Supervisory circuits for switch-mode power supplies

Processor supervisor with programmable window-Watchdog

Processor supervisory circuits feature window-Watchdog

Battery-backup supervisors retain RAM

Battery-backup supervisors for low-power processors

Dual and triple processor supervisors reduce part count

Versatile processor supervisor in small SOT-23 package

Ultra-low power supervisors reduce power consumption

Fully programmable supervisor with Watchdog

Three-channel supervisor for switch-mode power supplies

Supervisor with integrated delay and manual Reset in SC-70

Supervisor with programmable delay time provides flexibility

Application Reports

Selection Guides

Packaging

Decision Tree

Read Sine On online at www.ti.com/sc/sineon
Ultra-low voltage supervisors ideal for 1.2 V supplies

**TPS312x**

Get samples, datasheets and app reports at: [www.ti.com/sc/device/partnumber](http://www.ti.com/sc/device/partnumber)

Replace `partnumber` in URL with TPS3123xxx, TPS3124xxx, TPS3125xxx, TPS3126xxx or TPS3128xxx, where `xxx` is E12, J12, E15, G15, E18, or J18 (voltage options)

- Precision voltage monitoring of 1.2 V, 1.5 V or 1.8 V supports latest processor generations
- Ultra-low supply voltage of 0.75 V (min) for low-power operation
- Integrated delay time of 180 ms ensures stabilization of supply voltage
- Watchdog timer for monitoring processor activity
- Low supply current of 14 µA (typ) extends battery life
- Manual Reset input allows daisy-chaining of multiple devices or manual operation
- Packaging: SOT23-5 saves board space
- Suggested resale price starts at $0.80 each in quantities of 1,000

<table>
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<tr>
<th>Voltage options (V)</th>
<th>RESET output</th>
<th>RESET output</th>
<th>Watchdog</th>
<th>Manual Reset</th>
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Supervision of an ultra-low voltage DSP

Processor supervisory circuits feature window-Watchdog

**TPS381x**

Get samples and datasheets at: [www.ti.com/sc/device/partnumber](http://www.ti.com/sc/device/partnumber)

Replace `partnumber` in URL with TPS3813xxx, where `xxx` is J25, L30, K33, or I50 (voltage options)

- Window-Watchdog with programmable delay and window ratio
- Precision voltage monitoring of 2.5 V, 3.0 V, 3.3 V or 5.0 V supports latest processor generations
- Power-on Reset generator with integrated delay time of 25 ms ensures stabilization of supply voltage
- Low supply current of 9 µA (typ) extends battery life
- Open-drain reset output
- Temperature range -40°C to +85°C
- Packaging: SOT23-6 saves board space
- Suggested resale price starts at $0.82 each in quantities of 1,000

**Window-Watchdog prevents unwanted errors**

**Applications include:**

- Applications using microcontrollers, microprocessors or DSPs
- Safety critical systems
- Automotive systems
- Heating systems
- Medical systems

For technical support and ordering literature, see page 11.
Battery-backup supervisors retain RAM

**TPS361x**

Get samples and datasheets at: [www.ti.com/sc/device/partnumber](http://www.ti.com/sc/device/partnumber)

Replace `partnumber` in URL with TPS3610U18, TPS3610T50, TPS3613-01 or TPS3617-50

- Backup-battery switching for adjustable, 1.8-V and 5-V systems
- Integrated gating of chip-enable signals
- Watchdog timer
- Battery freshness seal
- Voltage monitor for Power-Fail or low-battery monitoring
- Manual switchover
- Battery OK output
- Packaging: available in TSSOP-14, MSOP-8 or MSOP-10
- Suggested resale price in quantities of 1,000:
  - TPS3610 price starts at $2.39 each
  - TPS3613 price starts at $1.86 each
  - TPS3617 price starts at $1.60 each

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Battery-backup switching for RAM retention

**TPS360x**

Get samples, datasheets and EVMs at: [www.ti.com/sc/device/partnumber](http://www.ti.com/sc/device/partnumber)

Replace `partnumber` in URL with TPS3600D20, TPS3600D33, TPS3600D50 or TPS3606-33

- Backup-battery switching for 2.0-V, 3.3-V and 5-V systems
- Integrated gating of chip-enable signals
- Watchdog timer
- Battery freshness seal
- Voltage monitor for Power-Fail or low-battery monitoring
- Manual Reset input and manual switchover
- Battery OK output
- Packaging: available in TSSOP-14 or MSOP-10
- Suggested resale price ranges from $1.86-$2.39 each in quantities of 1,000

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Battery-backup switching for low-power processors

- Applications include:
  - Low-power processors and DSPs
  - Portable/battery-powered equipment
  - Mobile phones, palmtops and PDAs
  - Battery management

![Battery-backup switching for low-power processors](image-url)
Dual and triple processor supervisors reduce part count

**TPS330x**

Get samples, datasheets and app reports at: [www.ti.com/sc/device/partnumber](http://www.ti.com/sc/device/partnumber)

Replace partnumber in URL with TPS3305-xx, TPS3307-xx, where xx is 18, 25 or 33 or replace partnumber with TPS3306-yx, where yx is 15, 18, 20, 25, or 33

- Integrated Watchdog timer monitors processor activity
- Integrated delay time of 100 ms and 200 ms ensures stabilization of supply voltage
- Low supply current of 15 µA (typ) extends battery life
- Precision voltage monitoring of fixed and adjustable input voltages to support latest generation of DSPs
- Manual Reset input allows daisy-chain of multiple devices
- Open-drain or push/pull Reset output stages
- Packaging: MSOP-8 reduces board space and allows compact designs
- Suggested resale price starts at $1.08 each in quantities of 1,000

Supervision of a dual-voltage DSP

**TPS382x**

Get samples, datasheets and app reports at: [www.ti.com/sc/device/partnumber](http://www.ti.com/sc/device/partnumber)

Replace partnumber in URL with TPS3820, TPS3823, TPS3824, TPS3825 or TPS3828

- Integrated Watchdog timer for monitoring processor activity
- Integrated delay time of 200 ms or 25 ms ensures stabilization of supply voltage
- Low supply current of 15 µA (typ) extends battery life
- Precision voltage monitoring of 2.5 V, 3 V, 3.3 V and 5 V supports a broad range of industry-standard processor supply voltages
- Manual Reset input allows daisy-chain of multiple devices or manual operation
- Reset output available in active-low, active-high and open-drain for resetting different processor types
- Monitors a single supply voltage rail in DSP/microprocessor/microcontroller applications
- Packaging: 5-pin SOT-23 reduces board space and allows for smaller designs
- Suggested resale price in quantities of 1,000: TPS382x price starts at $0.73 each
  TPS3825 price starts at $0.67 each

**Available options**

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<tr>
<th>Voltage options (V)</th>
<th>RESET output</th>
<th>RESET output</th>
<th>Watchdog</th>
<th>Manual Reset</th>
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</table>

**TPS382x typical application**

Applications include:
- Multi-voltage DSPs and processors
- Portable/battery-powered equipment
- Embedded control systems
- Intelligent instruments

For technical support and ordering literature, see page 11.
Ultra-low power supervisors reduce power consumption

**TPS383x**

Get samples, datasheets and app reports at: [www.ti.com/sc/device/partnumber](http://www.ti.com/sc/device/partnumber)

Replace `partnumber` in URL with TPS3836-xxx, TPS3837-xxx, TPS3838-xxx, where xxx is E18, J25, L30 or K33

- Ultra-low supply current of 220 nA (typ) significantly reduces system power consumption
- Selectable delay time of 10 ms or 200 ms ensures stabilization of supply voltage
- Precision voltage monitoring of 1.8 V, 2.5 V, 3.0 V or 3.3 V supports latest processor generations
- Manual Reset input allows daisy-chaining of multiple devices or manual operation
- Open-drain or push/pull Reset output stages
- Packaging: SOT23-5 saves board space
- Suggested resale price starts at $0.93 each in quantities of 1,000

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</table>

Supply current vs supply voltage

**Fully programmable supervisor with Watchdog allows flexibility**

**UCC3946**

Get samples and datasheet at: [www.ti.com/sc/device/UCC3946](http://www.ti.com/sc/device/UCC3946)

- Watchdog supervisor with programmable timeout period
- Programmable Reset threshold
- Programmable Reset delay time
- Low supply current of 10 µA (typ) extends battery life
- Packaging: available in TSSOP-8, SO-8 or DIP-8
- Suggested resale price starts at $2.39 each in quantities of 1,000

**UCC3946 features full programmability**

**Applications include:**

- Applications using low-voltage DSPs, microcontrollers or microprocessors
- Portable/battery-powered equipment
- Wireless communication systems
- Programmable controls
- Intelligent instruments
- Notebook/desktop computers
- Automotive systems

Read Sine On online at [www.ti.com/sc/sineon](http://www.ti.com/sc/sineon)
Three-channel supervisor for switch-mode power supplies

TPS351x

Get samples and datasheets at: www.ti.com/sc/device/partnumber
Replace partnumber in URL with TPS3510 or TPS3513

➤ Over- or under-voltage protection
➤ Over-current protection
➤ Maximum supply voltage of 15 V
➤ Integrated delay time of 300 ms
➤ Integrated 3-channel power supply supervisor for reduced component count and compact design
➤ Cost-effective monitoring and protection against power supply faults
➤ Over-voltage protection and lockout for 5 V, 3.3 V and 12 V
➤ UVLO for 5 V and 3.3 V
➤ Packaging: available in SO-8 and DIP-8 (TPS3510); SO-14 and DIP-14 (TPS3513)
➤ Suggested resale price in quantities of 1,000:
  TPS3510 price starts at $0.67 each
  TPS3513 price starts at $1.00 each

TPS3510 ideal for switch-mode power supplies

TPS380x

Get samples, datasheets and app reports at: www.ti.com/sc/device/partnumber
Replace partnumber in URL with TPS3801xxx or TPS3809xxx, where xxx is E18, J25, L30, K33, I50, or -01

➤ Ultra-small SC-70 packaging (2.0 mm x 2.1 mm) for TPS3801 is half the size of a SOT-23 package
➤ Low supply current of 10 µA (typ) extends battery life
➤ Integrated delay time of 200 ms ensures stabilization of supply voltage
➤ Precision voltage monitoring of 1.8 V, 2.5 V, 3.0 V, 3.3 V, 5.0 V and adjustable supports broad range of industry standard processor supply voltages
➤ Manual Reset input allows daisy-chaining of multiple devices or manual operation
➤ Packaging: available in either the 5-pin SC-70 or the 3-pin SOT-23, which integrates basic supervisor functionality
➤ Suggested resale price in quantities of 1,000:
  TPS3801-xx price starts at $0.53 each
  TPS3809-xx price starts at $0.40 each

For technical support and ordering literature, see page 11.
Supervisor with programmable delay time provides flexibility

TLC77xx

Get samples, datasheets and app reports at: www.ti.com/sc/device/partnumber
Replace partnumber in URL with TLC7701, TLC7725, TLC7703 or TLC7705

➤ Power-down control support for static RAM with battery backup
➤ Programmable delay time for maximum application flexibility
➤ Precision voltage monitoring of 2.5 V, 3.0 V, 3.3 V, 5.0 V and adjustable version supports broad range of industry standard processor supply voltages
➤ Low supply current of 9 µA (typ) extends battery life
➤ Active-low and active-high push/pull outputs for resetting different processor types
➤ Packaging: available in SOIC and TSSOP
➤ Suggested resale price in quantities of 1,000:
  TLC77xxI price starts at $0.73 each
  TLC77xxQ price starts at $0.80 each

Available options

<table>
<thead>
<tr>
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<th>Voltage options (V)</th>
<th>RESET output</th>
<th>RESET output</th>
</tr>
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<td>Push/Pull</td>
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Data retention during power down

➤ Applications include:

• Designs including RAM or other memory parts
• Battery-driven applications
• Embedded control systems
• Notebook/desktop computers
• Microcontroller or DSP designs
• Portable equipment
• Intelligent metering
## Selection Guide for Supervisory Circuits

<table>
<thead>
<tr>
<th>Device</th>
<th>Supervisory</th>
<th>Package</th>
<th>Temperature Range (°C)</th>
<th>VDD (V) Min</th>
<th>VDD (V) Max</th>
<th>VRR (V) TYP</th>
<th>VDDH (mV) TYP</th>
<th>IOP (µA) TYP</th>
<th>Time Delay (µs)</th>
<th>Manual Reset</th>
<th>Active-High</th>
<th>Over-Voltage Detection</th>
<th>Over-Current Detection</th>
<th>Watchdog Timer</th>
<th>Reference Output Buffer</th>
<th>Cip-Enable</th>
<th>Gating</th>
<th>Backup-Battery Switchover</th>
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<td><strong>2.0 V</strong></td>
<td>TPS3306-20</td>
<td>SO-8, MSOP-8</td>
<td>I</td>
<td>2.7</td>
<td>6</td>
<td>1.68</td>
<td>2</td>
<td>15</td>
<td>15</td>
<td>200</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
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<tr>
<td><strong>2.5 V</strong></td>
<td>TPS3306-20</td>
<td>SO-8, MSOP-8</td>
<td>I</td>
<td>2.7</td>
<td>6</td>
<td>1.68</td>
<td>2</td>
<td>15</td>
<td>15</td>
<td>200</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td><strong>3.0 V</strong></td>
<td>TPS3306-20</td>
<td>SO-8, MSOP-8</td>
<td>I</td>
<td>2.7</td>
<td>6</td>
<td>1.68</td>
<td>2</td>
<td>15</td>
<td>15</td>
<td>200</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

*Temperature range: C = 0° C to 70° C, I = -40° C to 85° C, Q = -40° C to 125° C

Note: All devices feature an active-low reset output except TPS3837

For technical support and ordering literature, see page 11.
## Selection Guide for Supervisory Circuits

| Device          | Package | Temperature Range | VDD (V) | VIT (V) | Vhys (mV) | IDD (µA) | Delay (ms) | Reset Input | Active-High Reset | Voltage-Over-Limit | Under-voltage | Over-current | Internal | Over-voltage detection | Output Load | Over-current detection | Under-voltage detection | Over-voltage detection | Over-current detection | Watchdog timer | Reference Output | Functional Tests | Reference Table | Temperature Tolerance |
|-----------------|---------|------------------|---------|---------|-----------|----------|-----------|-------------|------------------|-------------------|----------------|-------------|----------|----------------|----------------|---------------------|---------------------|---------------------|---------------------|----------------------|------------------------|
| 3.3V            | TLC7733 | SO-8, DIP-8, TSSOP-8 | 1, Q | 2 | 6 | 2.93 | 2 | 70 | 9 | Prog | x | x | x | x | x | x | x | x | x | 0.73 | 33.3V, 5V, 12V |
|                 | TPS3105-xx | SO-8, MSOP-8 | I | 2.7 | 6 | 2.93 | 2 | 30 | 15 | 200 | x | x | x | x | x | x | x | 1.00 | 33.3V, 5V, 12V |
|                 | TPS3106-33 | SO-8, MSOP-8 | I | 2.7 | 6 | 2.93 | 2 | 30 | 15 | 100 | x | x | x | x | x | x | x | x | 1.18 | 33.3V, 5V, 12V |
|                 | TPS3107-xx | SO-8, MSOP-8 | I | 2 | 6 | 2.93 | 2 | 30 | 15 | 200 | x | x | x | x | x | x | x | x | 1.18 | 33.3V, 5V, 12V |
|                 | TPS3510 | SO-8, DIP-8 | I | 4 | 15 | 2.2 | 4 | n/a | 1mA | 300 | x | x | x | x | x | x | x | x | 0.67 | 33.3V, 5V, 12V |
|                 | TPS3513 | SO-14, DIP-14 | I | 4.5 | 15 | 2.2 | 4 | n/a | 1mA | 300 | x | x | x | x | x | x | x | x | 0.93 | 33.3V, 5V, 12V |
|                 | TPS3600-33 | TSSOP-14 | I | 1.65 | 5.5 | 2.93 | 2 | 40 | 100 | 100 | x | x | x | x | x | x | x | x | 0.56 | 33.3V, 5V, 12V |
|                 | TPS3606-33 | MSOP-10 | I | 1.65 | 5.5 | 2.93 | 2 | 40 | 100 | 100 | x | x | x | x | x | x | x | x | 0.60 | 33.3V, 5V, 12V |
|                 | TPS3801K | SC-70 | I | 2 | 6 | 2.93 | 2 | 40 | 9 | 200 | x | x | x | x | x | x | x | x | 0.56 | 33.3V, 5V, 12V |
|                 | TPS3809K | SCOT-23 | I | 1.65 | 5.5 | 2.93 | 2 | 40 | 9 | 200 | x | x | x | x | x | x | x | x | 0.93 | 33.3V, 5V, 12V |
|                 | TPS3813K | SOT-23 | I | 1 | 6 | 2.93 | 2 | 40 | 0.25 | 20/200 | x | x | x | x | x | x | x | x | 0.93 | 33.3V, 5V, 12V |

*Temperature range: C = 0° C to 70° C, I = -40° C to 85° C, Q = -40° C to 125° C

Note: All devices feature an active-low reset output except TPS3837
## Target applications

- Applications using DSPs, microcontrollers or microprocessors
- Wireless communication systems
- Portable/battery-powered equipment
- Industrial equipment
- Intelligent instruments
- Notebook/desktop computers
- Automotive systems
- Power supplies

---

### Packaging

<table>
<thead>
<tr>
<th>Package Type</th>
<th>Pin Count</th>
<th>Width</th>
<th>Length</th>
<th>Pitch</th>
<th>Height</th>
</tr>
</thead>
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<tr>
<td>SO (D)*</td>
<td>8/14</td>
<td>4.00</td>
<td>5.00/8.75</td>
<td>1.27</td>
<td>1.75</td>
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<tr>
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<td>7.59</td>
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<td>DIP (N)</td>
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<td>19.69</td>
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<td>DIP (P)</td>
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<td>6.60</td>
<td>10.60</td>
<td>2.54</td>
<td>5.08</td>
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<tr>
<td>TO-226 (LP)*</td>
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<td>4.34</td>
<td>18.04</td>
<td>1.40</td>
<td>4.19</td>
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<tr>
<td>SOT-89 (PK)</td>
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<td>4.60</td>
<td>4.25</td>
<td>1.50</td>
<td>1.60</td>
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<td>SOT-23 (DBVR)**</td>
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<td>1.80</td>
<td>3.10</td>
<td>0.95</td>
<td>1.30</td>
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<tr>
<td>MSOP (DGN) (DGK) (DGS)*</td>
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<td>3.05</td>
<td>3.05</td>
<td>0.65/0.5</td>
<td>1.07</td>
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<tr>
<td>SC-70 (SOT-323) (DCKR)**</td>
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<td>1.35</td>
<td>2.20</td>
<td>0.65</td>
<td>1.0</td>
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<tr>
<td>TSSOP (PW)*</td>
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<td>3.10/5.1</td>
<td>0.65</td>
<td>1.0</td>
</tr>
</tbody>
</table>

All linear dimensions are maximums specified in millimeters.

*These packages are also available in tape and reel, as well as tube, and can be ordered by adding “R” to the end of the device name.

**Packages whose suffix includes “R” are only available in tape and reel.

For technical support and ordering literature, see page 11.
Reduce design time and **save 50%** when you order TI’s supervisory circuit evaluation module (EVM)

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