

FEATURES

Ultralow supply current of 1 μA maximum (ADM6326/ADM6328)

Accurate monitoring of 2.5 V, 3 V, 3.3 V, and 5 V rails

Reset thresholds available in increments from 2.2 V to 4.63 V

Glitch immunity from negative-going V_{CC} transients

2 reset output options

Push-pull $\overline{\text{RESET}}$ (ADM6326/ADM6346)

Open-drain $\overline{\text{RESET}}$ (ADM6328/ADM6348)

Minimum reset timeout of 100 ms

Operating temperature range of -40°C to $+85^{\circ}\text{C}$

3-lead SOT-23 package

APPLICATIONS

Telecommunications

Microprocessor systems

Desktop and notebook computers

Portable equipment

GENERAL DESCRIPTION

The ADM6326/ADM6328/ADM6346/ADM6348 devices provide low cost solutions for protecting sensitive circuitry, such as microprocessor and telecommunications circuitry.

With built-in glitch immunity, ultralow supply currents, and 24 reset threshold voltage options, the ADM6326/ADM6328/ADM6346/ADM6348 not only ensure that systems are immune to fast transients on V_{CC} , but also that the devices are suitable for monitoring a variety of supply voltages in low power, portable equipment.

These devices provide a reset output during power-up, power-down, and brownout conditions. On power-up, an internal timer holds $\overline{\text{RESET}}$ asserted for at least 100 ms. This holds the

FUNCTIONAL BLOCK DIAGRAMS

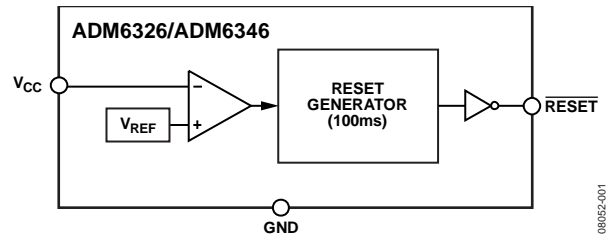


Figure 1.

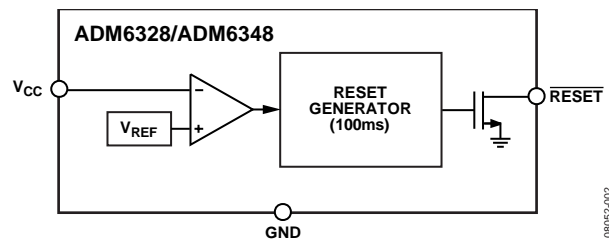


Figure 2.

microprocessor in a reset state until conditions have stabilized. The reset output remains operational with V_{CC} as low as 1 V.

The ADM6326 and ADM6346 have an active low push-pull reset output. The ADM6328 and ADM6348 have an active low open-drain reset output, which requires an external pull-up resistor. The ADM6326 and ADM6328 offer a choice of ten reset thresholds in increments between 2.2 V and 3.08 V, whereas the ADM6346 and ADM6348 offer a choice of 14 reset thresholds between 3.3 V and 4.63 V. Not all options are released for sale as standard models. See the Ordering Guide for details.

These devices are available in a 3-lead SOT-23 package and operate over the extended temperature range of -40°C to $+85^{\circ}\text{C}$.

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REVISION HISTORY

5/2018—Rev. A to Rev. B

| | |
|---|---|
| Changes to General Description Section | 1 |
| Changes to Table 2..... | 3 |
| Added Note 1, Table 2; Renumbered Sequentially..... | 3 |
| Changes to Ordering Guide | 9 |

6/2014—Rev. 0 to Rev. A

| | |
|---------------------------------------|---|
| Changes to Figure 1 and Figure 2..... | 1 |
|---------------------------------------|---|

9/2009—Revision 0: Initial Version

SPECIFICATIONS

$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, unless otherwise noted. Typical values are at $T_A = 25^{\circ}\text{C}$ and $V_{CC} = 3\text{ V}$. Overtemperature limits are guaranteed by design.

Table 1.

| Parameter | Min | Typ | Max | Unit | Test Conditions/Comments |
|---|---------------------|----------|------------------|-------------------------|--|
| OPERATING VOLTAGE RANGE, V_{CC} | 1.0 | | 5.5 | V | |
| INPUT CURRENT, I_{CC} | | 0.5 | 1.0 | μA | ADM6326/ADM6328 only, $V_{CC} = 3.0\text{ V}$ for $V_{TH} \leq 2.93\text{ V}$, $V_{CC} = 3.2\text{ V}$ for $V_{TH} > 2.93\text{ V}$, no load |
| | | 1.0 | 1.75 | μA | $V_{CC} = 5.5\text{ V}$, no load |
| RESET THRESHOLD | | | | | |
| Threshold Voltage, V_{TH} (See Table 2) | $V_{TH} - 2.5\%$ | V_{TH} | $V_{TH} + 2.5\%$ | V | $T_A = 25^{\circ}\text{C}$ |
| | $V_{TH} - 1.5\%$ | V_{TH} | $V_{TH} + 1.5\%$ | V | |
| Temperature Coefficient | | 40 | | ppm/ $^{\circ}\text{C}$ | |
| Hysteresis | | | | mV | |
| | | 6.3 | | mV | |
| | | 9.5 | | mV | |
| TIMING CHARACTERISTICS | | | | | |
| V_{CC} to Reset Delay (t_{RD}) | | 20 | | μs | $V_{CC} = V_{TH}$ to $(V_{TH} - 100\text{ mV})$ |
| Reset Active Timeout Period (t_{RP}) | 100 | 185 | 280 | ms | |
| RESET OUTPUT VOLTAGE LOW, VOL | | | 0.3 | V | $V_{CC} > 2.1\text{ V}$, $I_{SINK} = 1.6\text{ mA}$, reset asserted |
| | | | 0.4 | V | $V_{CC} \geq 1.2\text{ V}$, $I_{SINK} = 100\text{ }\mu\text{A}$, reset asserted |
| RESET OUTPUT VOLTAGE HIGH, VOH | $0.8 \times V_{CC}$ | | | V | ADM6326 only, $V_{CC} = 3.2\text{ V}$, $I_{SOURCE} = 500\text{ }\mu\text{A}$ |
| | $0.8 \times V_{CC}$ | | | V | ADM6326/ADM6346 only, $V_{CC} = 4.5\text{ V}$, $I_{SOURCE} = 800\text{ }\mu\text{A}$, $V_{TH} \leq 4.38\text{ V}$ |
| | $0.8 \times V_{CC}$ | | | V | ADM6326/ADM6346 only, $V_{CC} = V_{TH(MAX)}$, $I_{SOURCE} = 800\text{ }\mu\text{A}$, $V_{TH} \geq 4.5\text{ V}$ |
| OPEN-DRAIN RESET OUTPUT LEAKAGE CURRENT | | | 0.1 | μA | |

Table 2. Reset Threshold Voltage

| Parameter | $T_A = 25^{\circ}\text{C}$ | | | $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ | | Unit |
|---|----------------------------|------|-------|--|-------|------|
| | Min | Typ | Max | Min | Max | |
| RESET THRESHOLD VOLTAGE (V_{TH}) ¹ | | | | | | |
| ADM6326-22, ADM6328-22 | 2.167 | 2.2 | 2.233 | 2.145 | 2.25 | V |
| ADM6328-23 | 2.285 | 2.32 | 2.355 | 2.262 | 2.375 | V |
| ADM6328-25 | 2.462 | 2.5 | 2.537 | 2.437 | 2.562 | V |
| ADM6326-26 | 2.591 | 2.63 | 2.669 | 2.564 | 2.696 | V |
| ADM6326-27, ADM6328-27 | 2.66 | 2.7 | 2.741 | 2.633 | 2.768 | V |
| ADM6328-28 | 2.758 | 2.8 | 2.842 | 2.73 | 2.87 | V |
| ADM6326-29 | 2.886 | 2.93 | 2.974 | 2.857 | 3.0 | V |
| ADM6326-30 | 2.955 | 3.00 | 3.045 | 2.925 | 3.075 | V |
| ADM6326-31 | 3.034 | 3.08 | 3.126 | 3.003 | 3.15 | V |
| ADM6348-33 | 3.25 | 3.3 | 3.35 | 3.217 | 3.383 | V |
| ADM6348-34 | 3.349 | 3.4 | 3.451 | 3.315 | 3.485 | V |
| ADM6348-35 | 3.447 | 3.5 | 3.552 | 3.412 | 3.587 | V |
| ADM6348-36 | 3.546 | 3.6 | 3.654 | 3.51 | 3.69 | V |
| ADM6348-37 | 3.644 | 3.7 | 3.755 | 3.607 | 3.792 | V |
| ADM6348-38 | 3.743 | 3.8 | 3.857 | 3.705 | 3.895 | V |
| ADM6348-39 | 3.841 | 3.9 | 3.958 | 3.802 | 3.997 | V |
| ADM6348-40 | 3.94 | 4.0 | 4.06 | 3.9 | 4.1 | V |
| ADM6348-41 | 4.038 | 4.1 | 4.161 | 3.997 | 4.202 | V |
| ADM6348-42 | 4.137 | 4.2 | 4.263 | 4.095 | 4.305 | V |
| ADM6348-43 | 4.235 | 4.3 | 4.364 | 4.192 | 4.407 | V |
| ADM6348-44 | 4.314 | 4.38 | 4.446 | 4.27 | 4.489 | V |
| ADM6348-45 | 4.432 | 4.5 | 4.567 | 4.387 | 4.612 | V |
| ADM6346-46, ADM6348-46 | 4.56 | 4.63 | 4.699 | 4.514 | 4.746 | V |

¹ Not all device options are released for sale as standard models. See the Ordering Guide for full details.

ABSOLUTE MAXIMUM RATINGS

Table 3.

| Parameter | Rating |
|---------------------------------------|-------------------------------|
| Supply Voltage, V_{CC} | -0.3 V to +6 V |
| Input Current, I_{CC} | 20 mA |
| Output Voltage | |
| Push-Pull \overline{RESET} | -0.3 V to ($V_{CC} + 0.3$ V) |
| Open-Drain \overline{RESET} | -0.3 V to +6 V |
| Output Current (\overline{RESET}) | 20 mA |
| Rate of Rise of V_{CC} | 100 V/ μ s |
| Temperature | |
| Storage | -65°C to +155°C |
| Operating | -40°C to +85°C |
| Soldering (10 sec) | 300°C |

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

THERMAL RESISTANCE

θ_{JA} is specified for the worst-case conditions, that is, a device soldered in a circuit board for surface-mount packages.

Table 4. Thermal Resistance

| Package Type | θ_{JA} | Unit |
|---------------|---------------|------|
| 3-Lead SOT-23 | 270 | °C/W |

ESD CAUTION



ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

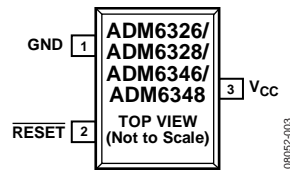


Figure 3. ADM6326/ADM6328/ADM6346/ADM6348 Pin Configuration

Table 5. Pin Function Descriptions

| Pin No. | Mnemonic | Description |
|---------|----------|---|
| 1 | GND | Ground Reference for All Signals; 0 V. |
| 2 | RESET | Active Low Logic Output. This pin is low when V_{CC} is less than the reset threshold; it remains low for 185 ms (typical) after V_{CC} becomes greater than the reset threshold. |
| 3 | V_{CC} | Supply Voltage Being Monitored. |

TYPICAL PERFORMANCE CHARACTERISTICS

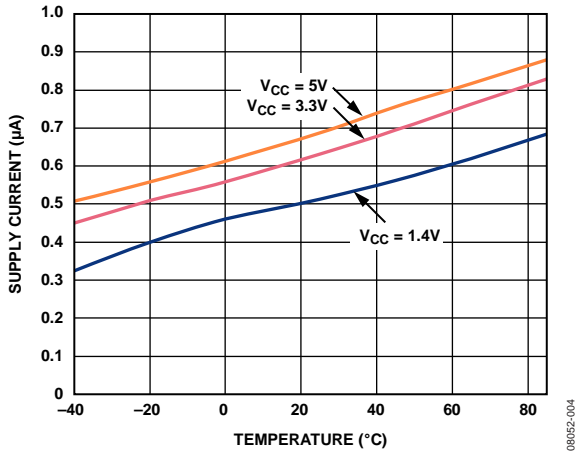


Figure 4. Supply Current vs. Temperature

08052-004

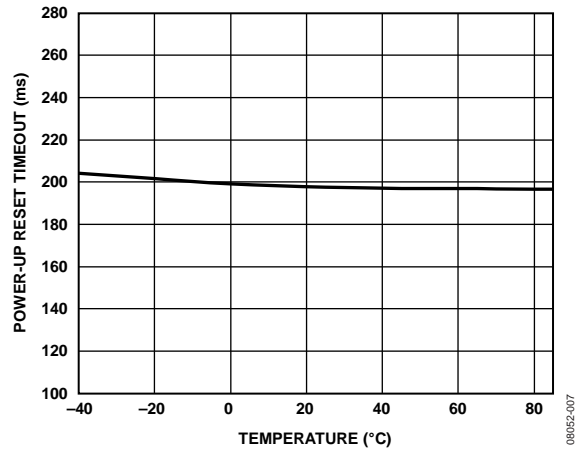


Figure 6. Power-Up Reset Timeout vs. Temperature

08052-007

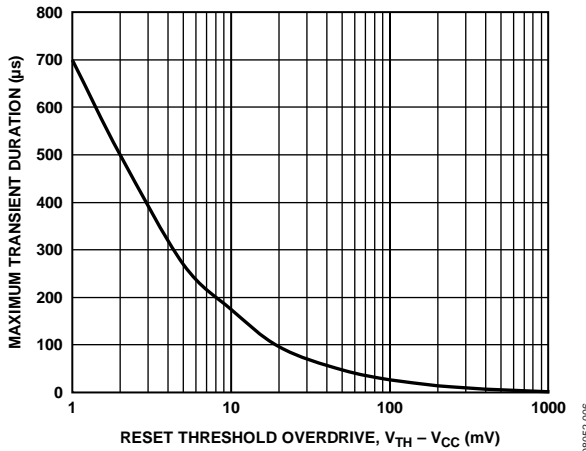


Figure 5. Maximum Transient Duration vs. Reset Threshold Overdrive

08052-008

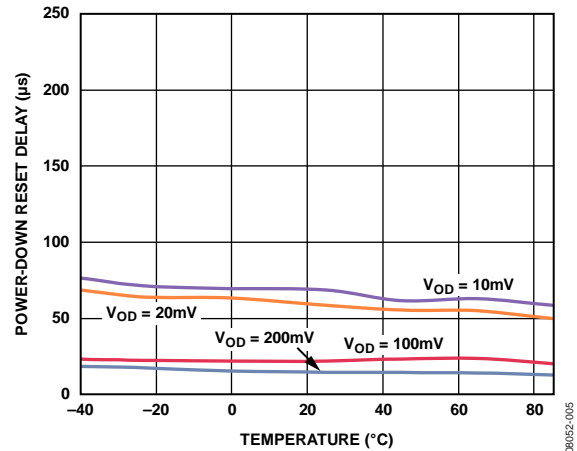


Figure 7. Power-Down Reset Delay vs. Temperature

08052-005

THEORY OF OPERATION

The ADM6326/ADM6328/ADM6346/ADM6348 are designed to protect the integrity of a system's operation by ensuring the proper operation of the system during power-up, power-down, and brownout conditions. Ultralow supply currents make these devices particularly suitable for use in low power, portable equipment.

RESET OUTPUT

The ADM6326 and ADM6346 have an active low, push-pull reset output, whereas the ADM6328 and ADM6348 have an active low, open-drain reset output, which requires an external pull-up resistor. The $\overline{\text{RESET}}$ signal is guaranteed to be valid for V_{CC} down to 1 V.

When the ADM6326/ADM6328/ADM6346/ADM6348 are powered up, the $\overline{\text{RESET}}$ output remains low for a period typically equal to the $\overline{\text{RESET}}$ active timeout period of 185 ms. This feature allows adequate time for the system to power up correctly and for the power supply to stabilize before any devices are brought out of reset and are allowed to begin executing instructions. Initializing a system in this way provides a more reliable startup for microprocessor systems.

When the monitored voltage falls below its associated threshold (V_{TH}), $\overline{\text{RESET}}$ is asserted within 20 μs (typical). Asserting $\overline{\text{RESET}}$ this quickly means that the entire system can be reset at once before any part of the system's voltage falls below its recommended operating voltage. This system reset can avoid dangerous and/or erroneous operation of a microprocessor based system.

INTERFACING TO OTHER DEVICES

The active low, open-drain reset output of the ADM6328 and ADM6348 makes these devices ideal for integration with devices such as microprocessors with bidirectional reset pins. Simply connect the $\overline{\text{RESET}}$ output of the ADM6328 or ADM6348 to the $\overline{\text{RESET}}$ input of the microprocessor using a single pull-up resistor to allow either device to initiate a system reset (see Figure 8).

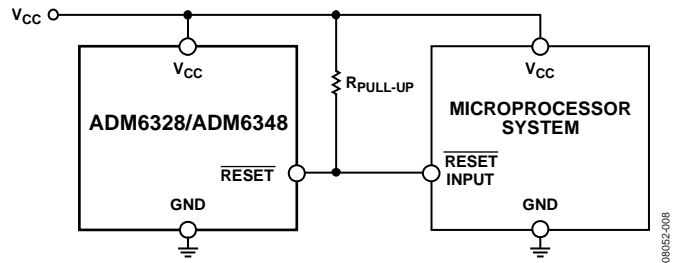


Figure 8. Interfacing to a Microprocessor with a Bidirectional Reset Pin

TRANSIENT IMMUNITY

To avoid unnecessary resets caused by fast power supply transients, the ADM6326/ADM6328/ADM6346/ADM6348 provide glitch immunity from negative-going V_{CC} transients.

Figure 5 shows the $\overline{\text{RESET}}$ comparator overdrive (that is, the maximum magnitude of negative-going pulses with respect to the typical threshold) vs. the pulse duration without a reset.

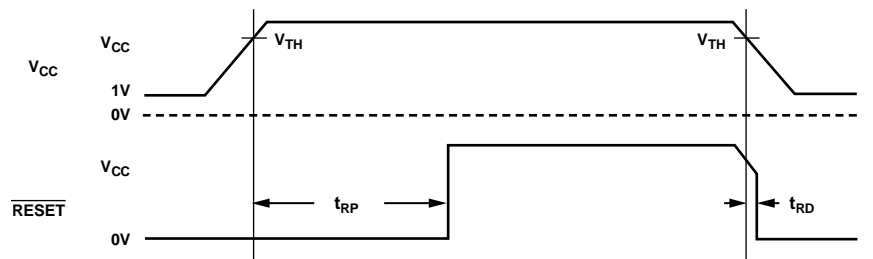
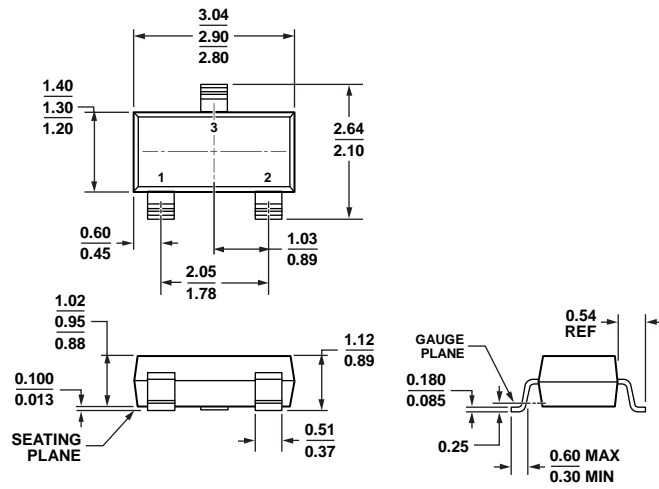


Figure 9. $\overline{\text{RESET}}$ Timing

OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS TO-236-AB

Figure 10. 3-Lead Small Outline Transistor Package [SOT-23] (RT-3)

Dimensions shown in millimeters

011989-C

ORDERING GUIDE

| Model ^{1,2} | Typical Threshold Voltage (T _A = 25°C) | RESET Output Structure | Package Description | Package Option | Marking Code |
|----------------------|---|------------------------|---------------------|----------------|--------------|
| ADM6326-22ARTZ-R7 | 2.2 V | Push-Pull | 3-Lead SOT-23 | RT-3 | LAQ |
| ADM6326-26ARTZ-R7 | 2.63 V | Push-Pull | 3-Lead SOT-23 | RT-3 | LAU |
| ADM6326-27ARTZ-R7 | 2.7 V | Push-Pull | 3-Lead SOT-23 | RT-3 | LAV |
| ADM6326-29ARTZ-R7 | 2.93 V | Push-Pull | 3-Lead SOT-23 | RT-3 | LAX |
| ADM6326-30ARTZ-R7 | 3.0 V | Push-Pull | 3-Lead SOT-23 | RT-3 | LAY |
| ADM6326-31ARTZ-R7 | 3.08 V | Push-Pull | 3-Lead SOT-23 | RT-3 | LAZ |
| ADM6328-22ARTZ-R7 | 2.2 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LB0 |
| ADM6328-23ARTZ-R7 | 2.32 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LB1 |
| ADM6328-25ARTZ-R7 | 2.5 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LB3 |
| ADM6328-27ARTZ-R7 | 2.7 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LB5 |
| ADM6328-28ARTZ-R7 | 2.8 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LB6 |
| ADM6346-46ARTZ-R7 | 4.63 V | Push-Pull | 3-Lead SOT-23 | RT-3 | LCU |
| ADM6348-33ARTZ-R7 | 3.3 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LCV |
| ADM6348-34ARTZ-R7 | 3.4 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LCW |
| ADM6348-35ARTZ-R7 | 3.5 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LCX |
| ADM6348-36ARTZ-R7 | 3.6 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LCY |
| ADM6348-37ARTZ-R7 | 3.7 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LCZ |
| ADM6348-38ARTZ-R7 | 3.8 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LD0 |
| ADM6348-39ARTZ-R7 | 3.9 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LD1 |
| ADM6348-40ARTZ-R7 | 4.0 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LD2 |
| ADM6348-41ARTZ-R7 | 4.1 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LD3 |
| ADM6348-42ARTZ-R7 | 4.2 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LD4 |
| ADM6348-43ARTZ-R7 | 4.3 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LD5 |
| ADM6348-44ARTZ-R7 | 4.38 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LD6 |
| ADM6348-45ARTZ-R7 | 4.5 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LD7 |
| ADM6348-46ARTZ-R7 | 4.63 V | Open-Drain | 3-Lead SOT-23 | RT-3 | LD8 |

¹ The ADM6326/ADM6328/ADM6346/ADM6348 include many device options; however, not all options are released for sale. Released options are called standard models and are listed in the Ordering Guide. For the most up to date list of standard models, check the [Single Supply Monitors IC](#) page on the Analog Devices website. Contact sales for information on nonstandard models and be aware that samples and production units have very long lead times.

² Z = RoHS Compliant Part.



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