# ANALOG DEVICES

# Low Voltage, High Accuracy, Quad Voltage Microprocessor Supervisory Circuit

Data Sheet

# ADM8710

## FEATURES

**Accurate monitoring of up to four power supply voltages**
**2 factory-set threshold options for monitoring 1.8 V and 3.3 V**
**Adjustable input threshold voltage 0.62 V (±1.5% accuracy)**
**50 ms typical reset timeout**
**Open-drain $\overline{RESET}$ output (10 μA internal pull-up)**
**Reset output stage: active low, valid to $IN_1 = 1$ V or $IN_2 = 1$ V**
**Power supply glitch immunity**
**Specified from −40°C to +85°C**
**6-lead SOT-23 package**

## APPLICATIONS

**Telecommunications**
**Microprocessor systems**
**Desktop and notebook computers**
**Data storage equipment**
**Servers/workstations**

## FUNCTIONAL BLOCK DIAGRAM



Figure 1.

## GENERAL DESCRIPTION

The ADM8710 is a low voltage, high accuracy supervisory circuit. The device monitors up to four system supply voltages.

The ADM8710 incorporates two internally pretrimmed under-voltage threshold options for monitoring 1.8 V and 3.3 V supply voltages. It also offers two adjustable inputs with 0.62 V internal reference, allowing users to program the reset threshold through external resistor dividers. The combination of pretrimmed and adjustable inputs gives the ADM8710 the advantage of being both space saving and flexible.
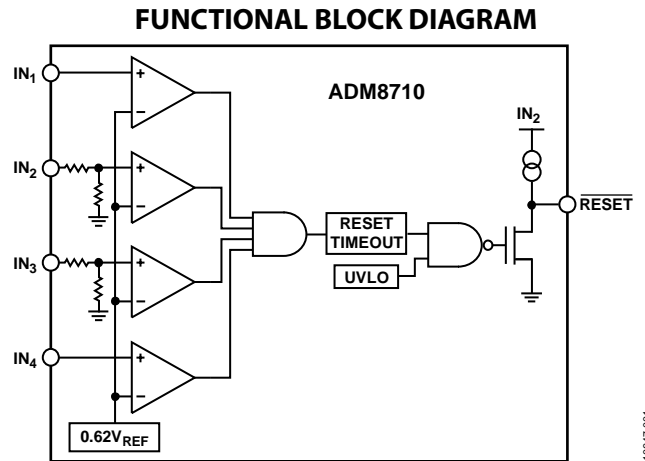
If a monitored power supply voltage falls below the minimum voltage threshold, a single active low output asserts, triggering a system reset. The output is open drain with a weak internal pull-up to the monitored $IN_2$ supply of typically 10 μA. When all voltages rise above the selected threshold level, the $\overline{RESET}$ signal remains low for the reset timeout period. The ADM8710 output remains valid as long as $IN_1$ or $IN_2$ exceeds 1 V.

Unused monitored inputs should not be allowed to float or to be grounded. Instead, connect them to a supply voltage greater than their specified threshold voltages.

The ADM8710 is available in a 6-lead SOT-23 package. The device operates over the extended temperature range of −40°C to +85°C.

# ADM8710* Product Page Quick Links

Last Content Update: 11/01/2016

## Comparable Parts

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## Documentation

**Data Sheet**

- ADM8710: Low Voltage, High Accuracy, Quad Voltage Microprocessor Supervisory Circuit Data Sheet

## Design Resources

- ADM8710 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

## Discussions

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## Sample and Buy

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## Technical Support

Submit a technical question or find your regional support number

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## REVISION HISTORY

**8/12—Revision 0: Initial Version**

## SPECIFICATIONS

$V_{IN2}$ = 1 V to 5.5 V, $T_A$ = −40°C to +85°C, unless otherwise noted. Typical values are $V_{IN2}$ = 3.0 V to 3.3 V, $T_A$ = 25°C.

**Table 1.**

| Parameter | Min | Typ | Max | Units | Test Conditions/Comments |
|---|---|---|---|---|---|
| OPERATING VOLTAGE RANGE | | | | | |
| $V_{IN2}$ [1] | 1.0 | | 5.5 | V | $T_A$ = 0°C to 85°C |
| | 1.2 | | 5.5 | V | $T_A$ = −40°C to +85°C |
| INPUT CURRENT | | | | | |
| $IN_x$ Input Current | | 55 | 115 | µA | $IN_2$ = nominal input voltage (3.3 V supplies); the supply splits into 25 µA for the resistor divider and 30 µA for other circuits |
| | | 25 | 40 | µA | $IN_3$ = nominal input voltage (1.8 V supplies) |
| | | | 0.4 | µA | $V_{IN1}$ = 0 V to 0.85 V |
| | | | 0.2 | µA | $V_{IN4}$ = 0 V to 0.85 V |
| THRESHOLD VOLTAGE | | | | | |
| Threshold Voltage ($V_{TH}$) | 3.010 | 3.07 | 3.130 | V | $IN_x$ decreasing; 3.3 V (−5% supply tolerance) |
| | 1.705 | 1.73 | 1.760 | V | $IN_x$ decreasing; 1.8 V (−2% supply tolerance) |
| Adjustable Input Threshold Voltage ($V_{TH}$) | 0.611 | 0.62 | 0.629 | V | $IN_x$ decreasing |
| RESET | | | | | |
| Reset Threshold Hysteresis ($V_{HYST}$) | | 0.3 | | %$V_{TH}$ | $IN_x$ increasing relative to $IN_x$ decreasing |
| Reset Threshold Temperature Coefficient ($TCV_{TH}$) | | 60 | | ppm/°C | |
| $IN_x$ to Reset Delay ($t_{RP}$) | | 30 | | µs | $V_{IN}$ falling at 10 mV/µs from $V_{TH}$ to $V_{TH}$ − 50 mV |
| Reset Timeout Period ($t_{RP}$) | 35 | 50 | 70 | ms | |
| $\overline{RESET}$ Output Low ($V_{OL}$) | | | 0.3 | V | $V_{IN2}$ = 5 V, $I_{SINK}$ = 2 mA |
| | | | 0.4 | V | $V_{IN2}$ = 2.5 V, $I_{SINK}$ = 1.2 mA |
| | | | 0.3 | V | $V_{IN2}$ = 1.0 , $I_{SINK}$ = 20 µA, $T_A$ = 0°C to +85°C |
| $\overline{RESET}$ Output High ($V_{OH}$) | 0.8 × $V_{IN2}$ | | | V | $V_{IN2}$ ≥ 2.0 V, $I_{SOURCE}$ = 4 µA, $\overline{RESET}$ deasserted |
| $\overline{RESET}$ Output High Source Current ($I_{OH}$) | | 10 | | µA | $V_{IN2}$ ≥ 2.0 V, $\overline{RESET}$ deasserted |

[1] The $\overline{RESET}$ output is guaranteed to be in the correct state for $IN_1$ or $IN_2$ down to 1 V.

# ABSOLUTE MAXIMUM RATINGS

**Table 2.**

| Parameter | Rating |
|---|---|
| IN$_X$, $\overline{\text{RESET}}$ to GND | −0.3 V to +6 V |
| Continuous $\overline{\text{RESET}}$ Current | 20 mA |
| Storage Temperature Range | −65°C to +125°C |
| Operating Temperature Range | −40°C to +85°C |
| Lead Temperature (10 sec) | 300°C |
| Junction Temperature | 135°C |

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; 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.

**Table 3. Thermal Resistance**

| Package Type | θ$_{JA}$ | Unit |
|---|---|---|
| 6-lead SOT-23 | 169.5 | °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.

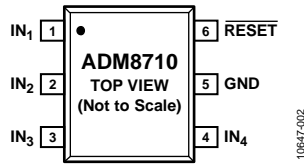# PIN CONFIGURATION AND FUNCTION DESCRIPTIONS



Figure 2. Pin Configuration

**Table 4. Pin Function Descriptions**

| Pin No. | Mnemonic | Description |
|---|---|---|
| 1 | $IN_1$ | Input Voltage 1. |
| 2 | $IN_2$ | Input Voltage 2. |
| 3 | $IN_3$ | Input Voltage 3. |
| 4 | $IN_4$ | Input Voltage 4. |
| 5 | GND | Ground. |
| 6 | $\overline{RESET}$ | Active Low $\overline{RESET}$ Output. $\overline{RESET}$ goes low when an input drops to less than the specified threshold. When all inputs rise higher than the threshold voltage, $\overline{RESET}$ remains low for the reset timeout period before going high. $\overline{RESET}$ is open drain with a weak internal pull-up to $IN_2$. |

# TYPICAL PERFORMANCE CHARACTERISTICS

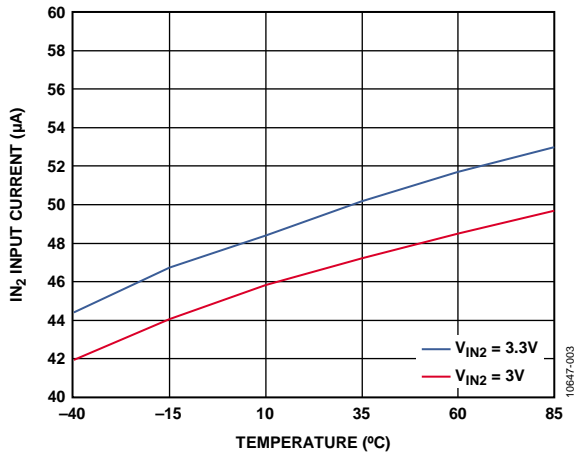$V_{IN2}$ = 3.0 V, $T_A$ = 25°C, unless otherwise noted.



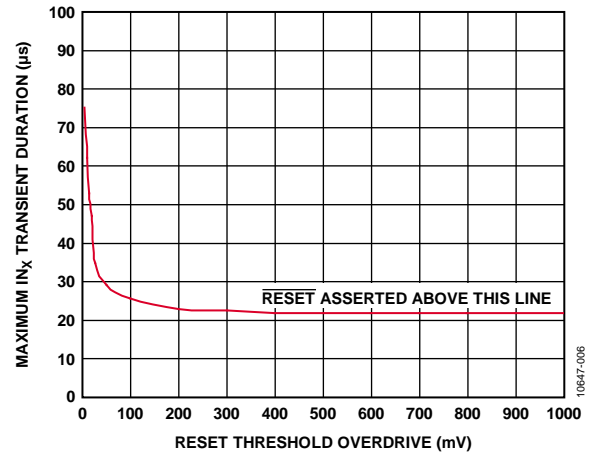Figure 3. $IN_2$ Input Current vs. Temperature



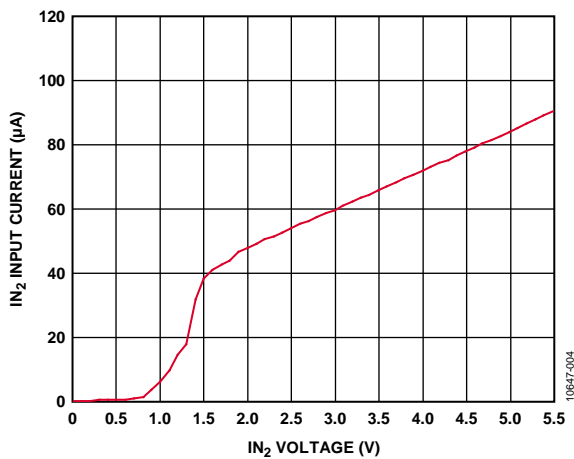Figure 6. Maximum $IN_x$ Transient Duration vs. Reset Threshold Overdrive



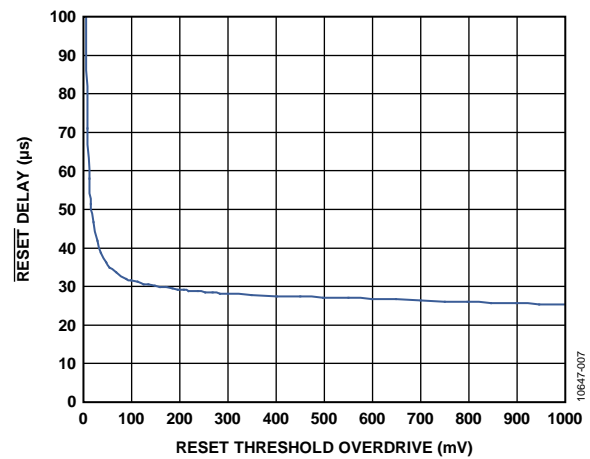Figure 4. $IN_2$ Input Current vs. $IN_2$ Voltage



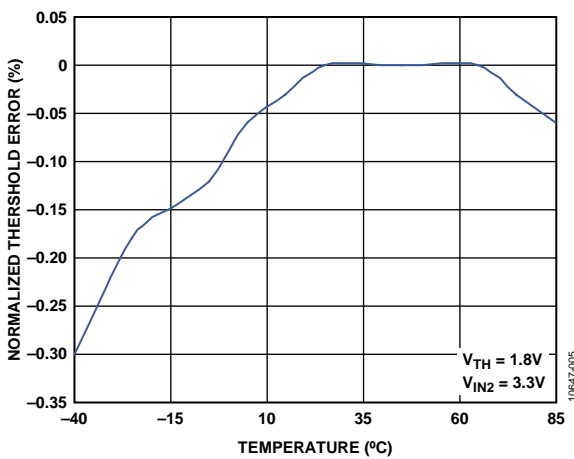Figure 7. $\overline{RESET}$ Delay vs. Reset Threshold Overdrive ($IN_x$ Decreasing)



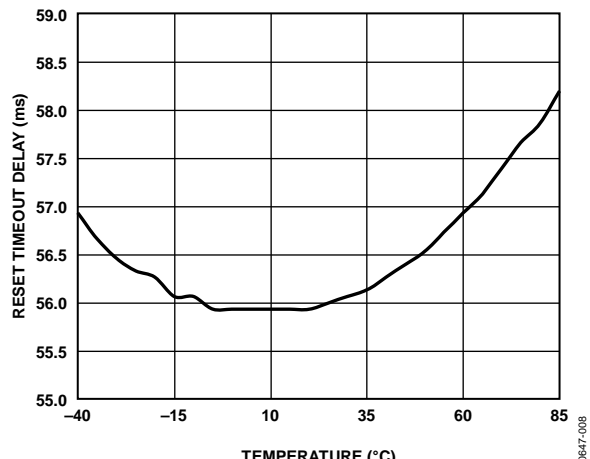Figure 5. Normalized Threshold Error vs. Temperature



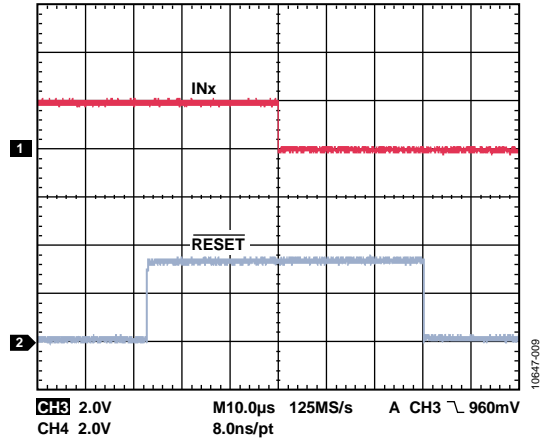Figure 8. Normalized Reset Timeout Delay vs. Temperature

Figure 9. $\overline{RESET}$ Pull-Up and Pull-Down Response (10 µs/DIV)
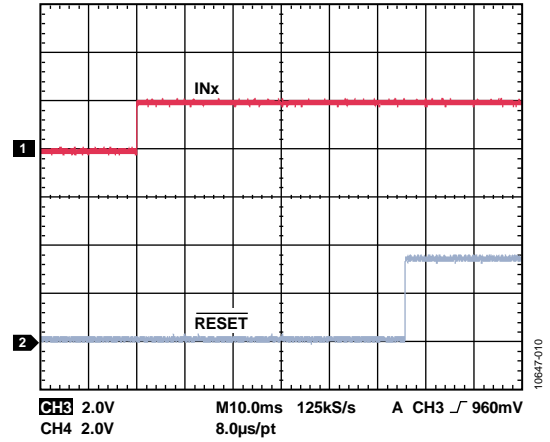


Figure 10. Timeout Delay (10 ms/DIV)

# THEORY OF OPERATION

The ADM8710 is a compact, low power supervisory circuit capable of monitoring up to four voltages in a multisupply application.

The device includes two factory-set voltage threshold options for monitoring 1.8 V and 3.3 V supplies. It also provides two adjustable thresholds for monitoring voltages down to 0.62 V.

The ADM8710 is powered by $IN_2$, which is a monitored voltage, and therefore monitors up to four voltages. If a monitored voltage drops below its associated threshold, the active low reset output asserts low and remains low while either $IN_1$ or $IN_2$ remains above 1.0 V.
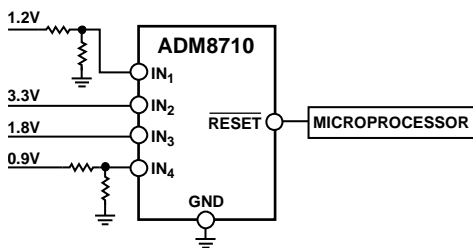


*Figure 11. Typical Applications Circuit*

## INPUT CONFIGURATION

The ADM8710 provides numerous monitor choices with adjustable reset thresholds. Typically, the threshold voltage at each adjustable $IN_x$ input is 0.62 V. To monitor a voltage greater than 0.62 V, connect a resistor divider network to the circuit as depicted in Figure 12, where

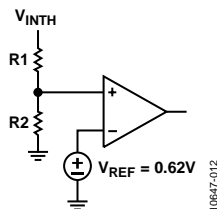$$V_{INTH} = 0.62\,V\left(\frac{R1+R2}{R2}\right)$$



*Figure 12. Setting the Adjustable Monitor*

The internal comparators each typically have a hysteresis of 0.3% with respect to the reset threshold. This built-in hysteresis improves the immunity of the device to ambient noise without noticeably reducing the threshold accuracy. The ADM8710 is unaffected by short input transients.

The ADM8710 is powered from the monitored $IN_2$. Monitored inputs are resistant to short power supply glitches. Figure 6 depicts the ADM8710 glitch immunity data. To increase noise immunity in noisy applications, place a 0.1 μF capacitor between the $IN_2$ input and ground. Adding capacitance to $IN_1$, $IN_3$, and $IN_4$ also improves noise immunity.

Do not allow unused monitor inputs to float or to be grounded. Connect these inputs to a supply voltage greater than their specified threshold voltages. In the case of unused $IN_x$ adjustable inputs, limit the bias current by connecting a 1 MΩ series resistor between the unused input and $IN_2$.

## RESET OUTPUT CONFIGURATION

The $\overline{RESET}$ output asserts low when a monitored $IN_x$ voltage drops below its voltage threshold. When all voltages rise above the selected threshold level, the $\overline{RESET}$ signal remains low for the reset timeout period. The $\overline{RESET}$ output is open drain with a weak internal pull-up to the monitored $IN_2$, typically 10 μA.

Many applications that interface with other logic devices do not require an external pull-up resistor. However, if an external pull-up resistor is required and it is connected to a voltage ranging from 0 V to 5.5 V, it overdrives the internal pull-up. Reverse current flow from the external pull-up voltage to $IN_2$ is prevented by the internal circuitry.
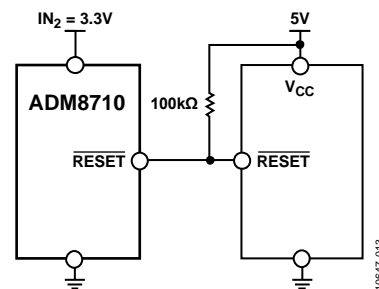


*Figure 13. Interface with a Different Logic Supply Voltage*

## ADDITION OF MANUAL RESET

Use the circuit shown in Figure 14 to add manual reset to any of the ADM8710 adjustable inputs. When the switch is closed, the analog input shorts to ground and a $\overline{RESET}$ output commences. The switch must remain open for a minimum of 35 ms for the $\overline{RESET}$ output to deassert.
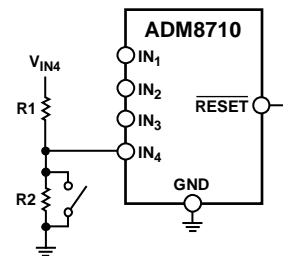


*Figure 14. Addition of Manual Reset ($IN_4$ is an Adjustable Input)*

## TOLERANCE AND ACCURACY

The primary function of the voltage supervisor is to keep the processor in a reset state whenever the processor supply voltage is below the specification limit. It needs to be able to differentiate the voltage out-of-processor limit from supply variations caused by voltage converter output tolerance. This means that the supervisor rest threshold should fit inside the narrow band between processor input tolerance and supply tolerance.

The ADM8710 offers up to ±2% accuracy on factory trimmed monitoring thresholds and ±1.5% accuracy on adjustable thresholds over the entire operating temperature range.
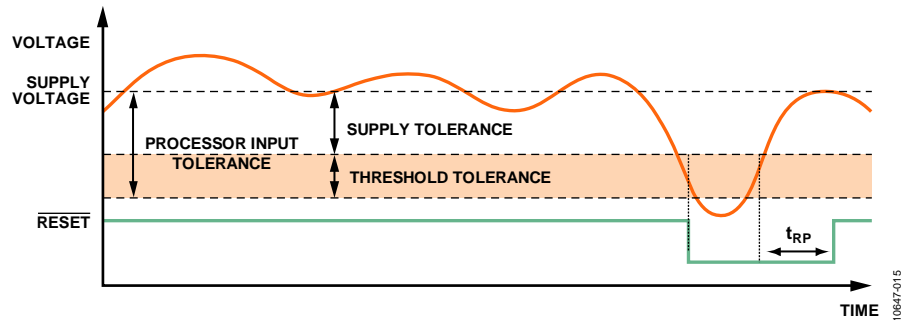


Figure 15. Tighter Threshold Tolerance on Voltage Supervisor Reduces Accuracy Requirement on Monitored Supply

## MODEL OPTIONS

**Table 5. Reset Voltage Threshold Options**

| Reset Threshold Code[1] | IN$_1$ | | IN$_2$ | | IN$_3$ | | IN$_4$ | |
|---|---|---|---|---|---|---|---|---|
| | Nominal Input Voltage (V) | Supply Tolerance (%) | Nominal Input Voltage (V) | Supply Tolerance (%) | Nominal Input Voltage (V) | Supply Tolerance (%) | Nominal Input Voltage (V) | Supply Tolerance (%) |
| L | Adjustable | Not applicable | 3.3 | −5 | 1.8 | −2 | Adjustable | Not applicable |

[1] Adjustable voltage based on 0.62 V internal threshold. The external threshold voltage can be set using an external resistor divider.

**Table 6. Reset Timeout Options**

| Reset Timeout Period Code[1] | T$_A$ = −40°C to +85°C | | | Unit |
|---|---|---|---|---|
| | Min | Typ | Max | |
| ADM8710x2 | 35 | 50 | 70 | ms |

[1] x = do not care.

ADM8710L2ARJZ-RL7

RESET THRESHOLD CODE

RESET TIMEOUT PERIOD CODE
2 = 50ms TYPICAL

TEMPERATURE RANGE
A: −40°C TO +85°C

PACKING MATERIAL
RL7 = 7" TAPE AND REEL
(3000 PIECE QUANTITY)

Z = LEAD-FREE
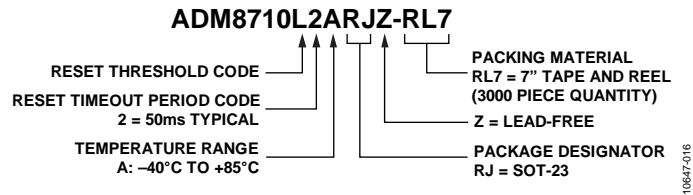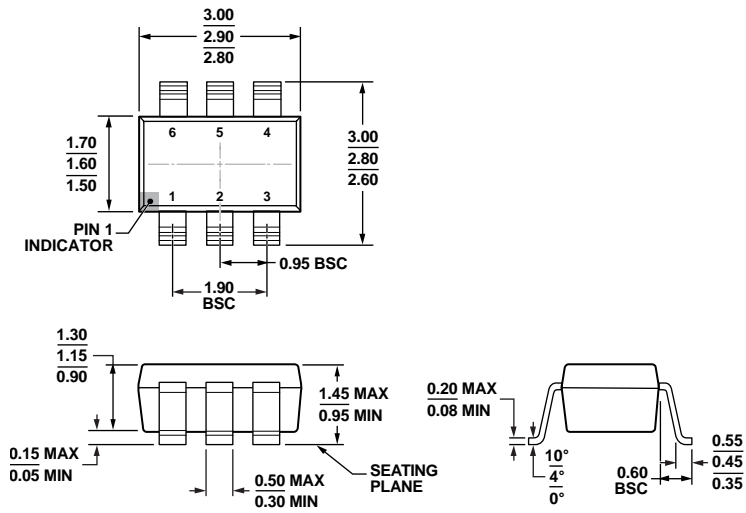
PACKAGE DESIGNATOR
RJ = SOT-23

10647-016

*Figure 16. ADM8710 Ordering Code Structure*

# OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-178-AB

*Figure 17. 6-Lead Small Outline Transistor Package [SOT-23]*
*(RJ-6)*
*Dimensions shown in millimeters*

## ORDERING GUIDE

| Model[1, 2] | Monitored Input Voltage (V) | | | | Minimum Reset Timeout (ms) | Temperature Range | Ordering Quantity | Package Description | Package Option | Branding |
|---|---|---|---|---|---|---|---|---|---|---|
| | IN$_1$ | IN$_2$ | IN$_3$ | IN$_4$ | | | | | | |
| ADM8710L2ARJZ-RL7 | Adj. | 3.07 | 1.73 | Adj. | 35 | −40°C to +85°C | 3,000 | 6-Lead SOT-23 | RJ-6 | LN3 |

[1] Z = RoHS Compliant Part.
[2] Adjustable voltage based on 0.62 V internal threshold. The external threshold voltage can be set using an external resistor divider.

# NOTES

**ANALOG DEVICES**

www.analog.com