

## ADM6316/ADM6317/ADM6318/ADM6319/ADM6320/ADM6321/ADM6322

### FEATURES

#### 26 reset threshold options:

2.5 V to 5 V in 100 mV increments

#### 4 reset timeout options:

1 ms, 20 ms, 140 ms, and 1120 ms (Min)

#### 4 watchdog timeout options:

6.3 ms, 102 ms, 1600 ms, and 25.6s (Typ)

#### Manual reset input

#### Reset output stages:

Push-pull active-low

Open-drain active-low

Push-pull active-high

#### Low power consumption (3 $\mu$ A)

#### Guaranteed reset output valid to $V_{CC} = 1$ V

#### Power supply glitch immunity

#### Specified over industrial temperature range

#### 5-lead SOT-23 package

### APPLICATIONS

Microprocessor systems

Computers

Controllers

Intelligent instruments

Portable equipment

### GENERAL DESCRIPTION

The ADM6316/ADM6317/ADM6318/ADM6319/ADM6320/ADM6321/ADM6322 are supervisory circuits which monitor power supply voltage levels and code execution integrity in microprocessor-based systems. As well as providing power on reset signals, an on-chip watchdog timer can reset the microprocessor if it fails to strobe within a preset timeout period. A reset signal can also be asserted by means of an external push-button, through a manual reset input. The seven parts feature different combinations of watchdog input, manual reset input and output stage configuration, as shown in Table 1.

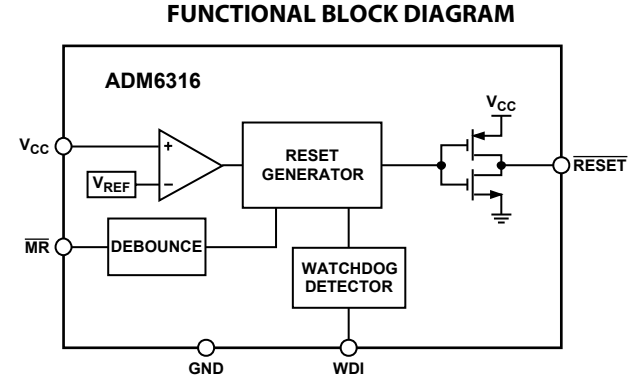


Figure 1.

Each part is available in a choice of 26 reset threshold options ranging from 2.5 V to 5 V in 100 mV increments. There are also four reset timeout options of 1 ms, 20 ms, 140 ms, and 1120 ms (min) and four watchdog timeout options of 6.3 ms, 102 ms, 1600 ms, and 25.6s (typ).

The ADM6316-ADM6322 are available in 5-lead SOT-23 packages and typically consume only 3  $\mu$ A, making them suitable for use in low power portable applications.

Table 1. Selection Table

| Part No. | Watchdog | Manual Reset | Output Stage |           |
|----------|----------|--------------|--------------|-----------|
|          |          |              | RESET        | RESET     |
| ADM6316  | Yes      | Yes          | Push-Pull    | –         |
| ADM6317  | Yes      | Yes          | –            | Push-Pull |
| ADM6318  | Yes      | –            | Push-Pull    | Push-Pull |
| ADM6319  | –        | Yes          | Push-Pull    | Push-Pull |
| ADM6320  | Yes      | Yes          | Open-Drain   | –         |
| ADM6321  | Yes      | –            | Open-Drain   | Push-Pull |
| ADM6322  | –        | Yes          | Open-Drain   | Push-Pull |

### Rev.PrC

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# ADM6316/ADM6317/ADM6318/ADM6319/ADM6320/ADM6321/ADM6322

## SPECIFICATIONS

$V_{CC}$  = full operating range,  $T_A$  =  $T_{MIN}$  to  $T_{MAX}$ , unless otherwise noted.

**Table 2.**

| Parameter  | Min                 | Typ      | Max              | Unit                  | Test Conditions/Comments                                      |
|--|---------------------|----------|------------------|-----------------------|---|
| <b>SUPPLY</b>  |                     |          |                  |                       |   |
| $V_{CC}$ Operating Voltage Range   | 1                   |          | 5.5              | V                     |   |
| Supply Current   |                     | 10       | 20               | $\mu$ A               | $V_{CC} = 5.5$ V  |
|  |                     | 5        | 12               | $\mu$ A               | $V_{CC} = 3.6$ V  |
| <b>RESET THRESHOLD VOLTAGE</b>   |                     |          |                  |                       |   |
|  | $V_{TH} - 1.5\%$    | $V_{TH}$ | $V_{TH} + 1.5\%$ | V                     | $T_A = +25^\circ\text{C}$                                     |
|  | $V_{TH} - 2.5\%$    | $V_{TH}$ | $V_{TH} + 2.5\%$ | V                     | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$              |
| <b>RESET THRESHOLD TEMPERATURE COEFFICIENT</b>                                 |                     |          |                  |                       |   |
|  |                     | 40       |                  | ppm/ $^\circ\text{C}$ |   |
| <b>RESET THRESHOLD HYSTERESIS</b>  |                     |          |                  |                       |   |
|  |                     | 3        |                  | mV                    |   |
| <b>RESET TIMEOUT PERIOD</b>  |                     |          |                  |                       |   |
| ADM63__A   | 1                   | 1.4      | 2                | ms                    |   |
| ADM63__B   | 20                  | 28       | 40               | ms                    |   |
| ADM63__C   | 140                 | 200      | 280              | ms                    |   |
| ADM63__D   | 1120                | 1600     | 2240             | ms                    |   |
| <b><math>V_{CC}</math> TO RESET DELAY</b>                                      |                     |          |                  |                       |   |
|  |                     | 40       |                  | $\mu$ s               | $V_{CC}$ falling at 1 mV/ $\mu$ s                             |
| <b>PUSH-PULL OUTPUT (ADM6316, ADM6317, ADM6318, ADM6319, ADM6321, ADM6322)</b> |                     |          |                  |                       |   |
| $\overline{\text{RESET}}$ Output Voltage                                       |                     |          | 0.3              | V                     | $V_{CC} > = 1.0$ V, $I_{SINK} = 50$ $\mu$ A                   |
|  |                     |          | 0.3              | V                     | $V_{CC} > = 1.2$ V, $I_{SINK} = 100$ $\mu$ A                  |
|  |                     |          | 0.3              | V                     | $V_{CC} > = 2.7$ V, $I_{SINK} = 1.2$ mA                       |
|  |                     |          | 0.4              | V                     | $V_{CC} > = 4.5$ V, $I_{SINK} = 3.2$ mA                       |
|  | $0.8 \times V_{CC}$ |          |                  | V                     | $V_{CC} > = 2.7$ V, $I_{SOURCE} = 500$ $\mu$ A                |
|  | $V_{CC} - 1.5$      |          |                  | V                     | $V_{CC} > = 4.5$ V, $I_{SOURCE} = 800$ $\mu$ A                |
| $\overline{\text{RESET}}$ Rise Time  |                     | 5        | 25               | ns                    | From 10% to 90% $V_{CC}$ , $C_L = 5$ pF, $V_{CC} = 3.3$ V     |
| RESET Output Voltage   |                     |          | 0.3              | V                     | $V_{CC} > = 2.7$ V, $I_{SINK} = 1.2$ mA                       |
|  |                     |          | 0.4              | V                     | $V_{CC} > = 4.5$ V, $I_{SINK} = 3.2$ mA                       |
|  | $0.8 \times V_{CC}$ |          |                  | V                     | $V_{CC} > = 1.8$ V, $I_{SOURCE} = 150$ $\mu$ A                |
|  | $0.8 \times V_{CC}$ |          |                  | V                     | $V_{CC} > = 2.7$ V, $I_{SOURCE} = 500$ $\mu$ A                |
|  | $V_{CC} - 1.5$      |          |                  | V                     | $V_{CC} > = 4.5$ V, $I_{SOURCE} = 800$ $\mu$ A                |
| <b>OPEN-DRAIN OUTPUT (ADM6320, ADM6321, ADM6322)</b>                           |                     |          |                  |                       |   |
| $\overline{\text{RESET}}$ Output Voltage                                       |                     |          | 0.3              | V                     | $V_{CC} > = 1.0$ V, $I_{SINK} = 50$ $\mu$ A                   |
|  |                     |          | 0.3              | V                     | $V_{CC} > = 1.2$ V, $I_{SINK} = 100$ $\mu$ A                  |
|  |                     |          | 0.3              | V                     | $V_{CC} > = 2.7$ V, $I_{SINK} = 1.2$ mA                       |
|  |                     |          | 0.4              | V                     | $V_{CC} > = 4.5$ V, $I_{SINK} = 3.2$ mA                       |
| Open-Drain Reset Output Leakage Current  |                     |          | 1                | $\mu$ A               |   |
| <b>WATCHDOG INPUT (ADM6316, ADM6317, ADM6318, ADM6320, ADM6321)</b>            |                     |          |                  |                       |   |
| Watchdog Timeout Period  | 4.3                 | 6.3      | 9.3              | ms                    | ADM63__W  |
|  | 71                  | 102      | 153              | ms                    | ADM63__X  |
|  | 1.12                | 1.6      | 2.4              | s                     | ADM63__Y  |
|  | 17.9                | 25.6     | 38.4             | s                     | ADM63__Z  |
| WDI Pulse Width  | 50                  |          |                  | ns                    | $V_{IL} = 0.3 \times V_{CC}$ , $V_{IH} = 0.7 \times V_{CC}$ , |

# ADM6316/ADM6317/ADM6318/ADM6319/ADM6320/ADM6321/ADM6322

| Parameter  | Min                 | Typ | Max                        | Unit         | Test Conditions/Comments          |
|--|---------------------|-----|----------------------------|--------------|-----------------------------------|
| WDI Input Threshold  | $0.3 \times V_{CC}$ |     |                            | V            |                                   |
| WDI Input Current  |                     | 120 | $0.7 \times V_{CC}$<br>160 | V<br>$\mu A$ | $V_{WDI} = V_{CC}$ , time average |
|  | -20                 | -15 |                            | $\mu A$      | $V_{WDI} = 0$ , time average      |
| MANUAL RESET INPUT (ADM6316, ADM6317, ADM6319, ADM6320, ADM6322) |                     |     |                            |              |                                   |
| $\overline{MR}$ Input Threshold                                  | 0.8                 |     | 2.0                        | V            | $V_{TH} > 4.0 V$                  |
|  |                     |     |                            | V            | $V_{TH} > 4.0 V$                  |
|  | $0.3 \times V_{CC}$ |     |                            | V            | $V_{TH} < 4.0 V$                  |
|  |                     |     | $0.7 \times V_{CC}$        | V            | $V_{TH} < 4.0 V$                  |
| $\overline{MR}$ Input Pulse Width                                | 1                   |     |                            | $\mu s$      |                                   |
| $\overline{MR}$ Glitch Rejection                                 |                     | 100 |                            | ns           |                                   |
| $\overline{MR}$ Pull-up Resistance                               | 35                  | 52  | 75                         | $k\Omega$    |                                   |
| $\overline{MR}$ to Reset Delay                                   |                     | 230 |                            | ns           | $V_{CC} = 5V$                     |

# ADM6316/ADM6317/ADM6318/ADM6319/ADM6320/ADM6321/ADM6322

## ABSOLUTE MAXIMUM RATINGS

T<sub>A</sub> = 25°C, unless otherwise noted.

Table 3.

| Parameter   | Rating          |
|---|-----------------|
| V <sub>CC</sub>                                       | -0.3 V to +6 V  |
| $\overline{\text{RESET}}$ (ADM6320, ADM6321, ADM6322) | -0.3 V to +6 V  |
| Output Current (RESET, $\overline{\text{RESET}}$ )    | 20 mA           |
| Operating Temperature Range                           | -40°C to +85°C  |
| Storage Temperature Range                             | -65°C to +125°C |
| $\theta_{JA}$ Thermal Impedance, SOT-23               | 270°C/W         |
| Lead Temperature                                      |                 |
| Soldering (10 sec)                                    | 300°C           |
| Vapour Phase (60 sec)                                 | 215°C           |
| Infrared (15 sec)                                     | 220°C           |

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

## ESD CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



# ADM6316/ADM6317/ADM6318/ADM6319/ADM6320/ADM6321/ADM6322

## PIN CONFIGURATIONS AND FUNCTION DESCRIPTIONS

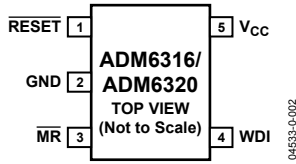


Figure 2. ADM6316/ADM6320 Pin Configuration

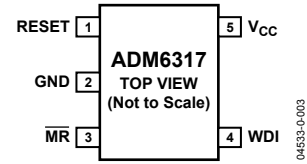


Figure 3. ADM6317 Pin Configuration

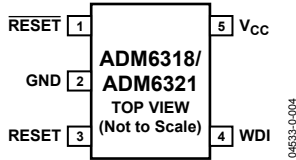


Figure 4. ADM6318/ADM6321 Pin Configuration

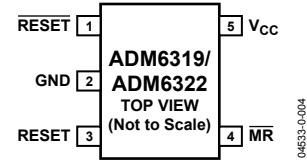


Figure 5. ADM6319/ADM6322 Pin Configuration

Table 4. Pin Function Descriptions

| Pin No. | Mnemonic   | Description   |
|---------|--|---|
| 1       | <p><math>\overline{\text{RESET}}</math> (ADM6316/ADM6318/ADM6319/ADM6320/ADM6321/ADM6322)</p> <p>RESET (ADM6317)</p> | <p>Active-Low Reset Output. Asserted whenever <math>V_{CC}</math> is below the reset threshold, <math>V_{TH}</math>. Push-Pull Output Stage for the ADM6316/ADM6318/ADM6319. Open-Drain Output Stage for the ADM6320/ADM6321/ADM6322.</p> <p>Active-High, Push-Pull Reset Output.</p>                   |
| 2       | GND  | Ground.   |
| 3       | <p><math>\overline{\text{MR}}</math> (ADM6316/ADM6317/ADM6320)</p> <p>RESET (ADM6318/ADM6319/ADM6321/ADM6322)</p>    | <p>Manual Reset Input. This is an active-low input which, when forced low for at least 1 <math>\mu\text{s}</math>, generates a reset. It features a 52 k<math>\Omega</math> internal pull-up.</p> <p>Active-High, Push-Pull Reset Output.</p>   |
| 4       | <p>WDI (ADM6316/ADM6317/ADM6318/ADM6320/ADM6321)</p> <p><math>\overline{\text{MR}}</math> (ADM6319/ADM6322)</p>      | <p>Watchdog Input. Generates a reset if the logic level on the pin remains low or high for the duration of the watchdog timeout. The timer is cleared if a logic transition occurs on this pin or if a reset is generated. Leave floating to disable the watchdog timer.</p> <p>Manual Reset Input.</p> |
| 5       | $V_{CC}$   | Power Supply Voltage Being Monitored.   |

TYPICAL PERFORMANCE CHARACTERISTICS

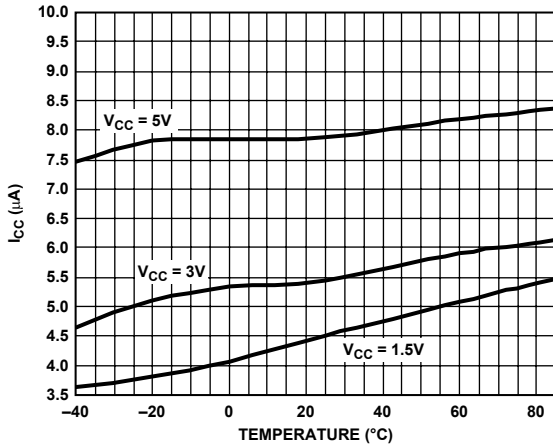


Figure 6. Supply Current vs. Temperature (ADM6316/ADM6317/ADM6318/ADM6320/ADM6321)

04533-0-006

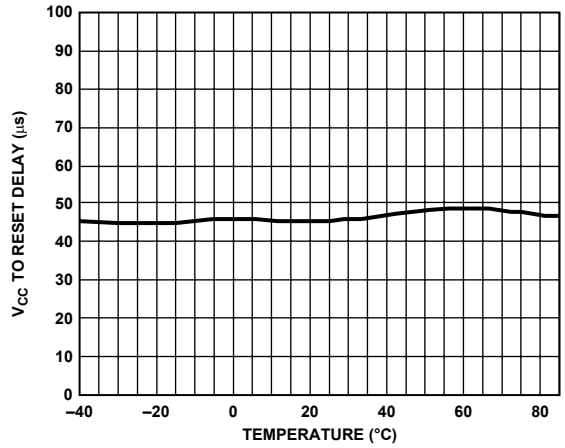


Figure 9. V<sub>CC</sub> Falling to Reset Propagation Delay vs. Temperature

04533-0-008

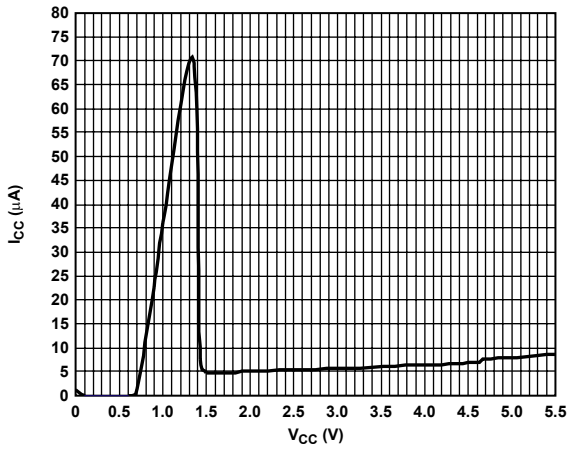


Figure 7. Supply Current vs. Supply Voltage

04533-0-007

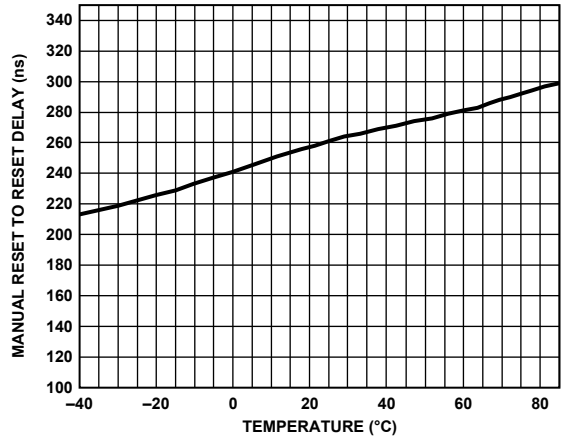


Figure 10. Manual Reset to Reset Propagation Delay vs. Temperature (ADM6316/ADM6317/ADM6319/ADM6320/ADM6322)

04533-0-010

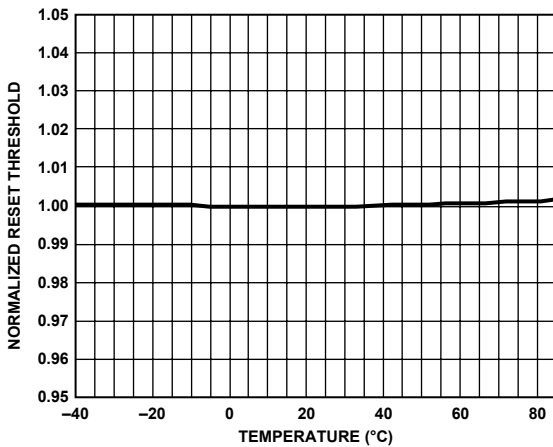


Figure 8. Normalized Reset Threshold vs. Temperature

04533-0-008

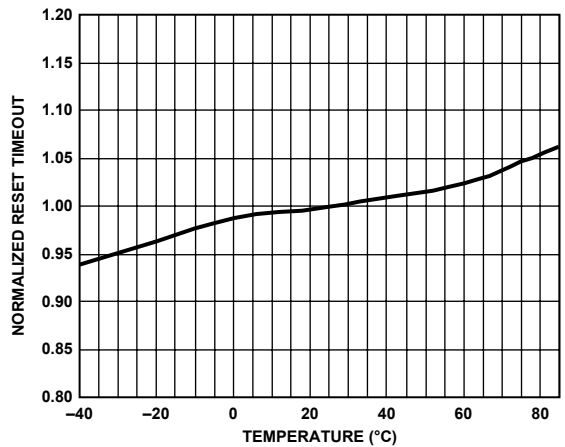
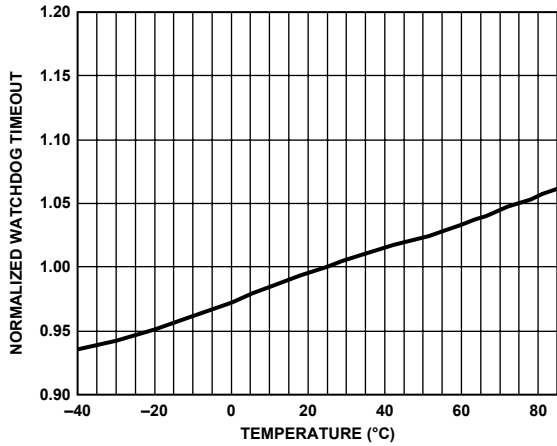


Figure 11. Normalized Reset Timeout Period vs. Temperature

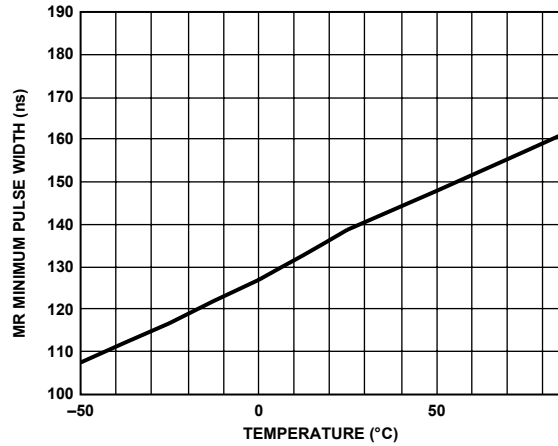
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# ADM6316/ADM6317/ADM6318/ADM6319/ADM6320/ADM6321/ADM6322



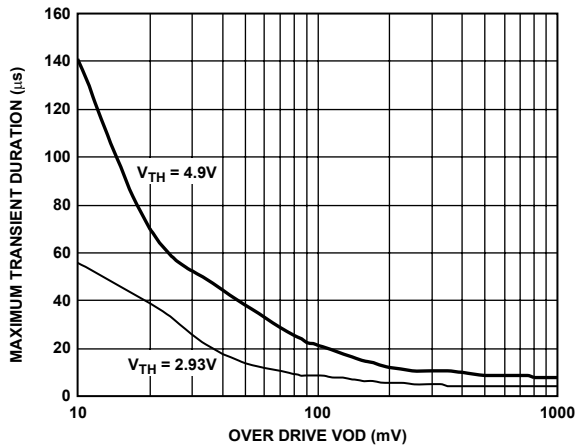
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Figure 12. Normalized Watchdog Timeout Period vs. Temperature (ADM6316/ADM6317/ADM6318/ADM6320/ADM6321)



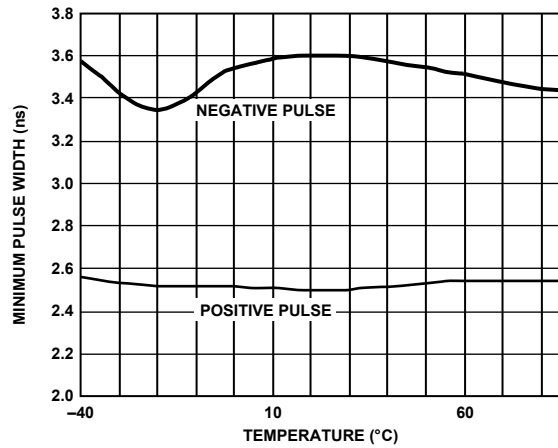
04533-0-014

Figure 14. Manual Reset Minimum Pulse Width vs. Temperature (ADM6316/ADM6317/ADM6319/ADM6320/ADM6322)



04533-0-013

Figure 13. Maximum V<sub>CC</sub> Transient Duration vs. Reset Threshold Overdrive



04533-0-015

Figure 15. Watchdog Input Minimum Pulse Width vs. Temperature (ADM6316/ADM6317/ADM6318/ADM6320/ADM6321)



# ADM6316/ADM6317/ADM6318/ADM6319/ADM6320/ADM6321/ADM6322

**Table 5. Reset Threshold Options**

| Part No.     | T <sub>A</sub> = +25°C |       |       | T <sub>A</sub> = -40°C to +85°C |       |
|--------------|------------------------|-------|-------|---------------------------------|-------|
|              | Min                    | Typ   | Max   | Min                             | Max   |
| ADM63 ___ 50 | 4.925                  | 5.000 | 5.075 | 4.875                           | 5.125 |
| ADM63 ___ 49 | 4.827                  | 4.900 | 4.974 | 4.778                           | 5.023 |
| ADM63 ___ 48 | 4.728                  | 4.800 | 4.872 | 4.680                           | 4.920 |
| ADM63 ___ 47 | 4.630                  | 4.700 | 4.771 | 4.583                           | 4.818 |
| ADM63 ___ 46 | 4.561                  | 4.630 | 4.699 | 4.514                           | 4.746 |
| ADM63 ___ 45 | 4.433                  | 4.500 | 4.568 | 4.388                           | 4.613 |
| ADM63 ___ 44 | 4.314                  | 4.390 | 4.446 | 4.270                           | 4.490 |
| ADM63 ___ 43 | 4.236                  | 4.300 | 4.365 | 4.193                           | 4.408 |
| ADM63 ___ 42 | 4.137                  | 4.200 | 4.263 | 4.095                           | 4.305 |
| ADM63 ___ 41 | 4.039                  | 4.100 | 4.162 | 3.998                           | 4.203 |
| ADM63 ___ 40 | 3.940                  | 4.00  | 4.060 | 3.900                           | 4.100 |
| ADM63 ___ 39 | 3.842                  | 3.900 | 3.959 | 3.803                           | 3.998 |
| ADM63 ___ 38 | 3.743                  | 3.800 | 3.857 | 3.705                           | 3.895 |
| ADM63 ___ 37 | 3.645                  | 3.700 | 3.756 | 3.608                           | 3.793 |
| ADM63 ___ 36 | 3.546                  | 3.600 | 3.654 | 3.510                           | 3.690 |
| ADM63 ___ 35 | 3.448                  | 3.500 | 3.553 | 3.413                           | 3.588 |
| ADM63 ___ 34 | 3.349                  | 3.400 | 3.451 | 3.315                           | 3.485 |
| ADM63 ___ 33 | 3.251                  | 3.300 | 3.350 | 3.218                           | 3.383 |
| ADM63 ___ 32 | 3.152                  | 3.200 | 3.248 | 3.120                           | 3.280 |
| ADM63 ___ 31 | 3.034                  | 3.080 | 3.126 | 3.003                           | 3.157 |
| ADM63 ___ 30 | 2.955                  | 3.000 | 3.045 | 2.925                           | 3.075 |
| ADM63 ___ 29 | 2.886                  | 2.930 | 2.974 | 2.857                           | 3.000 |
| ADM63 ___ 28 | 2.758                  | 2.800 | 2.842 | 2.730                           | 2.870 |
| ADM63 ___ 27 | 2.660                  | 2.700 | 2.741 | 2.633                           | 2.768 |
| ADM63 ___ 26 | 2.591                  | 2.630 | 2.669 | 2.564                           | 2.696 |
| ADM63 ___ 25 | 2.463                  | 2.500 | 2.538 | 2.438                           | 2.563 |

**Table 6. Reset Timeout Options**

| Suffix | Min  | Typ  | Max  | Unit |
|--------|------|------|------|------|
| A      | 1    | 1.6  | 2    | ms   |
| B      | 20   | 30   | 40   | ms   |
| C      | 140  | 200  | 280  | ms   |
| D      | 1.12 | 1.60 | 2.24 | s    |

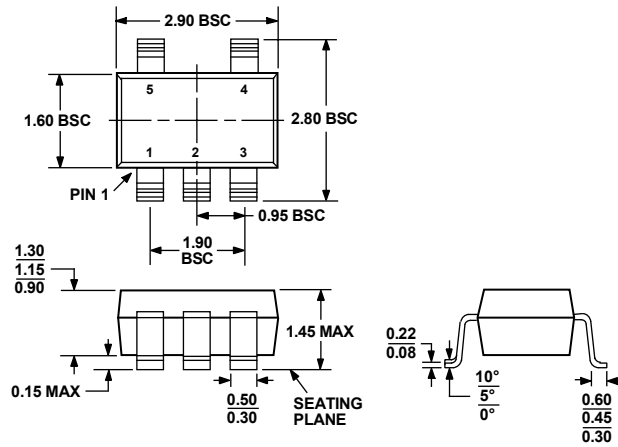
**Table 7. Watchdog Timer Operations**

| Suffix | Min  | Typ  | Max  | Unit |
|--------|------|------|------|------|
| W      | 4.3  | 6.3  | 9.3  | ms   |
| X      | 71   | 102  | 153  | ms   |
| Y      | 1.12 | 1.6  | 2.24 | s    |
| Z      | 17.9 | 25.6 | 38.4 | s    |

**Table 8. Standard Models**

| Model          | Reset Threshold (V) | Minimum Reset Timeout (ms) | Typical Watchdog Timeout (s) |
|----------------|---------------------|----------------------------|------------------------------|
| ADM6316CY29ARJ | 2.93                | 140                        | 1.6                          |
| ADM6316CY46ARJ | 4.63                | 140                        | 1.6                          |
| ADM6318CY46ARJ | 4.63                | 140                        | 1.6                          |
| ADM6319C46ARJ  | 4.63                | 140                        | 1.6                          |
| ADM6320CY29ARJ | 2.93                | 140                        | 1.6                          |
| ADM6320CY46ARJ | 4.63                | 140                        | 1.6                          |
| ADM6321CY46ARJ | 4.63                | 140                        | 1.6                          |
| ADM6322C46ARJ  | 4.63                | 140                        | 1.6                          |

OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-178AA

Figure 16. 5-Lead Small Outline Transistor Package [SOT-23] (RJ-5)

Dimensions shown in millimeters

# ADM6316/ADM6317/ADM6318/ADM6319/ADM6320/ADM6321/ADM6322

## ORDERING GUIDE

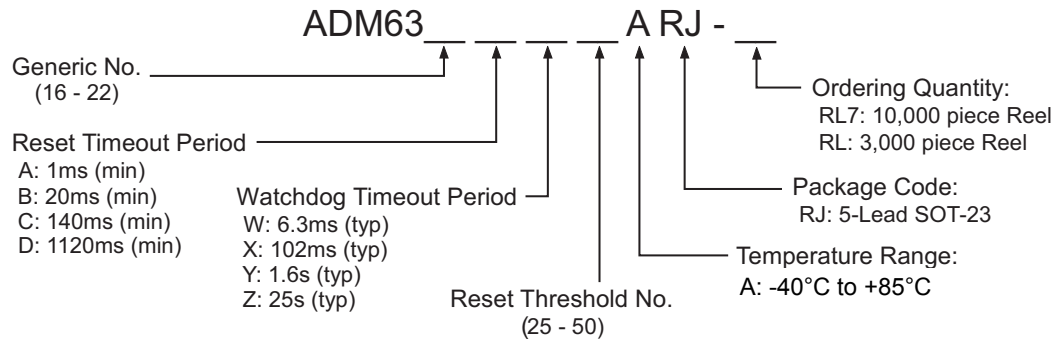


Figure 17. Ordering Code Structure

| Model <sup>12</sup> | Temperature Range | Quantity | Package Option | Branding |
|---------------------|-------------------|----------|----------------|----------|
| ADM6316 ___ ARJ-RL7 | -40°C to +85°C    | 3k       | SOT-23-5       | N00      |
| ADM6317 ___ ARJ-RL7 | -40°C to +85°C    | 3k       | SOT-23-5       | N01      |
| ADM6318 ___ ARJ-RL7 | -40°C to +85°C    | 3k       | SOT-23-5       | N02      |
| ADM6319 ___ ARJ-RL7 | -40°C to +85°C    | 3k       | SOT-23-5       | N03      |
| ADM6320 ___ ARJ-RL7 | -40°C to +85°C    | 3k       | SOT-23-5       | N04      |
| ADM6321 ___ ARJ-RL7 | -40°C to +85°C    | 3k       | SOT-23-5       | N05      |
| ADM6322 ___ ARJ-RL7 | -40°C to +85°C    | 3k       | SOT-23-5       | N06      |

<sup>1</sup> Complete the ordering code by inserting reset timeout, watchdog timeout (ADM6316/17/18/20/21) and reset threshold suffixes from tables 5 to 7.

<sup>2</sup> Contact the factory for the availability of nonstandard models. See Table 8 for a list of standard models.