Micropower Precision Triple Supply Monitors in 8-Lead MSOP and 5-Lead SOT-23 Packages

FEATURES

- Monitors Three Inputs Simultaneously
  - LTC1727-5: 5V, 3.3V and ADJ
  - LTC1727-2.5: 2.5V, 3.3V and ADJ
  - LTC1728-5: 5V, 3.3V and ADJ
  - LTC1728-2.5: 2.5V, 3.3V and ADJ
  - LTC1728-1.8: 3V, 1.8V and ADJ
  - LTC1728-3.3: 3.3V, 1.8V and ADJ
- ±1.5% Threshold Accuracy Over Temperature
- Very Low Supply Current: 10µA Typ
- 200ms Reset Time Delay
- Active Low RESET Output
- Power Supply Glitch Immunity
- Guaranteed RESET for \( V_{CC3} \geq 1V \) or \( V_{CC5}/V_{CC25}/V_{CC18} \geq 1V \)
- LTC1727 Includes Monitor Output for Each Supply
- LTC1727: 8-Lead MSOP and SO Packages
- LTC1728: 5-Lead SOT-23 Package

APPLICATIONS

- Desktop Computers
- Notebook Computers
- Intelligent Instruments
- Portable Battery-Powered Equipment
- Network Servers

DESCRIPTION

The LTC®1727 is a triple supply monitor intended for systems with multiple supply voltages. Each supply monitor has its own open-drain output for individual supply monitoring. A common open-drain reset output remains low until all three supplies have been in compliance for 200ms. Tight 1.5% accuracy specifications and glitch immunity ensure reliable reset operation without false triggering.

The LTC1728 is functionally identical to the LTC1727 without the individual monitor outputs.

The \( \text{RST} \) output is guaranteed to be in the correct state for \( V_{CC5}/V_{CC25}/V_{CC18} \) or \( V_{CC3} \) down to 1V. The LTC1727/LTC1728 may also be configured to monitor any one or two \( V_{CC} \) inputs instead of three, depending on system requirements.

Very low (10µA typical) supply current makes the LTC1727/LTC1728 ideal for power conscious systems.

The LTC1727 is available in an 8-lead MSOP or SO package and the LTC1728 is available in a 5-lead SOT-23 package.

**TYPICAL APPLICATION**

![Typical Application Diagram]

**Triple Supply Monitor with Power Good Output (3.3V, 2.5V and Adjustable)**

**ADJUSTABLE SUPPLY**

- \( 0.1\mu F \)
- \( 100k \) 1%
- \( 61.9k \) 1%

**SYSTEM LOGIC**

- \( V_{CC3} \)
- \( V_{CC5} \)
- \( V_{CCA} \)
- \( \text{GND} \)
- \( \text{RST} \)
- \( \text{COMP3} \)
- \( \text{COMP25} \)
- \( \text{R1} \)
- \( \text{R2} \)

**DC/DC CONVERTER**

- 3.3V
- 5V
- 1.8V

For more information, visit www.analog.com
ABSOLUTE MAXIMUM RATINGS (Notes 1, 2)

$V_{CC3}$, $V_{CC5} / V_{CC25} / V_{CC18}$, $V_{CCA}$ ....................... –0.3V to 7V

RST ................................................................. –0.3V to 7V

COMP3, COMP5

(Notes 1, 2)

Operating Temperature Range

LTC1727/LTC1728E (Note 3)............................. –40°C to 85°C

LTC1728H.................................................... –40°C to 125°C

LTC1727I.................................................... –40°C to 85°C

Storage Temperature Range........................... –65°C to 150°C

Lead Temperature (Soldering, 10 sec) .................. 300°C

PIN CONFIGURATION

LEAD FREE FINISH | TAPE AND REEL | PART MARKING* | PACKAGE DESCRIPTION | TEMPERATURE RANGE
-----------------|---------------|---------------|---------------------|------------------|
LTC1727EMS8-2.5#PBF | LTC1727EMS8-2.5#TRPBF | LTHY | 8-Lead Plastic MSOP | –40°C to 85°C |
LTC1727EMS8-5#PBF | LTC1727EMS8-5#TRPBF | LTX | 8-Lead Plastic MSOP | –40°C to 85°C |
LTC1727ES8-2.5#PBF | LTC1727ES8-2.5#TRPBF | 172725 | 8-Lead Plastic SO | –40°C to 85°C |
LTC1727IS8-2.5#PBF | LTC1727IS8-2.5#TRPBF | 727I25 | 8-Lead Plastic SO | –40°C to 85°C |
LTC1727ES8-5#PBF | LTC1727ES8-5#TRPBF | 17275 | 8-Lead Plastic SO | –40°C to 85°C |
LTC1727IS8-5#PBF | LTC1727IS8-5#TRPBF | 1727I5 | 8-Lead Plastic SO | –40°C to 85°C |
LTC1728ES5-1.8#PBF | LTC1728ES5-1.8#TRPBF | LTPH | 8-Lead Plastic SOT-23 | –40°C to 85°C |
LTC1728ES5-2.5#PBF | LTC1728ES5-2.5#TRPBF | LTH | 8-Lead Plastic SOT-23 | –40°C to 85°C |
LTC1728ES5-3.3#PBF | LTC1728ES5-3.3#TRPBF | LTY | 8-Lead Plastic SOT-23 | –40°C to 85°C |
LTC1728ES5-5#PBF | LTC1728ES5-5#TRPBF | LTHZ | 8-Lead Plastic SOT-23 | –40°C to 85°C |
LTC1728HS5-5#PBF | LTC1728HS5-5#TRPBF | LTHZ | 8-Lead Plastic SOT-23 | –40°C to 125°C |

Contact the factory for parts specified with wider operating temperature ranges. *The temperature grade is identified by a label on the shipping container.

Tape and reel specifications. Some packages are available in 500 unit reels through designated sales channels with #TRMPBF suffix.

For more information www.analog.com
# Electrical Characteristics

All except LTC1728-1.8/LTC1728-3.3. The ● denotes specifications which apply over the full operating temperature range, otherwise specifications are at \( T_A = 25°C \). \( V_{CC3} = 3.3V \), \( V_{CC5} = 5V \), \( V_{CC25} = 2.5V \), \( V_{CCA} = V_{CC3} \) unless otherwise noted.

## Symbols and Parameters

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{RT3} )</td>
<td>Reset Threshold ( V_{CC3} )</td>
<td>( V_{CC3} ) Input Threshold</td>
<td>●</td>
<td>3.036</td>
<td>3.086</td>
<td>3.135</td>
</tr>
<tr>
<td>( V_{RT5} )</td>
<td>Reset Threshold ( V_{CC5} )</td>
<td>( V_{CC5} ) Input Threshold (5V Version)</td>
<td>●</td>
<td>4.600</td>
<td>4.675</td>
<td>4.750</td>
</tr>
<tr>
<td>( V_{RT25} )</td>
<td>Reset Threshold ( V_{CC25} )</td>
<td>( V_{CC25} ) Input Threshold (2.5V Version)</td>
<td>●</td>
<td>2.300</td>
<td>2.338</td>
<td>2.375</td>
</tr>
<tr>
<td>( V_{RTA} )</td>
<td>Reset Threshold ( V_{CCA} )</td>
<td>( V_{CCA} ) Input Threshold</td>
<td>●</td>
<td>0.985</td>
<td>1.000</td>
<td>1.015</td>
</tr>
<tr>
<td>( V_{CCOP} )</td>
<td>( V_{CC3}, V_{CC5}/V_{CC25} ) Operating Voltage</td>
<td>RST, COMP3, COMP5, COMP25 in Correct Logic State</td>
<td>●</td>
<td>1</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>( V_{CCOPA} )</td>
<td>( V_{CC3}, V_{CC5}/V_{CC25} ) Operating Voltage</td>
<td>Minimum Supply Voltage to Guarantee COMPA in Correct Logic State</td>
<td>●</td>
<td>2</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>( I_{CC3} )</td>
<td>( V_{CC3} ) Supply Current</td>
<td>( V_{CC5}/V_{CC25} &gt; V_{CC3} ) ( V_{CC3} = 3.3 ) (Note 4)</td>
<td>●</td>
<td>2</td>
<td>20</td>
<td>( \mu A )</td>
</tr>
<tr>
<td>( I_{CC25} )</td>
<td>( V_{CC25} ) Supply Current</td>
<td>( V_{CC25} &lt; V_{CC3} ) ( V_{CC5}/V_{CC25} = 2.5 ) (Note 4)</td>
<td>●</td>
<td>2</td>
<td>2</td>
<td>( \mu A )</td>
</tr>
<tr>
<td>( I_{CC5} )</td>
<td>( V_{CC5} ) Supply Current</td>
<td>( V_{CC5} = 5V, V_{CC3} &lt; V_{CC5} )</td>
<td>●</td>
<td>2</td>
<td>20</td>
<td>( \mu A )</td>
</tr>
<tr>
<td>( I_{CCCA} )</td>
<td>( V_{CCA} ) Input Current</td>
<td>( V_{CCA} = 1V ) ( -40°C &lt; T_A &lt; 125°C )</td>
<td>●</td>
<td>–15</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>( I_{CC5} )</td>
<td>( V_{CC5} ) Input Current</td>
<td>( V_{CCA} = 1V ) ( -40°C &lt; T_A &lt; 125°C )</td>
<td>●</td>
<td>–20</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>( I_{RST} )</td>
<td>Reset Pulse Width</td>
<td>RST Low with 10k Pull-Up to ( V_{CC3} ) (Note 5)</td>
<td>●</td>
<td>140</td>
<td>200</td>
<td>280</td>
</tr>
<tr>
<td>( I_{UV} )</td>
<td>( V_{CC} ) Undervoltage Detect to RST or COMPX</td>
<td>( V_{CC}, V_{CC5}, V_{CC18} ) or ( V_{CCA} ) Less Than Reset Threshold ( V_{RT} ) by More Than 1% (Note 5)</td>
<td></td>
<td>110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_{OL} )</td>
<td>Output Voltage Low, RST, COMPX</td>
<td>( I_{SINK} = 2.5mA, V_{CC} = 3V, V_{CC5}/V_{CC25} = 0V )</td>
<td>●</td>
<td>0.15</td>
<td>0.4</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_{SINK} = 100mA, V_{CC} = 1V, V_{CC5}/V_{CC25} = 0V )</td>
<td>●</td>
<td>0.05</td>
<td>0.3</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_{SINK} = 100mA, V_{CC} = 0V, V_{CC5}/V_{CC25} = 1V )</td>
<td>●</td>
<td>0.05</td>
<td>0.3</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_{SINK} = 100mA, V_{CC} = 1V, V_{CC5}/V_{CC25} = 1V )</td>
<td>●</td>
<td>0.05</td>
<td>0.3</td>
<td>V</td>
</tr>
<tr>
<td>( V_{OH} )</td>
<td>Output Voltage High, RST, COMPX</td>
<td>( I_{SOURCE} = 1\mu A )</td>
<td>●</td>
<td>( V_{CC3} - 1 )</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

## LTC1727-5/LTC1728-5 Only

\( V_{DR} \) \( V_{CC5} \) Reset Override Voltage (Note 6) Override \( V_{CC5} \) Ability to Assert RST \( V_{CC3} ±0.025 \) V

## LTC1728-1.8

The ● denotes specifications which apply over the full operating temperature range, otherwise specifications are at \( T_A = 25°C \). \( V_{CC3} = 3V \), \( V_{CC18} = 1.8V \), \( V_{CCA} = V_{CC3} \) unless otherwise noted.

<table>
<thead>
<tr>
<th>Symbol</th>
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<th>Min</th>
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</tr>
</thead>
<tbody>
<tr>
<td>( V_{RT3} )</td>
<td>Reset Threshold ( V_{CC3} )</td>
<td>( V_{CC3} ) Input Threshold</td>
<td>●</td>
<td>2.760</td>
<td>2.805</td>
<td>2.850</td>
</tr>
<tr>
<td>( V_{RT18} )</td>
<td>Reset Threshold ( V_{CC18} )</td>
<td>( V_{CC18} ) Input Threshold</td>
<td>●</td>
<td>1.656</td>
<td>1.683</td>
<td>1.710</td>
</tr>
<tr>
<td>( V_{RTA} )</td>
<td>Reset Threshold ( V_{CCA} )</td>
<td>( V_{CCA} ) Input Threshold</td>
<td>●</td>
<td>0.985</td>
<td>1.000</td>
<td>1.015</td>
</tr>
<tr>
<td>( V_{CCOP} )</td>
<td>( V_{CC3}, V_{CC18} ) Operating Voltage</td>
<td>RST in Correct Logic State</td>
<td>●</td>
<td>1</td>
<td>7</td>
<td>V</td>
</tr>
<tr>
<td>( I_{CC3} )</td>
<td>( V_{CC3} ) Supply Current</td>
<td>( V_{CC18} &gt; V_{CC3} ) ( V_{CC18} &lt; V_{CC3}, V_{CC3} = 3V ) (Note 4)</td>
<td>●</td>
<td>1</td>
<td>2</td>
<td>( \mu A )</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{CC18} &lt; V_{CC3}, V_{CC3} = 3V ) (Note 4)</td>
<td>●</td>
<td>10</td>
<td>20</td>
<td>( \mu A )</td>
</tr>
<tr>
<td>( I_{CC18} )</td>
<td>( V_{CC18} ) Supply Current</td>
<td>( V_{CC18} &lt; V_{CC3}, V_{CC18} = 1.8V ) (Note 4)</td>
<td>●</td>
<td>1</td>
<td>2</td>
<td>( \mu A )</td>
</tr>
<tr>
<td>( I_{CCCA} )</td>
<td>( V_{CCA} ) Input Current</td>
<td>( V_{CCA} = 1V )</td>
<td>●</td>
<td>–15</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>( I_{RST} )</td>
<td>Reset Pulse Width</td>
<td>RST Low (Note 5)</td>
<td>●</td>
<td>140</td>
<td>200</td>
<td>280</td>
</tr>
<tr>
<td>( I_{UV} )</td>
<td>( V_{CC} ) Undervoltage Detect to RST or COMPX</td>
<td>( V_{CC18}, V_{CC3} ) or ( V_{CCA} ) Less Than Reset Threshold ( V_{RT} ) by More Than 1% (Note 5)</td>
<td></td>
<td>110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_{OL} )</td>
<td>Output Voltage Low, RST, COMPX</td>
<td>( I_{SINK} = 2.5mA ) ( V_{CC18}, V_{CC3} = 3V ), ( V_{CC5}/V_{CC25} = 0V )</td>
<td>●</td>
<td>0.15</td>
<td>0.4</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_{SINK} = 100mA ) ( V_{CC18}, V_{CC3} = 1V ), ( V_{CC5}/V_{CC25} = 0V )</td>
<td>●</td>
<td>0.05</td>
<td>0.3</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_{SINK} = 100mA ) ( V_{CC18}, V_{CC3} = 0V ), ( V_{CC5}/V_{CC25} = 1V )</td>
<td>●</td>
<td>0.05</td>
<td>0.3</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_{SINK} = 100mA ) ( V_{CC18}, V_{CC3} = 1V ), ( V_{CC5}/V_{CC25} = 1V )</td>
<td>●</td>
<td>0.05</td>
<td>0.3</td>
<td>V</td>
</tr>
<tr>
<td>( V_{OH} )</td>
<td>Output Voltage High, RST</td>
<td>( I_{SOURCE} = 1\mu A ) (Note 6)</td>
<td>●</td>
<td>( V_{CC3} - 1 )</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>
ELECTRICAL CHARACTERISTICS

LTC1728-3.3 The ● denotes specifications which apply over the full operating temperature range, otherwise specifications are at \( T_A = 25^\circ C \). \( V_{CC3} = 3.3V \), \( V_{CC18} = 1.8V \), \( V_{CCA} = V_{CC3} \) unless otherwise noted.

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{RT3} )</td>
<td>Reset Threshold ( V_{CC3} )</td>
<td>( V_{CC3} ) Input Threshold</td>
<td>3.036</td>
<td>3.086</td>
<td>3.135</td>
<td>V</td>
</tr>
<tr>
<td>( V_{RT18} )</td>
<td>Reset Threshold ( V_{CC18} )</td>
<td>( V_{CC18} ) Input Threshold</td>
<td>1.656</td>
<td>1.683</td>
<td>1.710</td>
<td>V</td>
</tr>
<tr>
<td>( V_{RTA} )</td>
<td>Reset Threshold ( V_{CCA} )</td>
<td>( V_{CCA} ) Input Threshold</td>
<td>0.985</td>
<td>1.000</td>
<td>1.015</td>
<td>V</td>
</tr>
<tr>
<td>( V_{CCOP} )</td>
<td>( V_{CC3}, V_{CC18} ) Operating Voltage</td>
<td>RST in Correct Logic State</td>
<td>1</td>
<td>7</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( I_{VCC3} )</td>
<td>( V_{CC3} ) Supply Current</td>
<td>( V_{CC18} &gt; V_{CC3} \ V_{CC18} &lt; V_{CC3}, V_{CC3} = 3.3V ) (Note 4)</td>
<td>●</td>
<td>1</td>
<td>2</td>
<td>μA</td>
</tr>
<tr>
<td>( I_{VCC18} )</td>
<td>( V_{CC18} ) Supply Current</td>
<td>( V_{CC18} &lt; V_{CC3}, V_{CC18} = 1.8V ) (Note 4)</td>
<td>●</td>
<td>1</td>
<td>2</td>
<td>μA</td>
</tr>
<tr>
<td>( I_{VCCA} )</td>
<td>( V_{CCA} ) Input Current</td>
<td>( V_{CCA} = 1V )</td>
<td>●</td>
<td>15</td>
<td>0</td>
<td>nA</td>
</tr>
<tr>
<td>( I_{RST} )</td>
<td>Reset Pulse Width</td>
<td>RST Low (Note 5)</td>
<td>●</td>
<td>140</td>
<td>200</td>
<td>280</td>
</tr>
<tr>
<td>( t_{UV} )</td>
<td>( V_{CC} ) Undervoltage Detect to RST</td>
<td>( V_{CC18}, V_{CC3} ) or ( V_{CCA} ) Less Than Reset (Note 5)( V_{RT} ) by More Than 1%</td>
<td>110</td>
<td></td>
<td></td>
<td>μs</td>
</tr>
<tr>
<td>( V_{OL} )</td>
<td>Output Voltage Low, RST</td>
<td>( I_{SINK} = 2.5\mu A, V_{CC3} = 3.3V, V_{CC18} = 0V )</td>
<td>●</td>
<td>0.15</td>
<td>0.4</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_{SINK} = 100\mu A, V_{CC3} = 1V, V_{CC18} = 0V )</td>
<td>●</td>
<td>0.05</td>
<td>0.3</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_{SINK} = 100\mu A, V_{CC3} = 0V, V_{CC18} = 1V )</td>
<td>●</td>
<td>0.05</td>
<td>0.3</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( I_{SINK} = 100\mu A, V_{CC3} = 1V, V_{CC18} = 1V )</td>
<td>●</td>
<td>0.05</td>
<td>0.3</td>
<td>V</td>
</tr>
<tr>
<td>( V_{OH} )</td>
<td>Output Voltage High, RST</td>
<td>( I_{SOURCE} = 1\mu A ) (Note 6)</td>
<td>●</td>
<td></td>
<td>V_{CC3} – 1</td>
<td>V</td>
</tr>
</tbody>
</table>

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

Note 2: All voltage values are with respect to GND.

Note 3: The LTC1727E/LTC1728E are guaranteed to meet specified performance from 0°C to 70°C and are designed, characterized and assured to meet the extended temperature limits of –40°C to 85°C but are not tested at these temperatures.

Note 4: Both \( V_{CC3} \) and \( V_{CC5}/V_{CC25}/V_{CC18} \) can act as the supply depending on which pin has the greatest potential.

Note 5: Measured from when input passes through the input threshold (\( V_{RTX} \)) until RST or COMPX passes through 1.5V.

Note 6: The output pins RST and COMPX have internal pull-ups to \( V_{CC3} \) of typically 6μA. However, external pull-up resistors may be used when faster rise times are required or for \( V_{OH} \) voltages greater than \( V_{CC3} \).

Note 7: The \( V_{CC5} \) reset override voltage is valid for an operating range less than approximately 1.15V. Above this point the override is turned off and the \( V_{CC5} \) pin functions normally.
TYPICAL PERFORMANCE CHARACTERISTICS

**VCCA Input Current vs Input Voltage**

- **TA = 25°C**

**VCCA Threshold Voltage vs Temperature**

**Typical Transient Duration vs Comparator Overdrive**

- **TA = 25°C**

**Reset Pulse Width vs Temperature**

- **RST, COMPX ISINK vs Supply Voltage**

**I\(^{\text{VCC3}}\) vs Temperature (LTC1727-2.5/LTC1728-2.5)**

**I\(^{\text{VCC3}}\) vs Temperature (LTC1727-5/LTC1728-5)**

**I\(^{\text{VCC5}}\) vs Temperature (LTC1727-5/LTC1728-5)**

For more information [www.analog.com](http://www.analog.com)
TYPICAL PERFORMANCE CHARACTERISTICS

**V_{CC25} Threshold Voltage vs Temperature (LTC1727-2.5/LTC1728-2.5)**

-30°C to 100°C
-2.3750 V to 2.3000 V

**V_{CC3} Threshold Voltage vs Temperature (LTC1728-1.8)**

-30°C to 100°C
-3.135 V to 3.035 V

**V_{CC5} Threshold Voltage vs Temperature (LTC1727-5/LTC1728-5)**

-30°C to 100°C
-4.725 V to 4.600 V

**I_{VCC18} vs Temperature (LTC1728-1.8/LTC1728-3.3)**

-30°C to 100°C
-0.5 µA to 1.5 µA

**I_{VCC3} vs Temperature (LTC1728-1.8)**

-30°C to 100°C
-5 µA to 15 µA

**V_{CC18} Threshold Voltage vs Temperature (LTC1728-1.8/LTC1728-3.3)**

-30°C to 100°C
-1.650 V to 1.710 V

**V_{CC3} Threshold Voltage vs Temperature (LTC1728-1.8)**

-30°C to 100°C
-2.765 V to 2.845 V

For more information www.analog.com
### PIN FUNCTIONS (LTC1727/LTC1728)

**VCC3 (Pin 1/Pin 5):** 3.3V Sense Input and Power Supply Pin. (3V Sense Input and Power Supply Pin for LTC1728-1.8.) This pin provides power to the part when the voltage on VCC3 is greater than the voltage on VCC5/VCC25/VCC18. Bypass to ground with a ≥ 0.1µF ceramic capacitor.

**VCC5 (Pin 2/Pin 4):** 5V Sense Input and Power Supply Pin. This pin is used on the LTC1727-5/LTC1728-5 to provide power to the part when the voltage on VCC5 is greater than the voltage on VCC3. Bypass to ground with a ≥0.1µF ceramic capacitor.

**VCC25 (Pin 2/Pin 4):** 2.5V Sense Input and Power Supply Pin. This pin is used on the LTC1727-2.5/LTC1728-2.5 to provide power to the part when the voltage on VCC25 is greater than the voltage on VCC3. Bypass to ground with a ≥0.1µF ceramic capacitor.

**VCC18 (Pin 2/Pin 4):** 1.8V Sense Input and Power Supply Pin. This pin is used on the LTC1728-1.8/LTC1728-3.3 to provide power to the part when the voltage on VCC18 is greater than the voltage on VCC3. Bypass to ground with a ≥0.1µF ceramic capacitor.

**VCCA (Pin 3/Pin 3):** 1V Sense, High Impedance Input. If unused, it can be tied to either VCC3 or VCC5/VCC25/VCC18.

**GND (Pin 4/Pin 2):** Ground.

**COMPA (Pin 5):** VCCA Comparator Output for the LTC1727. Active high, open-drain logic output with weak pull-up to VCC3. Asserted when VCCA is above VRTA. Deasserted when VCCA is below VRTA or if both the VCC3 and VCC5 supply pins are too low to power the internal bandgap reference (typically < 2.0V). Can be pulled greater than VCC3 using an external pull-up.

**RST (Pin 6/Pin 1):** Reset Logic Output. Active low, open-drain logic output with weak pull-up to VCC3. Can be pulled up greater than VCC3 when interfacing to 5V logic. Asserted when one or all of the supplies are below trip thresholds and held for 200ms after all supplies become valid.

**COMP5 (Pin 7):** VCC5 Comparator Output for the LTC1727-5. Active high, open-drain logic output with weak pull-up to VCC3. Asserted when VCC5 is above VRT5. Can be pulled greater than VCC3 using an external pull-up.

**COMP25 (Pin 7):** VCC25 Comparator Output for the LTC1727-2.5. Active high, open-drain logic output with weak pull-up to VCC3. Asserted when VCC25 is above VRT25. Can be pulled greater than VCC3 using an external pull-up.

**COMP3 (Pin 8):** VCC3 Comparator Output for the LTC1727. Active high, open-drain logic output with weak pull-up to VCC3. Asserted when VCC3 is above VRT3. Can be pulled greater than VCC3 using an external pull-up.
LTC1727/LTC1728

BLOCK DIAGRAMS

LTC1727-5/LTC1727-2.5

For more information www.analog.com
**BLOCK DIAGRAMS**

![Block Diagram](BlockDiagram.png)

**TIMING DIAGRAM**

![Timing Diagram](TimingDiagram.png)
**APPLICATIONS INFORMATION**

**Supply Monitoring**

The LTC1727 is a low power, high accuracy triple supply monitoring circuit with three monitor outputs and a 200ms microprocessor reset output.

The LTC1728 is a low power, high accuracy triple supply monitoring circuit with a single 200ms microprocessor reset output.

All three VCC inputs must be above predetermined thresholds for reset not to be invoked. The LTC1727/LTC1728 will assert reset during power-up, power-down and brownout conditions on any one or all of the VCC inputs.

**Power Detect**

The LTC1727/LTC1728 are powered from the 3.3V/3V input pin (VCC3), the 1.8V input pin (VCC18), the 2.5V input pin (VCC25) or the 5V input pin (VCC5), whichever pin has the highest potential. This ensures the part pulls the RST pin low as soon as either input pin is ≥1V.

**Power-Up**

Upon power-up, either the VCC5/VCC25/VCC18 or VCC3 pin, can power the part. This ensures that RST will be low when either VCC5/VCC25/VCC18 or VCC3 reaches 1V. As long as any one of the VCC inputs is below its predetermined threshold, RST will stay a logic low. Once all of the VCC inputs rise above their thresholds, an internal timer is started and RST is released after 200ms.

RST is reasserted whenever any one of the VCC inputs drops below its predetermined threshold and remains asserted until 200ms after all of the VCC inputs are above their thresholds.

On the LTC1727, each of the comparator outputs will be low until the VCC input that is monitored by that comparator rises above the appropriate predetermined threshold. The COMP3, and COMP5/COMP25 outputs are guaranteed to be in the correct logic state for either VCC3 or VCC5/VCC25 greater than 1V. The COMPA output requires the internal bandgap reference to be valid before the correct logic state can be output. Therefore, the COMPA output will be held low until VCCA is above 1V and VCC3 or VCC5/VCC25 is greater than 2V (typ).

**Power-Down**

On power-down, once any of the VCC inputs drop below its threshold, RST is held at a logic low. A logic low of 0.3V is guaranteed until both VCC3 and VCC5/VCC25/VCC18 drop below 1V.

**Glitch Immunity**

The RST output of the LTC1727/LTC1728 have two forms of glitch immunity built in. First, the input monitors require the input voltage to transition at least 10% of the input threshold (0.1 • VRTH) below the input threshold for approximately 50µs in order to force the monitor output low. The duration of the transition must be longer for voltage transitions of lesser magnitude (see Figure 1). Secondly, the reset pulse width of approximately 200ms acts to debounce the RST output ensuring that the RST output will always be in the correct state.

The individual monitor outputs of the LTC1727 do not have hysteresis and will track the monitor inputs relative to the monitor’s input threshold (VRTA, VRT25, VRT3 and VRT5). A very slow moving input voltage with ripple riding on it may cause the individual monitor outputs (COMPA, COMP25, COMP3 and COMP5) to toggle on the ripple as the input voltage passes the input threshold. The slow response time of the LTC1727’s input monitors has a tendency to integrate signals on the inputs improving their immunity to noise and ripple.

![Figure 1. Transient Duration vs Comparator Overdrive](https://www.analog.com/library/assets/LTC1727-1728pdf/fig1.jpg)
APPLICATIONS INFORMATION

Override Functions (5V Versions Only)

The VCCA pin, if unused, can be tied to either VCC3 or VCC5. This is an obvious solution since the trip points for VCC3 and VCC5 will always be greater than the trip point for VCCA.

The VCC5 input trip point is disabled if its voltage is equal to the voltage on VCC3 ± 25mV and the voltage on VCC5 is less than 4.15V. In this manner, the LTC1727-5/ LTC1728-5 will behave as a 3.3V monitor and VCC5 reset capability will be disabled.

The VCC5 trip point is reenabled when the voltage on VCC5 is equal to the voltage on VCC3 ± 25mV and the two inputs are greater than approximately 4.15V. In this manner, the part can function as a 5V monitor with the 3.3V monitor disabled.

When monitoring either 3.3V or 5V with VCC3 strapped to VCC5 (see Figure 2), the part determines which is the appropriate range. The part handles this situation as shown in Figure 3. Above 1V and below VRT3, RST is held low. From VRT3 to approximately 4.15V the part assumes 3.3V supply monitoring and RST is deasserted. Above approximately 4.15V the part operates as a 5V monitor. In most systems the 5V supply will pass through the 3.1V to 4.15V region in <200ms during power-up, and the RST output will behave as desired. Table 1 summarizes the state of RST at various operating voltages with VCC3 = VCC5.

<table>
<thead>
<tr>
<th>INPUTS (VCC3 = VCC5 = VCC)</th>
<th>RST</th>
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<tbody>
<tr>
<td>0V ≤ VCC ≤ 1V</td>
<td>—</td>
</tr>
<tr>
<td>1V ≤ VCC ≤ VRT3</td>
<td>0</td>
</tr>
<tr>
<td>VRT3 ≤ VCC ≤ 4.15V</td>
<td>1</td>
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<tr>
<td>4.15V ≤ VCC ≤ VRT5</td>
<td>0</td>
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<tr>
<td>VRT5 ≤ VCC</td>
<td>1</td>
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</table>

Table 1. Override Truth Table (VCC3 = VCC5)

Figure 2. Single Supply Monitor with Others Disabled

Figure 3. RST Voltage vs Supply Voltage
APPLICATIONS INFORMATION

Figure 4 contains a simple circuit for 5V systems that can’t risk the RST output going high in the 3.1V to 4.15V range (possibly due to very slow rise time on the 5V supply). Diode D1 powers the LTC1728-5 while dropping ≈ 0.6V from the VCC5 pin to the VCC3 pin. This prevents the part’s internal override circuit from being activated. Without the override circuit active, the RST pin stays low until VCC5 reaches VRT5 ≅ 4.675V. (See Figure 5.)

LTC1727-2.5/LTC1728-2.5/LTC1728-1.8/LTC1728-3.3 Override Functions

The VCCA pin, if unused, can be tied to either VCC3 or VCC25/VCC18. This is an obvious solution since the trip points for VCC3 and VCC25/VCC18 will always be greater than the trip point for VCCA. Likewise, the VCC25/VCC18, if unused, can be tied to VCC3. VCC3 must always be used. Tying VCC3 to VCC25/VCC18 and operating off of a 2.5V/1.8V supply will result in the continuous assertion of RST.

TYPICAL APPLICATIONS

Triple Supply Monitor (3.3V, 5V and Adjustable)

For more information [www.analog.com](http://www.analog.com)
TYPICAL APPLICATIONS

Dual Supply Monitor (3.3V and 5V, Defeat VCCA Input)

Dual Supply Monitor (3.3V or 5V Plus Adjustable)

*TO PRESERVE THRESHOLD ACCURACY, SET PARALLEL COMBINATION OF R1 AND R2 ≤ 66.5k
REFER TO LTC1728-5 OVERRIDE FUNCTIONS IN THE APPLICATIONS INFORMATION SECTION

Dual Supply Monitor (3.3V Plus Adjustable)

*TO PRESERVE THRESHOLD ACCURACY, SET PARALLEL COMBINATION OF R1 AND R2 ≤ 66.5k

Using VCCA Tied to DC/DC Feedback Divider

For more information www.analog.com
NOTE:
1. DIMENSIONS IN MILLIMETER/(INCH)
2. DRAWING NOT TO SCALE
3. DIMENSION DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
   MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.152mm (.006") PER SIDE
4. DIMENSION DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSIONS.
   INTERLEAD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.152mm (.006") PER SIDE
5. LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.102mm (.004") MAX

For more information www.analog.com
S8 Package
8-Lead Plastic Small Outline (Narrow .150 Inch)
(Reference LTC DWG # 05-08-1610 Rev G)

RECOMMENDED SOLDER PAD LAYOUT

NOTE:
1. DIMENSIONS IN INCHES
2. DRAWING NOT TO SCALE
3. THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
   MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .006" (0.15mm)
4. PIN 1 CAN BE BEVEL EDGE OR A DIMPLE

For more information www.analog.com
**PACKAGE DESCRIPTION**

**S5 Package**
5-Lead Plastic TSOT-23
(Reference LTC DWG # 05-08-1635)

**NOTE:**
1. DIMENSIONS ARE IN MILLIMETERS
2. DRAWING NOT TO SCALE
3. DIMENSIONS ARE INCLUSIVE OF PLATING
4. DIMENSIONS ARE EXCLUSIVE OF MOLD FLASH AND METAL BURR
5. MOLD FLASH SHALL NOT EXCEED 0.254mm
6. JEDEC PACKAGE REFERENCE IS MO-193
### REVISION HISTORY

(Revision history begins at Rev C)

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<th>DESCRIPTION</th>
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<td>C</td>
<td>01/16</td>
<td>Updated package drawings.</td>
<td>14-16</td>
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<tr>
<td>D</td>
<td>10/16</td>
<td>Corrected maximum temperature for E-grade.</td>
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<tr>
<td>E</td>
<td>05/19</td>
<td>Corrected orderable part number (LTC1727EMS8-2.5#PBF → LTC1727EMS8-5#PBF)</td>
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**TYPICAL APPLICATION**

Triple Supply Monitor with Manual Reset Button

![Triple Supply Monitor with Manual Reset Button Diagram](image)

**RELATED PARTS**

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<th>DESCRIPTION</th>
<th>COMMENTS</th>
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<td>5V Supply Monitor, Watchdog Timer and Battery Backup</td>
<td>4.65V Threshold</td>
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<tr>
<td>LTC694-3.3</td>
<td>3.3V Supply Monitor, Watchdog Timer and Battery Backup</td>
<td>2.9V Threshold</td>
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<tr>
<td>LTC699</td>
<td>5V Supply Monitor and Watchdog Timer</td>
<td>4.65V Threshold</td>
</tr>
<tr>
<td>LTC1326</td>
<td>Micropower Precision Triple Supply Monitor for 5V, 3.3V and ADJ</td>
<td>4.725V, 3.118V, 1V Thresholds (±0.75%)</td>
</tr>
<tr>
<td>LTC1326-2.5</td>
<td>Micropower Precision Triple Supply Monitor for 2.5V, 3.3V and ADJ</td>
<td>2.363V, 3.118V, 1V Thresholds (±0.75%)</td>
</tr>
<tr>
<td>LTC1443/LTC1444/LTC1445</td>
<td>Micropower Quad Comparators with 1% Reference</td>
<td>LTC1443 Has 1.182V Reference, LTC1444/LTC1445 Have 1.221V Reference and Adjustable Hysteresis</td>
</tr>
<tr>
<td>LTC1536</td>
<td>Precision Triple Supply Monitor for PCI Applications</td>
<td>Meets PCI I&lt;sub&gt;FAIL&lt;/sub&gt; Timing Specifications</td>
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<tr>
<td>LTC1540</td>
<td>Nanopower Comparator with 2% Reference</td>
<td>1.182V Reference, 300mA Supply Current, 8-Pin MSOP</td>
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<tr>
<td>LTC1726-2.5</td>
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<td>Adjustable RESET and Watchdog Time Outs</td>
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<td>Adjustable RESET and Watchdog Time Outs</td>
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<td>Micropower Triple Supply Monitor for 3.3V, 1.8V and ADJ</td>
<td>Push-Pull RESET Output, SOT-23</td>
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