indicates a supply voltage range of 12 V or higher

*Indicates manual reset pin

⊕ Indicates automotive-grade version available (AECQ-100 qualified)



TPS37x-Q1 (65 V & 2uA) Over & Under Voltage Detector with Delay Function

TPS37A-Q1
SNVSD09 – AUGUST 2020

1 Features

- AEC-Q100 qualified with the following results:
 - Device temperature grade 1: -40°C to +125°C ambient operating temperature
 - Device HBM ESD classification level 2
 - Device CDM ESD classification level C7B
- VDD: 2.7 V to 65 V ($V_{POR}=1.4V$)
- SENSE and RESET pins are 65V graded
- Low supply current: 1uA (Typ.)
- Flexible voltage options Table 13-2
 - 2.7V to 36V (1.5% max accuracy)
 - 800 mV option (1% max accuracy)
- Built-in hysteresis (V_{HYS})
 - Percentage options: 2% to 13% (1% steps)
 - Fixed options: $V_{TH} < 8V = 0.5V, 1V, 1.5V, 2V, 2.5V$.
- Programmable reset time delay
- Programmable sense time delay
- Manual reset feature
- Output reset latching feature
- Output topology:
 - Channel 1: Open-Drain or Push-Pull topologies
 - Channel 2: Open-Drain

3 Description

High voltage supervisor with integrated voltage divider for low power and continuous car battery voltage monitoring. No compensation components required (only pull-up resistor), external capacitor for timing are optional to adjust voltage detection time (CTS) and release time (CTR). Sense pins are high impedance and can support external resistors if needed by the application. This device has large hysteresis voltage options to ignore cold/warm crank, start stop and other common car battery transients.

CTRx pins also work as manual reset (CTR1/MR, CTR2/MR) that can be used as a hard reset debugging mechanism or as digital mute for Telematics and Infotainment applications.

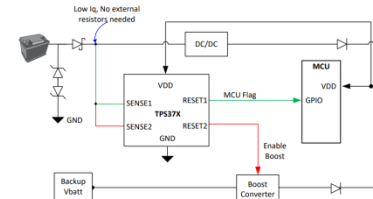
Both channels have Open Drain, Active high and Active low options. Channel 1 has Push-pull output option capable to drive an external FET/BJT.

Small WSON package with 100µm height Wettable flanks to facilitate Automatic Optical Inspection (AOI) and long pads facilitate low resolution X-Ray inspection. Central pad is non-conductive to increase the creepage between VDD and GND per guidelines in IEC 60664

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
TPS37x-Q1	WSON (10) (DSK)	2.5 mm × 2.5 mm

(1) For package details, see the mechanical drawing addendum at the end of the data sheet.



Typical Application Circuit

Shunt Voltage References

Voltage Reference Selection Guide

Temp Drift ppm/°C		Initial Accuracy				Part Number	Output Voltage										Temp Range	Package Option
							Adjustable	1.2	2.0	2.5	3.0	3.3	4.0	5.0	8.2	10		
10	0.05					LM4030 A				•			•				0 up to 85	
20	0.05	0.1				LM4030 A/B				•			•				Q	3SOT-23,
30			0.15			LM4030 C				•			•				Q	5SOT-23
20				1.0	2.0	LM2/385/B*		•									C/I	TSSOP, SOP,
30				1.0	2.0	LM1/2/385 BX*	Up to 5.3V	•		•							I/C/M	SDIC-8,
50				1.0	2.0	LM1/2/385 BY*	Up to 5.3V	•		•							I/C/M	T0-92
30/50			0.2			REF1112		•									C/I	
50		0.1	0.2	0.5		LM4050/1 A/B/C		•	•	•			•	•	•	•	I/Q	3SOT-23
50		0.1	0.2	0.5		TL4050/1 A/B/C	Up to 10V	•		•			•	•		•	I/Q	3/5SOT-23**
50				0.4	1.0	2.2	LM431 C/B/A	Up to 36V		•							I/Q	3SOT-23
50				0.5	1.0	2.0	TL431 A/B	Up to 36V		•							C/I	3/5SOT-23**
100		0.1	0.2			LM4040 A/B*			•	•	•		•	•	•	•	I	
100				0.5		LM4040 C*			•	•	•		•	•	•	•	I/Q	3SOT-23,
100		0.1	0.2			LM4041 A/B	Up to 15V	•									I	SC-70,
100				0.5		LM4041 C*	Up to 15V	•									I/Q	T0-92
129				0.5		LMV431B	Up to 30V	•									I/C	
129					1.0	LMV431A	Up to 30V	•									I/C	
129					1.5	LMV431	Up to 30V	•									I/C	3/5SOT-23
150					1.0	2.0	LM1/2/385 B*	Up to 5.3V	•		•						I/C/M	
150					1.0	2.0	LM4040 D/E*			•	•	•		•	•	•	I/Q	
150					1.0	2.0	LM4041 D/E*	Up to 15V	•								I/Q	
150			0.5			TLV431B	Up to 6V	•									I/C/Q	3/5SOT-23,
150					1.0	TLV431A	Up to 6V	•									I/C/Q	T0-92
150					1.5	TLV431	Up to 6V	•									I/C/Q	



Low IQ



Small Size



ATL431LI
ATL432LI

SLVS060 – NOV 2017 – REVISED NOVEMBER 2019

ATL431LI / ATL432LI High Bandwidth Low-Iq Programmable Shunt Regulator

1 Features

- Reference voltage tolerance at 25°C
 - 0.5% (B Grade)
 - 1% (A Grade)
- Minimum typical output voltage: 2.5 V
- Adjustable output voltage: V_{ref} to 36 V
- Operation from -40°C to +125°C (Q temp)
- Maximum temperature drift
 - 17 mV (I Temp)
 - 27 mV (Q Temp)
- 0.3-Ω Typical output impedance
- Sink-current capability
 - $I_{min} = 0.08 \text{ mA (max)}$
 - $I_{KA} = 15 \text{ mA (max)}$
- Reference input current $I_{REF} = 0.4 \mu\text{A (max)}$
- Deviation of reference input current over temperature, $I_{I(dev)} = 0.3 \mu\text{A (max)}$
- Packages: 1-mm x 1-mm X2SON or SOT23-3

2 Applications

- Adjustable voltage and current referencing
- Secondary side regulation in Flyback SMPS
- Zener diode replacement
- Voltage monitoring
- Precision constant current sink/source
- Comparator with integrated reference

3 Description

The ATL43xLI device is a three-terminal adjustable shunt regulator, with specified thermal stability over applicable automotive, commercial, and military temperature ranges. The output voltage can be set to any value between V_{ref} (approximately 2.5 V) and 36 V, with two external resistors. These devices have a typical output impedance of 0.3 Ω. Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacements for Zener diodes in many applications, such as onboard regulation, adjustable power supplies, and switching power supplies. This device is a pin-to-pin alternative to the TL431LI and TL432LI, with lower minimum operating current to help reduce system power consumption. The ATL432LI device has exactly the same functionality and electrical specifications as the ATL431LI device, but has a different pinout for the DBZ package. The ATL431LI is also offered in a tiny X2SON (1.00 mm x 1.00 mm) package which makes it ideal for space constraint applications.

The ATL43xLI device is offered in two grades, with initial tolerances (at 25°C) of 0.5%, and 1%, for the B and A grade, respectively. In addition, low output drift versus temperature ensures good stability over the entire temperature range.

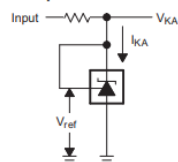
The ATL43xLI devices are characterized for operation from -40°C to +125°C.

Device Information⁽¹⁾

PART NUMBER	PACKAGE (PIN)	BODY SIZE (NOM)
ATL43xLI	SOT-23 (3)	2.90 mm x 1.30 mm
ATL431LI	X2SON (4)	1.00 mm x 1.00 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

Simplified Schematic



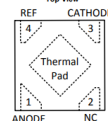
ATL431LI DBZ Package
3-Pin SOT-23
Top View



ATL432LI DBZ Package
3-Pin SOT-23
Top View



ATL431LI DQW Package
4-Pin X2SON
Top View



Series Voltage References



Precision

Voltage Reference Selection Guide

							Output Voltage															
Temp Drift ppm/°C	Initial Accuracy						Part Number	Adjustable	1.0	1.2	1.8	2.0	2.5	3.0	3.3	4.1	4.5	5.0	10	Temp Range	Package Options	
3	0.05						REF50xx					•	•	•	•		•	•	•	•	Q	MSOP-8
3		0.1					LM4140A		•	•		•	•			•					C	SOIC-8
6		0.1					LM4140B		•	•		•	•			•					C	
7			0.2				REF32xx			•		•	•	•	•	•					O/M	SC23-6
8		0.1					REF50xx					•	•	•		•	•	•	•	Q	MSOP-8	
10		0.1					LM4140C		•	•		•	•			•					C	SOIC-8
10	0.05						LM4132A				•	•	•	•	•	•					I/Q	5SOT-23
15		0.2					REF31xx			•		•	•	•	•	•					C	SC23-6
20		0.2					REF32xx			•		•	•	•	•	•					Q	SC23-6
20		0.1	0.2	0.4			LM4132B/C/D				•	•	•	•	•	•					I/Q	
30					0.5		LM4132E				•	•	•	•	•	•					I/Q	
30		0.15					REF33xx			•	•	•	•	•	•	•					Q	3SOT-23
50		0.2					LM4120/1/5A	•			•	•	•	•	•	•		•			I	
50					0.5		LM4120/1/5	•			•	•	•	•	•	•		•			I	5SOT-23
50		0.2					REF30xx			•		•	•	•	•	•					C	
75		0.2					REF30xx			•		•	•	•	•	•					Q	
75		0.1	0.2				LM4128A/B				•	•	•	•	•	•					Q	
100					0.5	1.0	LM4128C/D				•	•	•	•	•	•					Q	5SOT-23
100						2.0	REF29xx			•		•	•	•	•	•					Q	3SOT-23



REF70 Ultra-High-Precision Voltage Reference with Low Noise and Low Drift

1 Features

- Low noise :
 - 1/f Noise (0.1 Hz to 10 Hz): 0.22 ppm_{p-p}
 - 10 Hz to 1 kHz: 0.5 ppm_{rms}
- Low temperature drift coefficient :
 - 2 ppm/°C (maximum for -40°C to 125°C)
- High accuracy: ±0.025% (maximum)
- Available in humidity resistance ceramic package (LCCC)
- Low dropout: 250 mV
- Wide input voltage: 3 V to 18 V
- Output current: ±10 mA
- Industry standard voltage options: 2.5 V, 3.0 V, 3.3 V, 4.096 V, 5.0 V
- Operating temperature range: -40°C to +125°C

2 Applications

- Precision data acquisition systems
- Industrial instrumentation
- Semiconductor test equipment
- Power monitoring
- PLC analog I/O modules
- Field transmitters

3 Description

The REF70 device family offers a unique combination of very low noise (0.22 ppm_{p-p}), low thermal drift (2 ppm/°C), and high accuracy (±0.025%). These characteristics of the REF70, when paired with high-resolution data converters, enable various end equipment to achieve their performance targets.

High initial accuracy with very low temperature and long-term drift help reduce the need for frequent in system calibration.

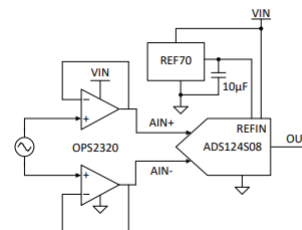
LCCC (FKH) package helps improve the long term drift and thermal hysteresis performance further for applications requiring a very stable reference.

REF70 is specified for the wide temperature range of -40°C to +125°C. The wide temperature range enables the device to operate across various applications. Contact the TI sales representative for additional voltage and package options.

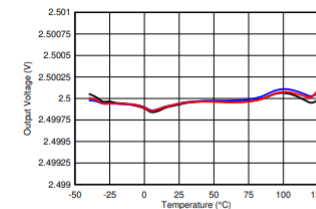
Device Information

PART NAME ⁽¹⁾	PACKAGE	BODY SIZE (NOM)
REF7025	LCCC (8)	5.00 mm × 5.00 mm
REF7025	VSSOP (8)	3.00 mm × 3.00 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.



Simplified Schematic



Output Voltage Vs Free-Air-Temperature

ADVANCE INFORMATION

Resources

Overview Products Applications Reference designs Technical documents Support & training

Voltage references – Technical documents



Voltage Reference Overview

Review the Shunt and Series selection guide parameters at a glance to choose the right VREF for your application.

Download (PDF, 1130KB)



Tips and tricks for designing with voltage references

Tips and Tricks for Designing with Voltage References provides a comprehensive overview of voltage reference basics and application design.

Download (PDF, 5486KB)



Voltage reference selection basics white paper (Rev. A)

Voltage references are a key building block in data conversion systems, and understanding their specifications and how they contribute to error is necessary for selecting the right application.

Download (PDF, 123KB)

Application Report
SLV487 – July 2016

Using the TL431 as a Voltage Comparator

Ricardo Rivera-Mateo, Elhan Tan, Marcos Zamora

ABSTRACT

This application report shows how engineers can use the TL431 as voltage supervisor or window comparator applications. This document will also cover common design problems and solutions when using TL431 as a comparator.

Contents

- 1 Introduction
- 2 Voltage Comparator Application
- 3 Design Considerations for V_{REF} and R_{REF}
- 4 Design Considerations for V_{REF} and R_{REF}
- 5 TL431 for Low-Cost Comparator Applications
- 6 Alternative Device Recommendations

Trademarks

All trademarks are the property of their respective owners.

1 Introduction

An adjustable shunt regulator is used to take an input voltage and produce a regulated output voltage determined by the device characteristics. Engineers can control the "REF" pin of the TL431 to use as a window comparator to generate feedback and regulate the output of the device based on the input. Furthermore, engineers can also use a resistor pin network to increase the regulated output voltage in this configuration.

Engineers can break the isolated pin of "REF" on TL431 to use as an adjustable shunt regulator as a simple voltage comparator or window comparator in the open-loop configuration. The TL431 is a shunt resistor commonly used for this approach.

3 Voltage Comparator Application

Figure 1 shows the TL431 functional block diagram in the voltage comparator application. The input voltage is sent into the "REF" pin and is compared to the internal reference voltage. If the input voltage on the "REF" pin is less than the reference voltage, then the transistor in the block diagram remains off and no current flows through the collector and the emitter. In this state, the output voltage is equal and a logic "high" output is produced. Conversely, if the input voltage on the "REF" pin is greater than the reference voltage, the transistor in the block diagram conducts and current flows between the collector and the emitter. In this state, the V_{OUT} and V_{REF} are equal and a logic "low" output is produced. Design considerations and layout tips are discussed in more detail in Section 3.

(1)

Voltage Reference Solutions in Motor Drives

Introduction

Motor drives have a critical need for a precision signal and current to motor power stage and they both involve an isolated amplifier as shown in Figure 1. For voltage measurements there is typically an error resistor in connected to an isolated amplifier and for current measurements there is typically an error resistor in each of the 3 phases isolated amplifier. The isolated amplifier is used because it enables the measurement of large common-mode voltages and transients and it is also a requirement of safety standard IEC 61800-2 in an electric drive. For example, it is required that the signal be fully shielded and isolated to the input of the ADC.

Motor Drive Basics

All motor drives require a motor power stage to provide power and control the motor but they can be inefficient due to its high-power consumption. There is a need for lower power consumption that is partially driven by government regulations such as EN 50568 which call for higher power efficiency of variance across three motor drive power stage. The power stage would typically consist of a three-phase AC input and a variable frequency 3-phase AC output as shown in Figure 1 that due to its motor reliability and high-power requirements, this stage requires constant sensing.

Figure 1. Motor Power Stage Example

Figure 1 shows the motor power stage and its associated feedback. The motor power stage is a three-phase AC input and a variable frequency 3-phase AC output as shown in Figure 1 that due to its motor reliability and high-power requirements, this stage requires constant sensing.

Figure 2. Voltage and Current Sense Example Using

One of the most important features of a high-performance motor control drive is how the system handles the control loop feedback of the speed and position sensors. Motor control feedback is a feature common in synchronous servomotors and in high-end AC/DC motor. The two traditional ways of measuring motor speed are done with either a resolver or an encoder. In a resolver, the motor speed is measured (SR) and cosine (CR) signals are induced through

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Overview Products Applications Reference designs Technical documents

Supervisor & reset ICs – Technical documents



Voltage Supervisor and Reset ICs: Tips, Tricks and Basics

Get an introduction to voltage supervisors and an in-depth overview of their various applications.

Download (PDF, 2025KB)



Voltage Supervisors (Reset ICs) Quick Reference Guide (Rev. H)

Check out our most popular supervisors and reset ICs.

Download (PDF, 422KB)



Voltage Supervisors (Reset ICs): Frequently Asked Questions (FAQs) (Rev. A)

Read about the most frequently asked questions (FAQs) for voltage supervisors, reset ICs, voltage detectors, watchdog timers and all related monitoring devices.

Download (PDF, 387KB)

Application Report
SVA488 – May 2020

Back-Up Power Supply Switchover With Supply Voltage Supervisor and Power Multiplexer / Switch

Tristram Re, Sandesh S, Michael DeSanto

ABSTRACT

This application report describes how to create a programmable push-button, pulse detector and pulse generator using the voltage supervisor family (TPS3000, TPS3005, TPS3007, and TPS3008). This device can be used to monitor negative voltages. This application note focuses on the basic of using the TPS3007 for dual voltage monitoring applications such as the dual rail or on-chip DACs, ADCs, and other high-resolution analog circuitry that may need UV or OV protection.

Figure 1. Back-up Battery Switchover Solution Block Diagram

Migrating Designs to LP3470A Low Iq Voltage Supervisor for Improved Power Supply Monitoring

Michael DeSanto

ABSTRACT

LP3470A is a low-power consumption voltage supervisor that features programmable reset delay using an external capacitor and an open-drain output. The device monitors under-voltage faults at 2.63 V, 2.75 V, 2.83 V, 3.08 V, 3.60 V, 4.05 V, 4.38 V, and 4.83 V and is available in 5-pin SO23 package.

What Applications Does LP3470A Benefit?

The three main performance benefits offered by LP3470A are low power, wide input voltage range, and wide temperature range. This device is perfect for monitoring batteries or for applications powered by batteries such as remote controls and sensors.

How Does LP3470A Compare to the Older LP3470?

The new LP3470A is available in the standard SO23 package with the same pinout and threshold voltages but this device is more compact, smaller.

Application Report
SVA489 – March 2019

Programmable Push-Button, Pulse Detector, and Pulse Generator Solutions

Michael DeSanto

ABSTRACT

This application note describes how to create a programmable push-button, pulse detector and pulse generator using the voltage supervisor family (TPS3000, TPS3005, TPS3007, and TPS3008). This device can be used to monitor negative voltages. This application note focuses on the basic of using the TPS3007 for dual voltage monitoring applications such as the dual rail or on-chip DACs, ADCs, and other high-resolution analog circuitry that may need UV or OV protection.

Application Report
SVA490 – October 2019

TPS3700 Split Supply Positive and Negative Dual Voltage Monitoring Solution

Michael DeSanto

ABSTRACT

The TPS3700 is a voltage supervisor with 16V adjustable voltage and it is designed to be used in over-voltage (OV) and under-voltage (UV) detection. This application note shows how this device can be used to monitor negative voltages. This application note focuses on the basic of using the TPS3700 for dual voltage monitoring applications such as the dual rail or on-chip DACs, ADCs, and other high-resolution analog circuitry that may need UV or OV protection.

Contents

- 1 Introduction
- 2 TPS3700 Dual OV and UV Monitoring Solution Overview
- 3 Setting the Overvoltage and Undervoltage Thresholds
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Type	Title	Date
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Application notes	TPS3703-Q1 Functional Safety FIT Rate and Failure Mode Distribution	Dec. 18, 2019
White papers	Voltage Supervisor and Reset ICs: Tips, Tricks and Basics	Jun. 28, 2019
Application notes	Implementing Voltage References and Supervisors Into Your Traction Inverter Desi	May 22, 2019
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Functional Safety FIT Rate, Failure Mode Distribution TPS3703-Q1

Overvoltage and Undervoltage Reset IC with Time Delay and Manual Reset

Functional Block Diagram

FIT IEC TR 62380 / ISO 26262-11 (1)		Per 10 ⁹ Hours (FIT)
Total FIT Rate		4
Die FIT Rate		2
Package FIT Rate		2

FIT Siemens Norm SN29500 (2)			
Table	Category	Ref FIT A_{ref}	Ref Virtual Tj $\theta_{ref,1}$
Table 5	Digital, Analog, Mixed	25 FIT	55 C

Failure Modes	Failure Mode Distribution (%)
nRESET fails to trip	15%
nRESET false trip	15%
nRESET trip outside specification (voltage or time)	60%
nRESET delay outside specification	5%
Pin to Pin short any two pins	5%

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