

## FEATURES

Precision 2.5 V to 5 V power supply monitor

7 reset threshold options: 2.19 V to 4.63 V

140 ms (min) reset timeout

Watchdog timer with 1.6s timeout (ADM823, ADM824)

Manual reset input (ADM823, ADM825)

Push-pull output stages:

RESET (ADM823)

RESET, RESET (ADM824/ADM825)

Low power consumption (3  $\mu$ A)

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

Power supply glitch immunity

Specified over automotive temperature range

5-lead SC70 and SOT-23 packages

## APPLICATIONS

Microprocessor systems

Computers

Controllers

Intelligent instruments

Portable equipment

## GENERAL DESCRIPTION

The ADM823/ADM824/ADM825 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 three parts feature different combinations of watchdog input, manual reset input and output stage configuration, as shown in Table 1.

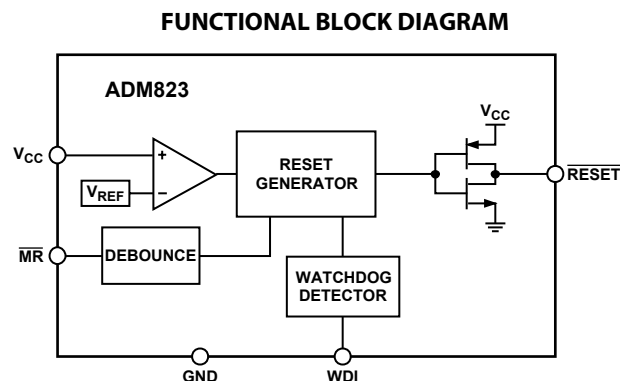


Figure 1.

Each part is available in a choice of seven reset threshold options ranging from 2.19 V to 4.63 V. The reset and watchdog timeout periods are fixed at 140 ms (min) and 1.6s (typ), respectively.

The ADM823/ADM824/ADM825 are available in 5-lead SC70 and 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 Timer | Manual Reset | Output Stage |           |
|----------|----------------|--------------|--------------|-----------|
|          |                |              | <u>RESET</u> | RESET     |
| ADM823   | Yes            | Yes          | Push-Pull    | –         |
| ADM824   | Yes            | –            | Push-Pull    | Push-Pull |
| ADM825   | –              | Yes          | Push-Pull    | Push-Pull |

## Rev.PrB

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## SPECIFICATIONS

$V_{CC} = 4.75\text{ V}$  to  $5.5\text{ V}$  for ADM82\_L,  $V_{CC} = 4.5\text{ V}$  to  $5.5\text{ V}$  for ADM82\_M,  $V_{CC} = 3.15\text{ V}$  to  $3.6\text{ V}$  for ADM82\_T,

$V_{CC} = 3\text{ V}$  to  $3.6\text{ V}$  for ADM82\_S,  $V_{CC} = 2.7\text{ V}$  to  $3.6\text{ V}$  for ADM82\_R,  $V_{CC} = 2.38\text{ V}$  to  $2.75\text{ V}$  for ADM82\_Z,

$V_{CC} = 2.25\text{ V}$  to  $2.75\text{ V}$  for ADM82\_Y,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise noted

Table 2.

| Parameter                               | Min                 | Typ  | Max  | Unit                  | Test Conditions/Comments                                                                                                        |
|-----------------------------------------|---------------------|------|------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------|
| SUPPLY                                  |                     |      |      |                       |                                                                                                                                 |
| $V_{CC}$ Operating Voltage Range        | 1                   |      | 5.5  | V                     | $T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$                                                                                  |
|                                         | 1.2                 |      |      | V                     | $T_A = T_{MIN}$ to $T_{MAX}$                                                                                                    |
| Supply Current                          |                     | 10   | 24   | $\mu\text{A}$         | WDI and $\overline{\text{MR}}$ unconnected<br>ADM82_L/M                                                                         |
|                                         |                     | 5    | 12   | $\mu\text{A}$         | WDI and $\overline{\text{MR}}$ unconnected<br>ADM82_T/S/R/Z/Y                                                                   |
| RESET THRESHOLD VOLTAGE                 |                     |      |      |                       |                                                                                                                                 |
| ADM82_L                                 | 4.56                | 4.63 | 4.70 | V                     | $T_A = 25^\circ\text{C}$                                                                                                        |
|                                         | 4.50                |      | 4.75 | V                     | $T_A = T_{MIN}$ to $T_{MAX}$                                                                                                    |
| ADM82_M                                 | 4.31                | 4.38 | 4.45 | V                     | $T_A = 25^\circ\text{C}$                                                                                                        |
|                                         | 4.25                |      | 4.50 | V                     | $T_A = T_{MIN}$ to $T_{MAX}$                                                                                                    |
| ADM82_T                                 | 3.04                | 3.08 | 3.11 | V                     | $T_A = 25^\circ\text{C}$                                                                                                        |
|                                         | 3.00                |      | 3.15 | V                     | $T_A = T_{MIN}$ to $T_{MAX}$                                                                                                    |
| ADM82_S                                 | 2.89                | 2.93 | 2.96 | V                     | $T_A = 25^\circ\text{C}$                                                                                                        |
|                                         | 2.85                |      | 3.00 | V                     | $T_A = T_{MIN}$ to $T_{MAX}$                                                                                                    |
| ADM82_R                                 | 2.59                | 2.63 | 2.66 | V                     | $T_A = 25^\circ\text{C}$                                                                                                        |
|                                         | 2.55                |      | 2.70 | V                     | $T_A = T_{MIN}$ to $T_{MAX}$                                                                                                    |
| ADM82_Z (SC70 only)                     | 2.28                | 2.32 | 2.35 | V                     | $T_A = 25^\circ\text{C}$                                                                                                        |
|                                         | 2.25                |      | 2.38 | V                     | $T_A = T_{MIN}$ to $T_{MAX}$                                                                                                    |
| ADM82_Y (SC70 only)                     | 2.16                | 2.19 | 2.22 | V                     | $T_A = 25^\circ\text{C}$                                                                                                        |
|                                         | 2.13                |      | 2.25 | V                     | $T_A = T_{MIN}$ to $T_{MAX}$                                                                                                    |
| RESET THRESHOLD TEMPERATURE COEFFICIENT |                     | 40   |      | ppm/ $^\circ\text{C}$ |                                                                                                                                 |
| RESET THRESHOLD HYSTERESIS              |                     | 10   |      | mV                    | ADM82_L/M                                                                                                                       |
|                                         |                     | 5    |      | mV                    | ADM82_T/S/R/Z/Y                                                                                                                 |
| RESET TIMEOUT PERIOD                    | 140                 | 200  | 280  | ms                    |                                                                                                                                 |
| $V_{CC}$ TO RESET DELAY                 |                     | 40   |      | $\mu\text{s}$         | $V_{TH} - V_{CC} = 100\text{ mV}$                                                                                               |
| RESET Output Voltage                    |                     |      | 0.4  | V                     | $V_{CC} = V_{TH}\text{ min}$ , $I_{SINK} = 3.2\text{ mA}$ ,<br>ADM82_L/M                                                        |
|                                         |                     |      | 0.3  | V                     | $V_{CC} = V_{TH}\text{ min}$ , $I_{SINK} = 1.2\text{ mA}$ ,<br>ADM82_T/S/R/Z/Y                                                  |
|                                         |                     |      | 0.3  | V                     | $T_A = 0^\circ\text{C}$ to $70^\circ\text{C}$ , $V_{CC} = 1\text{ V}$ ,<br>$V_{CC}$ falling, $I_{SINK} = 50\text{ }\mu\text{A}$ |
|                                         | $V_{CC} - 1.5$      |      |      | V                     | $V_{CC} = V_{TH}\text{ max}$ , $I_{SOURCE} = 120\text{ }\mu\text{A}$ ,<br>ADM82_L/M                                             |
|                                         | $0.8 \times V_{CC}$ |      |      | V                     | $V_{CC} = V_{TH}\text{ max}$ , $I_{SOURCE} = 30\text{ }\mu\text{A}$ ,<br>ADM82_T/S/R/Z/Y                                        |
| RESET Output Short Circuit Current      |                     |      | 800  | $\mu\text{A}$         | RESET = 0 V, $V_{CC} = 5.5\text{ V}$ ,<br>ADM82_L/M                                                                             |
|                                         |                     |      | 400  | $\mu\text{A}$         | RESET = 0 V, $V_{CC} = 5.5\text{ V}$ ,<br>ADM82_T/S/R/Z/Y                                                                       |
| RESET Output Voltage                    |                     |      | 0.4  | V                     | $V_{CC} = V_{TH}\text{ max}$ , $I_{SINK} = 3.2\text{ mA}$ ,<br>ADM824L/M, ADM825L/M                                             |
|                                         |                     |      | 0.3  | V                     | $V_{CC} = V_{TH}\text{ max}$ , $I_{SINK} = 1.2\text{ mA}$ ,<br>ADM824T/S/R/Z/Y,<br>ADM825T/S/R/Z/Y                              |
|                                         | $0.8 \times V_{CC}$ |      |      | V                     | $V_{CC} > 1.8\text{ V}$ , $I_{SOURCE} = 150\text{ }\mu\text{A}$                                                                 |

| Parameter                           | Min                 | Typ | Max                 | Unit      | Test Conditions/Comments                                          |
|-------------------------------------|---------------------|-----|---------------------|-----------|-------------------------------------------------------------------|
| WATCHDOG INPUT (ADM823, ADM824)     |                     |     |                     |           |                                                                   |
| Watchdog Timeout Period             | 1.12                | 1.6 | 2.40                | s         | $V_{IL} = 0.4 V, V_{IH} = 0.8 \times V_{CC}$                      |
| WDI Pulse Width                     | 50                  |     |                     | ns        |                                                                   |
| WDI Input Threshold                 |                     |     |                     |           |                                                                   |
| $V_{IL}$                            |                     |     | $0.3 \times V_{CC}$ | V         | $V_{WDI} = V_{CC}$ , time average<br>$V_{WDI} = 0$ , time average |
| $V_{IH}$                            | $0.7 \times V_{CC}$ |     |                     | V         |                                                                   |
| WDI Input Current                   |                     | 120 | 160                 | $\mu A$   |                                                                   |
|                                     | -20                 | -15 |                     | $\mu A$   |                                                                   |
| MANUAL RESET INPUT (ADM823, ADM825) |                     |     |                     |           |                                                                   |
| $\overline{MR}$ Input Threshold     |                     |     | $0.3 \times V_{CC}$ | V         |                                                                   |
|                                     | $0.7 \times V_{CC}$ |     |                     | 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      |                     | 500 |                     | ns        |                                                                   |

## ABSOLUTE MAXIMUM RATINGS

$T_A = 25^\circ\text{C}$ , unless otherwise noted.

**Table 3.**

| Parameter                                          | Rating          |
|----------------------------------------------------|-----------------|
| $V_{CC}$                                           | -0.3 V to +6 V  |
| Output Current (RESET, $\overline{\text{RESET}}$ ) | 20 mA           |
| Operating Temperature Range                        | -40°C to +125°C |
| Storage Temperature Range                          | -65°C to +150°C |
| $\theta_{JA}$ Thermal Impedance                    |                 |
| SC70                                               | 146°C/W         |
| SOT-23                                             | 270°C/W         |
| Lead Temperature                                   |                 |
| Soldering (10 sec)                                 | 300°C           |
| Vapor 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.



## PIN CONFIGURATIONS AND FUNCTION DESCRIPTIONS

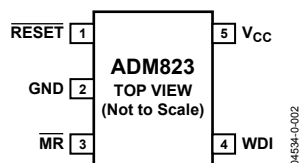


Figure 2. ADM823 Pin Configuration

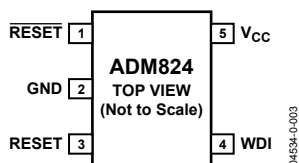


Figure 3. ADM824 Pin Configuration

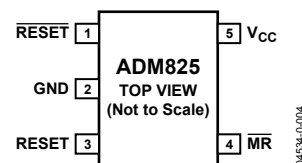


Figure 4. ADM825 Pin Configuration

Table 4. Pin Function Descriptions

| Pin. No. | Mnemonic                                     | Description                                                                                                                                                                                                                                                 |
|----------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | RESET                                        | Push-Pull Active-Low Reset Output. Asserted whenever $V_{CC}$ is below the reset threshold, $V_{TH}$ .                                                                                                                                                      |
| 2        | GND                                          | Ground.                                                                                                                                                                                                                                                     |
| 3        | MR (ADM823)                                  | Manual Reset Input. This is an active-low input which, when forced low for at least 1 $\mu$ s, generates a reset. It features a 52 k $\Omega$ internal pull-up.                                                                                             |
| 4        | RESET (ADM824/ADM825)<br>WDI (ADM823/ADM824) | Active-High, Push-Pull Reset Output.<br>Watchdog Input. Generates a reset if the voltage 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. |
| 5        | MR (ADM825)<br>$V_{CC}$                      | Manual Reset Input.<br>Power Supply Voltage Being Monitored.                                                                                                                                                                                                |

## TYPICAL PERFORMANCE CHARACTERISTICS

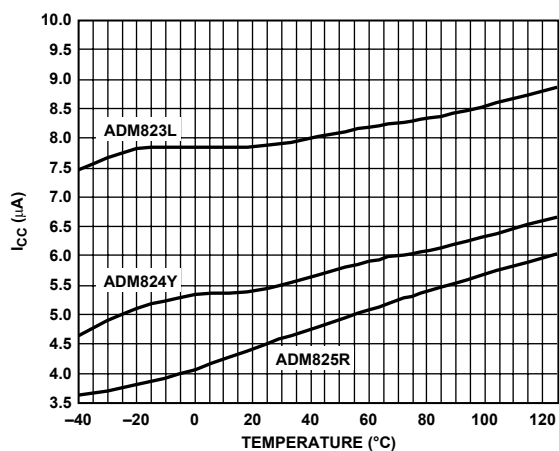


Figure 5. Supply Current vs. Temperature

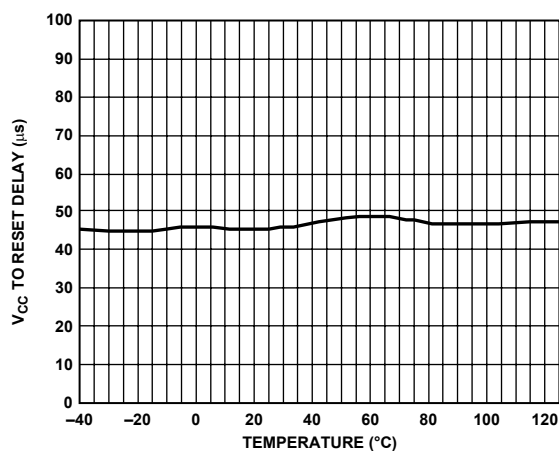


Figure 8. Reset Comparator Propagation Delay vs. Temperature ( $V_{CC}$  Falling)

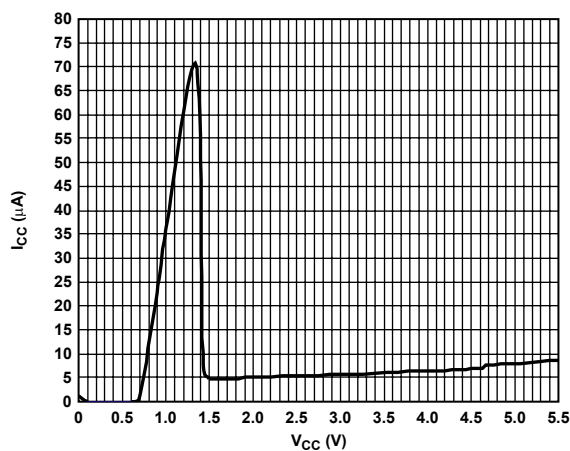


Figure 6. Supply Current vs. Supply Voltage

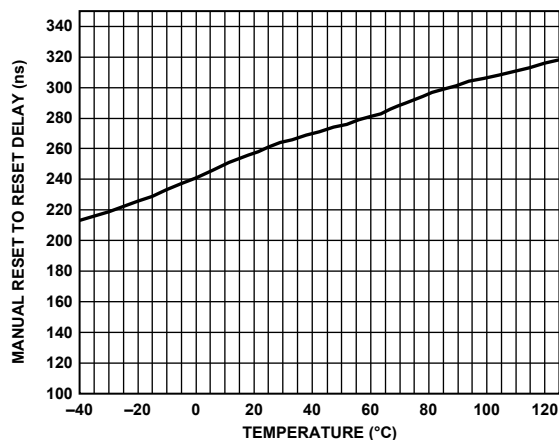


Figure 9. Manual Reset to Reset Propagation Delay vs. Temperature (ADM823/ADM825)

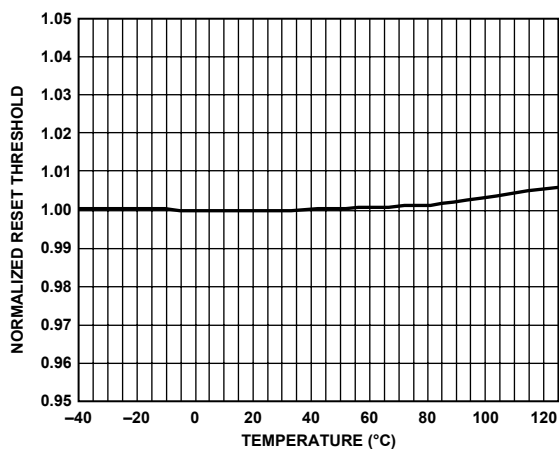


Figure 7. Normalized Reset Threshold vs. Temperature

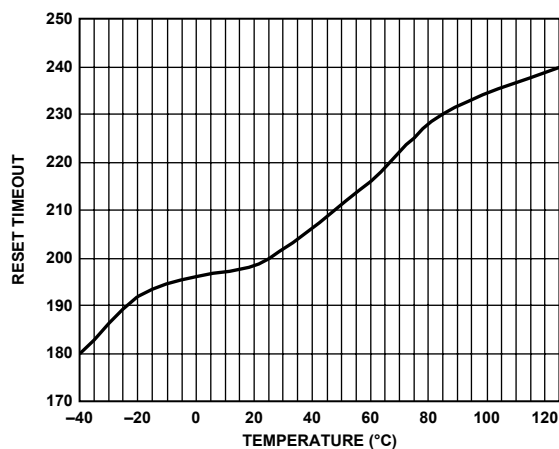
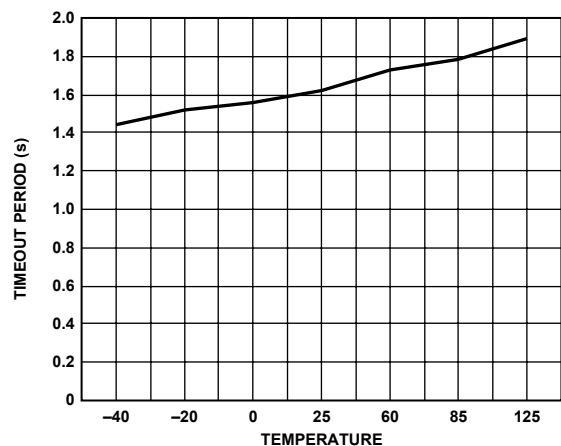
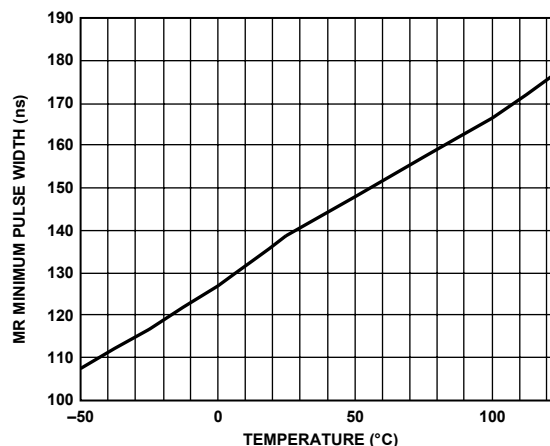


Figure 10. Reset Timeout Period vs. Temperature



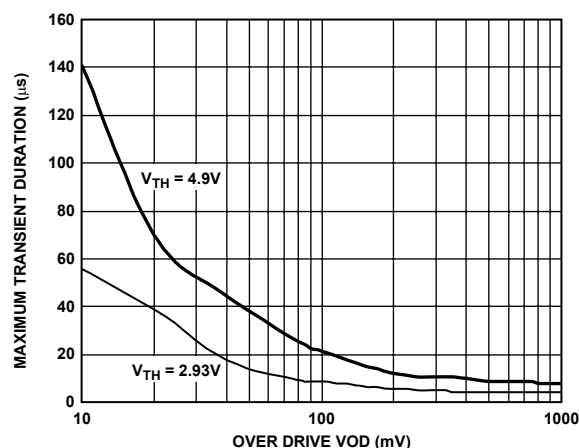
04534-0-011

Figure 11. Watchdog Timeout Period vs. Temperature (ADM823/ADM824)



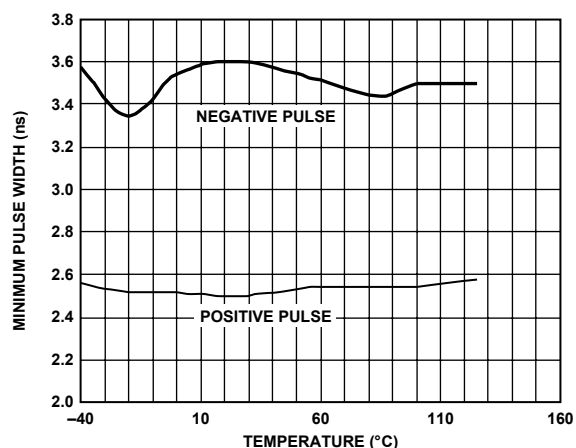
04534-0-013

Figure 13. Manual Reset Minimum Pulse Width vs. Temperature (ADM823/ADM825)



04534-0-012

Figure 12. Maximum V<sub>CC</sub> Transient Duration vs. Reset Threshold Overdrive



04534-0-014

Figure 14. Watchdog Input Minimum Pulse Width vs. Temperature (ADM823/ADM824)



## OUTLINE DIMENSIONS

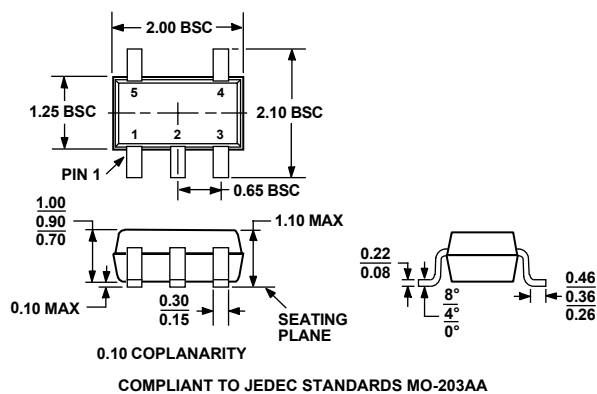


Figure 15. 5-Lead Plastic Surface-Mount Package [SC-70]  
(KS-5)

Dimensions shown in millimeters

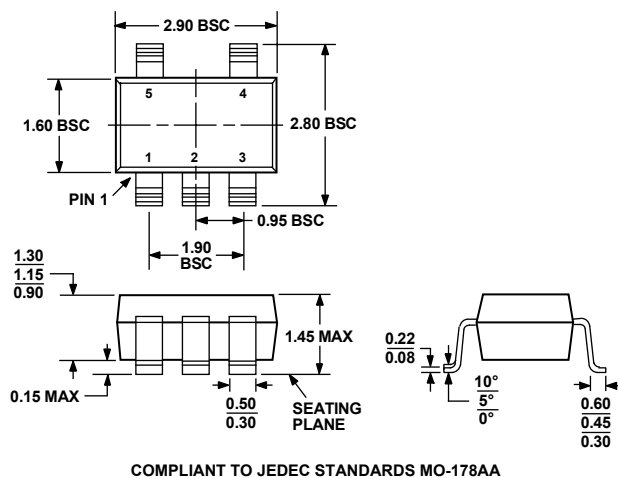


Figure 16. 5-Lead Small Outline Transistor Package [SOT-23]  
(RJ-5)

Dimensions shown in millimeters

## ORDERING GUIDES

Table 5. ADM823 Ordering Guide

| Model         | Reset Threshold (V) | Temperature Range | Quantity | Package Type | Branding |
|---------------|---------------------|-------------------|----------|--------------|----------|
| ADM823LYKS-R7 | 4.63                | –40°C to +125°C   | 3k       | SC70-5       | N07      |
| ADM823LYRT-R7 | 4.63                | –40°C to +125°C   | 3k       | SOT-23-5     | N07      |
| ADM823MYKS-R7 | 4.38                | –40°C to +125°C   | 3k       | SC70-5       | N07      |
| ADM823MYRT-R7 | 4.38                | –40°C to +125°C   | 3k       | SOT-23-5     | N07      |
| ADM823TYKS-R7 | 3.08                | –40°C to +125°C   | 3k       | SC70-5       | N07      |
| ADM823TYRT-R7 | 3.08                | –40°C to +125°C   | 3k       | SOT-23-5     | N07      |
| ADM823SYKS-R7 | 2.93                | –40°C to +125°C   | 3k       | SC70-5       | N07      |
| ADM823SYRT-R7 | 2.93                | –40°C to +125°C   | 3k       | SOT-23-5     | N07      |
| ADM823RYKS-R7 | 2.63                | –40°C to +125°C   | 3k       | SC70-5       | N07      |
| ADM823RYRT-R7 | 2.63                | –40°C to +125°C   | 3k       | SOT-23-5     | N07      |
| ADM823ZYKS-R7 | 2.32                | –40°C to +125°C   | 3k       | SC70-5       | N07      |
| ADM823YYKS-R7 | 2.19                | –40°C to +125°C   | 3k       | SC70-5       | N07      |

Table 6. ADM824 Ordering Guide

| Model <sup>1</sup> | Reset Threshold (V) | Temperature Range | Quantity | Package Type | Branding |
|--------------------|---------------------|-------------------|----------|--------------|----------|
| ADM824LYKS-R7      | 4.63                | –40°C to +85°C    | 3k       | SC70-5       | N08      |
| ADM824LYRT-R7      | 4.63                | –40°C to +125°C   | 3k       | SOT-23-5     | N08      |
| ADM824MYKS-R7      | 4.38                | –40°C to +85°C    | 3k       | SC70-5       | N08      |
| ADM824MYRT-R7      | 4.38                | –40°C to +125°C   | 3k       | SOT-23-5     | N08      |
| ADM824TYKS-R7      | 3.08                | –40°C to +85°C    | 3k       | SC70-5       | N08      |
| ADM824TYRT-R7      | 3.08                | –40°C to +125°C   | 3k       | SOT-23-5     | N08      |
| ADM824SYKS-R7      | 2.93                | –40°C to +85°C    | 3k       | SC70-5       | N08      |
| ADM824SYRT-R7      | 2.93                | –40°C to +125°C   | 3k       | SOT-23-5     | N08      |
| ADM824RYKS-R7      | 2.63                | –40°C to +85°C    | 3k       | SC70-5       | N08      |
| ADM824RYRT-R7      | 2.63                | –40°C to +125°C   | 3k       | SOT-23-5     | N08      |
| ADM824ZYKS-R7      | 2.32                | –40°C to +85°C    | 3k       | SC70-5       | N08      |
| ADM824YYKS-R7      | 2.19                | –40°C to +85°C    | 3k       | SC70-5       | N08      |

<sup>1</sup> All of the ADM824 models are nonstandard. Contact factory for availability of nonstandard models.

Table 7. ADM825 Ordering Guide

| Model <sup>1</sup> | Reset Threshold (V) | Temperature Range | Quantity | Package Type | Branding |
|--------------------|---------------------|-------------------|----------|--------------|----------|
| ADM825LYKS-R7      | 4.63                | –40°C to +85°C    | 3k       | SC70-5       | N09      |
| ADM825LYRT-R7      | 4.63                | –40°C to +125°C   | 3k       | SOT-23-5     | N09      |
| ADM825MYKS-R7      | 4.38                | –40°C to +85°C    | 3k       | SC70-5       | N09      |
| ADM825MYRT-R7      | 4.38                | –40°C to +125°C   | 3k       | SOT-23-5     | N09      |
| ADM825TYKS-R7      | 3.08                | –40°C to +85°C    | 3k       | SC70-5       | N09      |
| ADM825TYRT-R7      | 3.08                | –40°C to +125°C   | 3k       | SOT-23-5     | N09      |
| ADM825SYKS-R7      | 2.93                | –40°C to +85°C    | 3k       | SC70-5       | N09      |
| ADM825SYRT-R7      | 2.93                | –40°C to +125°C   | 3k       | SOT-23-5     | N09      |
| ADM825RYKS-R7      | 2.63                | –40°C to +85°C    | 3k       | SC70-5       | N09      |
| ADM825RYRT-R7      | 2.63                | –40°C to +125°C   | 3k       | SOT-23-5     | N09      |
| ADM825ZYKS-R7      | 2.32                | –40°C to +85°C    | 3k       | SC70-5       | N09      |
| ADM825YYKS-R7      | 2.19                | –40°C to +85°C    | 3k       | SC70-5       | N09      |