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AS1923
Quad-Voltage Microprocessor Supervisory Circuit

1 General Description

The AS1923 microprocessor supervisory circuit was designed to monitor up to four system supply voltages without the need for external components, and asserts a single reset if any of the monitored supply voltages drops below its reset threshold.

The AS1923 features an active-low reset output that is asserted when any of the 4 monitored voltages are below their respective reset threshold. The reset output is open-drain with a weak internal pullup (10µA) to IN2. Reset remains low for a specified reset timeout period (120ms min) after all voltages have stabilized. The output is valid as long as the IN1 or IN2 input voltage remains >1V.

Minimal external component requirements, small size, and wide temperature range (-40 to +85°C) greatly improves reliability compared to individual supervisory circuits or discrete components.

A wide range of factory-trimmed threshold voltages are available to accommodate many different supply voltages/tolerances with minimal external component requirements.

Factory-trimmed options are available for monitoring +5.0, +3.3, +3.0, +2.5, +1.8, and -5.0V supplies with -5% and/or -10% tolerances. The device is also available with one or two user-adjustable threshold options (via external resistor-divider network) if non-standard voltage thresholds are required.

The AS1923 is available in an 6-pin SOT23 package.

2 Key Features

- Simultaneous Quad-Voltage Monitoring
- Precision Factory-Trimmed Reset Threshold Options: +5.0, +3.3, +3.0, +2.5, +1.8, and -5.0V
- User-Adjustable Voltage Monitoring Threshold Options
- Low Supply Current: 55µA
- Open-Drain – AS1923A
- 10µA Current Source Pullup – AS1923B
- Reset Timeout Period: 120ms
- RESET Valid to IN1 = 1V or IN2 = 1V
- Immune to Fast IN*x* Transients
- External Components not Required
- Guaranteed Performance: Operating Temperature Range = -40 to +85ºC
- 6-pin SOT23 Package

3 Applications

The device is ideal for portable and battery-powered systems, embedded controllers, intelligent instruments, automotive systems, critical CPU monitoring, and any multi-supply application.
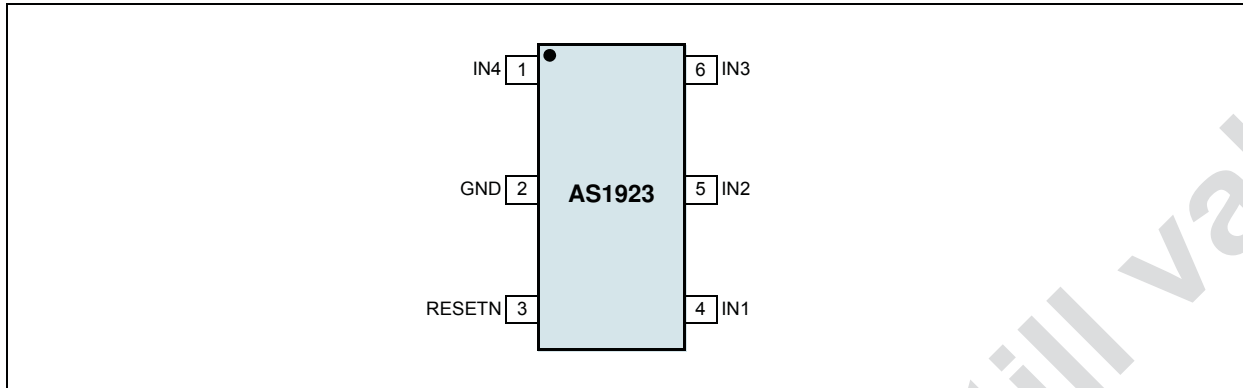
Figure 1. AS1923 - Typical Application
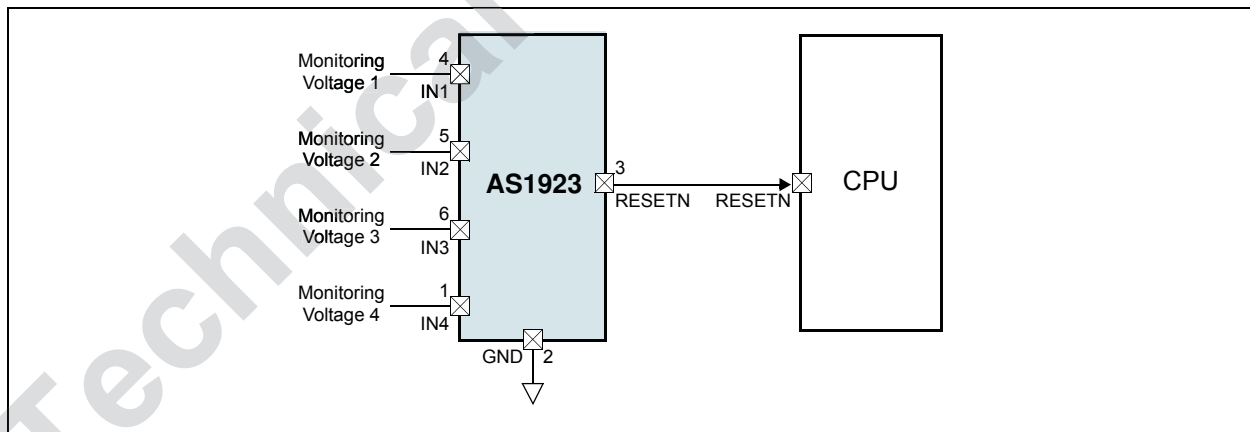
4 Pinout

Pin Assignments

Figure 2. Pin Assignments (Top View)

Pin Descriptions

Table 1. Pin Descriptions

Pin Number	Pin Name	Description
1	IN4	**Input Voltage 4**. See Ordering Information on page 14 for monitored voltages.
2	GND	**Ground**
3	RESETN	**Reset Output**. AS1923A (see Ordering Information on page 14) supports an external pullup resistor; AS1923B contains an internal 10μA current source pullup. RESETN goes low (reset asserted) when any one of the INx voltages goes below its specified threshold. After all inputs have stabilized, RESETN remains low for at least 120ms (min) before going high.
4	IN1	**Input Voltage 1**. See Ordering Information on page 14 for monitored voltages.
5	IN2	**Input Voltage 2**. See Ordering Information on page 14 for monitored voltages. **Note:** IN2 is the power supply input for the AS1923.
6	IN3	**Input Voltage 3**. See Ordering Information on page 14 for monitored voltages.

5 Absolute Maximum Ratings

Stresses beyond those listed in Table 2 may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in Electrical Characteristics on page 4 is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Table 2. Absolute Maximum Ratings

Parameter	Min	Max	Units	Comments
Electrical Parameters				
IN1, IN2 (Monitored Voltage), IN3, IN4 to GND	-0.3	+7	V	
IN4 to GND (Device Variants M, N, O, and P, see Table 5 on page 14)	-7	+0.3	V	
RESETN to GND	-0.3	+6	V	
Latchup immunity				Class I Level A in accordance with *EIA/JEDEC 78*
Continuous Power Dissipation				
Continuous Power Dissipation (T_{AMB} = +70ºC)		696	mW	Derate 8.7mW/ºC above +70ºC
Temperature Ranges and Storage Conditions				
Junction Temperature		+150	ºC	
Storage Temperature Range	-55	+150	ºC	
Package Body Temperature		+260	ºC	The reflow peak soldering temperature (body temperature) specified is in accordance with *IPC/JEDEC J-STD-020 "Moisture/Reflow Sensitivity Classification for Non-Hermetic Solid State Surface Mount Devices"*. The lead finish for Pb-free leaded packages is matte tin (100% Sn).
Humidity non-condensing	5	85	%	
Moisture Sensitive Level		1		Represents a max. floor life time of unlimited

6 Electrical Characteristics

V_{IN2} = +1V to +5.5V, Typ values @ V_{IN2} = +3.0V to +3.3V, T_{AMB} = +25ºC (unless otherwise specified).

Table 3. Electrical Characteristics

Symbol	Parameter [1]	Conditions	Min	Typ	Max	Units
Tamb	Operating Temperature Range		-40		85	°C
V_{IN2}	Supply Voltage Range [2, 3]		1.0		5.5	V
I_{INx}	Input Current	V_{INx} = Input Threshold Voltage (Input Threshold Voltage of 1.8, 2.5, or 5V)		25	40	μA
		V_{IN2} = Input Threshold Voltage (Input Threshold Voltage of 3.0 or 3.3V) [4]		55	115	
		V_{INx} = 0 to V_{IN2} (Input Threshold Voltage = +1.23V) [5]	-0.1		0.1	
		V_{IN1} = 1.5V (AS1923 K/L only)		0.4	1.5	
		V_{INx} = -5V (Input Threshold Voltage = -5V)		-15	-20	
V_{TH}	Reset Threshold Voltage	V_{INx} Decreasing, +5V (-5%) Threshold	4.50	4.63	4.75	V
		V_{INx} Decreasing, +5V (-10%) Threshold	4.25	4.38	4.50	
		V_{INx} Decreasing, +3.3V (-5%) Threshold	3.00	3.08	3.15	
		V_{INx} Decreasing, +3.3V (-10%) Threshold	2.85	2.93	3.00	
		V_{INx} Decreasing, +3.0V (-5%) Threshold	2.70	2.78	2.85	
		V_{INx} Decreasing, +3.0V (-10%) Threshold	2.55	2.63	2.70	
		V_{INx} Decreasing, +2.5V (-10%) Threshold	2.13	2.19	2.25	
		V_{INx} Decreasing, +1.8V (-10%) Threshold	1.53	1.58	1.62	
		V_{INx} Increasing, -5V (+5%) Threshold	-4.75	-4.63	-4.50	
		V_{INx} Increasing, -5V (+10%) Threshold	-4.50	-4.38	-4.25	
V_{TH}	Adjustable Threshold	V_{INx} Decreasing	1.20	1.23	1.26	V
	Threshold Voltage Temperature Coefficient			60		ppm/ºC
V_{HYS}	Threshold Hysteresis			0.5		%
t_{RD}	Reset Delay	V_{INx} = V_{TH} to (V_{TH} - 50mV), All Inputs Except -5V, or V_{INx} = V_{TH} to (V_{TH} + 50mV), -5V Input Only		20		μs
t_{RP}	Reset Active Timeout Period		120	200	280	ms

Table 3. Electrical Characteristics (Continued)

Symbol	Parameter [1]	Conditions	Min	Typ	Max	Units
V_{OL}	Output Low Voltage	V_{IN2} = 5V, I_{SINK} = 2mA			0.4	V
		V_{IN2} = 2.5V, I_{SINK} = 1.2mA			0.4	
		V_{IN1} = V_{IN2} = 1V, I_{SINK} = 50µA			0.4	
V_{OH} [6]	Output High Voltage, Output High Source Current	V_{IN2} > 2.55V, I_{SOURCE} = 6µA (Reset Not Asserted)	0.8 x V_{IN2}			V
I_{OH} [5]	Output High Source Current	$V_{IN2} \geq$ 2.55V (Reset Not Asserted), $V_{OUT} \geq$ 0.8 x V_{IN2}	6	10		µA

1. 100% production tested at T_{AMB} = +25ºC. Limits over temperature guaranteed by design.
2. The device is powered from input IN2.
3. The RESETN output is guaranteed to be in the correct state for IN1 or IN2 down to 1V.
4. Monitored voltage at IN2 (+3.3V, +3.0V) is also the device power supply. Supply current split is 25µA for the resistor-divider network (for the monitored voltage) and 30µA for other circuits.
5. Adjustable pin only.
6. AS1923B only.

Note: All limits are guaranteed. The parameters with min and max values are guaranteed with production tests or SQC (Statistical Quality Control) methods.

7 Typical Operating Characteristics

Tamb = +25ºC, unless otherwise noted
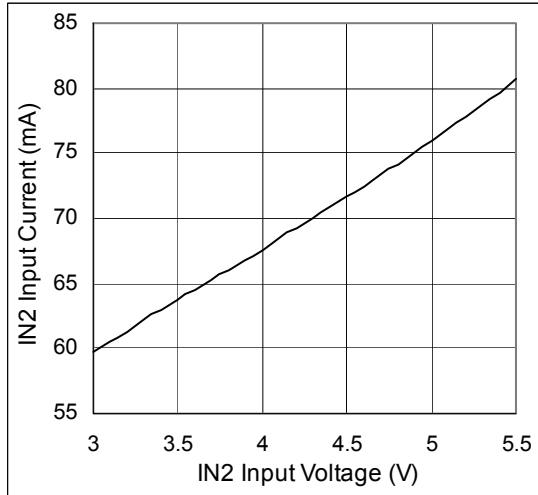
Figure 3. IN2 Input Current vs. IN2 Input Voltage

Figure 4. IN2 Input Current vs. Temperature

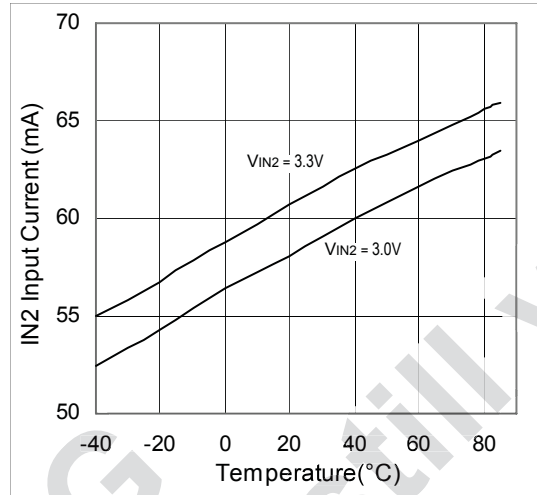*Figure 5. Reset Delay vs. Reset Threshold Overdrive;
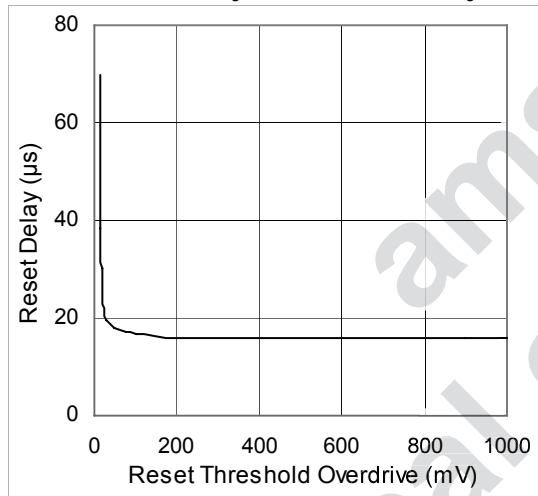V_{IN2} = 3.0V, IN decreasingV_{IN2} = 3.0V, IN decreasing*

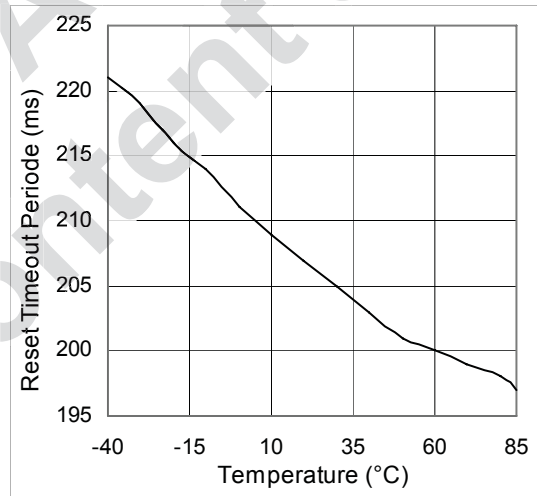*Figure 6. Reset Timeout Periode vs. Temperature;*

Figure 7. Normalized Threshold Error vs. Temperature;
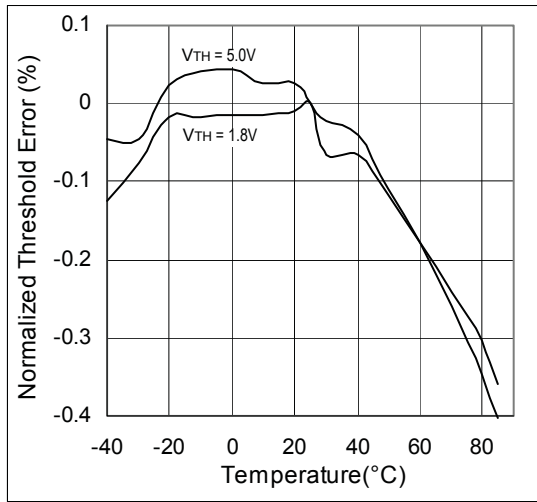V_{IN2} = 3.0V

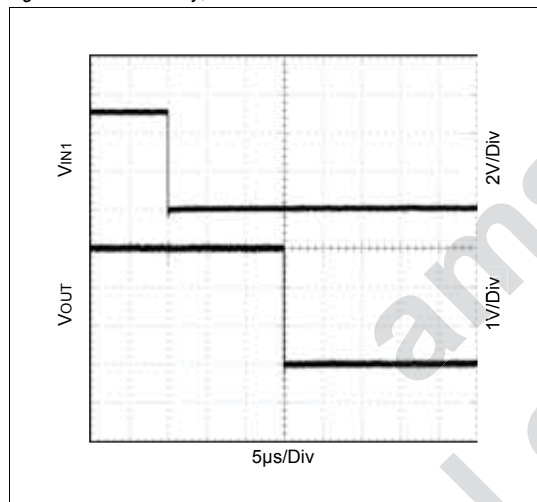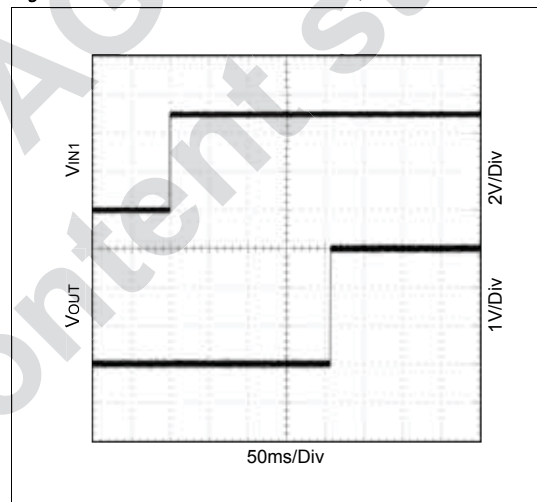*Figure 8. Reset Delay; V_{IN2} = 3.0V*

*Figure 9. Reset Active Timeout Periode; V_{IN2} = 3.0V*

8 Detailed Description

The AS1923 is a very small, low-power, quad-voltage microprocessor supervisory circuit designed to maintain system integrity in multi-supply systems (see Figure 10). The device offers several factory-trimmed under-voltage threshold values that minimize or eliminate the need for external components.

Preset voltage monitoring values of +5.0, +3.3, +3.0, +2.5, +1.8, and -5.0V (see Ordering Information on page 14) are available for a wide range of applications such as telecommunications equipment, desktop and notebook computers, high-end printers, data storage equipment, and networking equipment applications.

The device is powered via the IN2 input (3.0 to 3.3V) and a reset is asserted if V_{IN1} or V_{IN2} is > 1V. For improved performance, the AS1923 was also designed to ignore fast INx transients.

Figure 10. AS1923 - Block Diagram
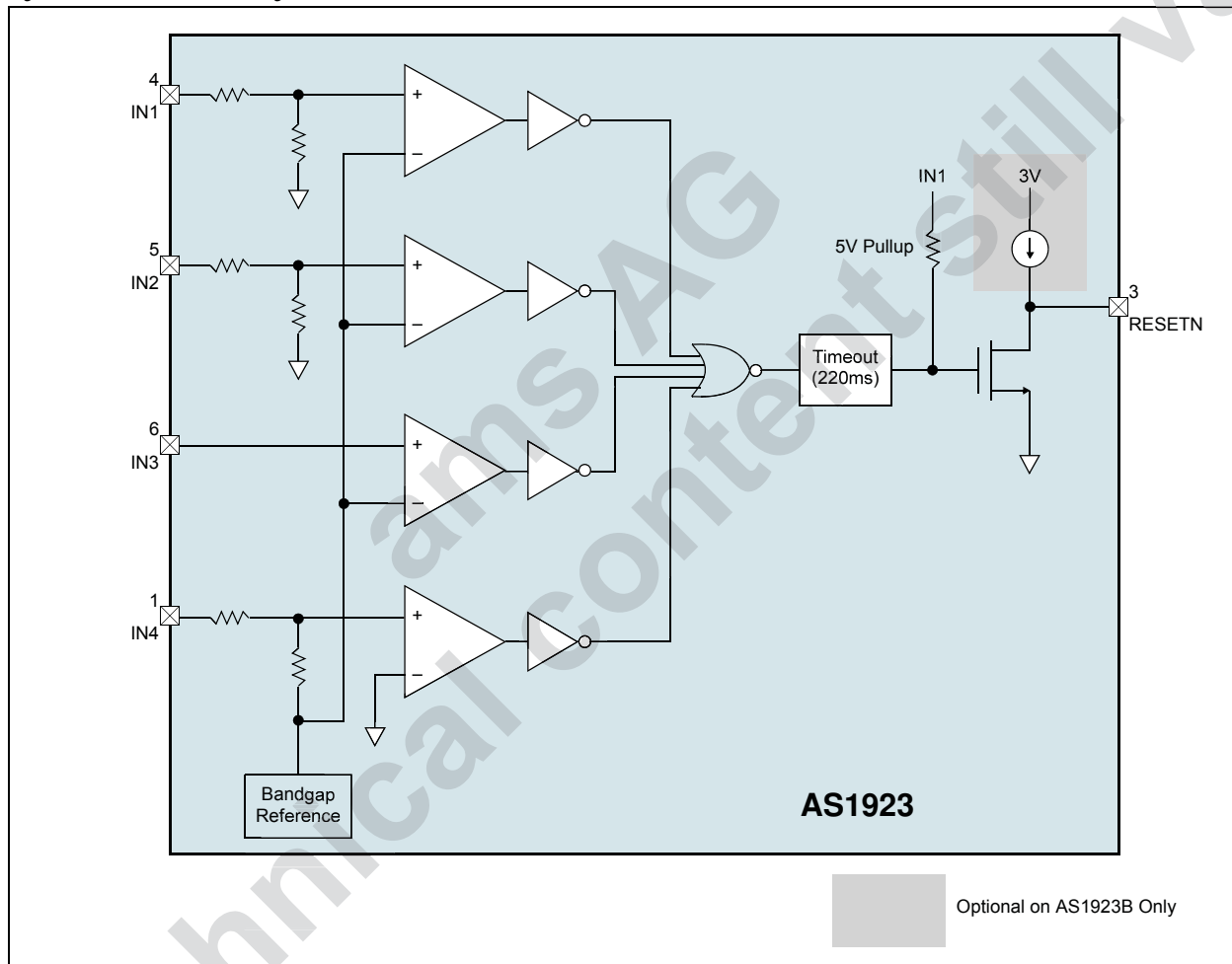
The quad-voltage monitor/reset circuitry includes an accurate bandgap reference, four precision comparators, and a series of internal trimmed resistor-divider networks to set the factory-trimmed reset threshold values.

The resistor networks scale the specified INx reset voltages to match the internal bandgap reference/comparator voltage. User-adjustable threshold options bypass the internal resistor networks and connect directly to one of the comparator inputs (an external resistor-divider network is required for threshold matching).

Each of the internal comparators has a typical hysteresis of 0.5% with respect to its reset threshold. This built-in hysteresis improves device immunity to ambient noise without significantly reducing threshold accuracy when an input sits at its specified reset voltage.

Note: Threshold voltage options (fixed and adjustable) are designated by the single-letter code in the model number (see Ordering Information on page 14).

9 Application Information

Reset Output

The AS1923 RESETN output is asserted low when any of the monitored IN*x* voltages drop below its specified reset threshold (above for -5V option) and remains asserted for the duration of the reset timeout period (120ms minimum) after all inputs have stabilized (Figure 11).

Figure 11. RESETN Output Timing Diagram
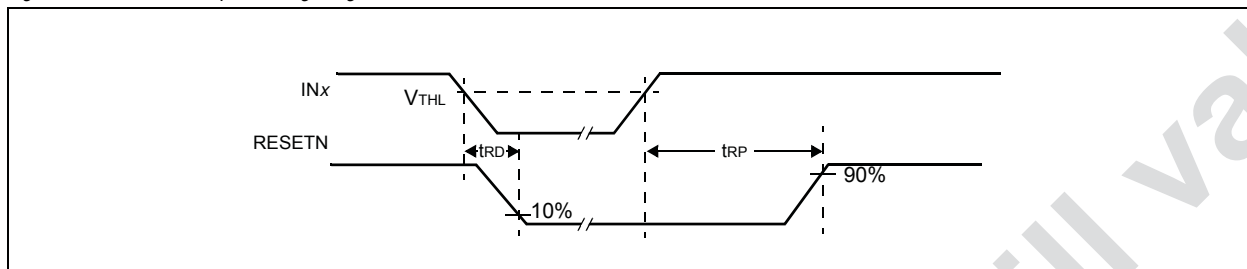
The AS1923B output driver is driven by an internal 10µA current source pullup resistor. For most applications there is no need for an external pullup resistor to interface with other logic supplies.

Note: An external pullup resistor must not be connected to the AS1923B.

The AS1923A supports an external pullup resistor to any voltage from 0 to +5.5V if interfaced to non-standard logic supply voltages (see Figure 12).

Figure 12. Interfacing to Various Logic Supply Voltages
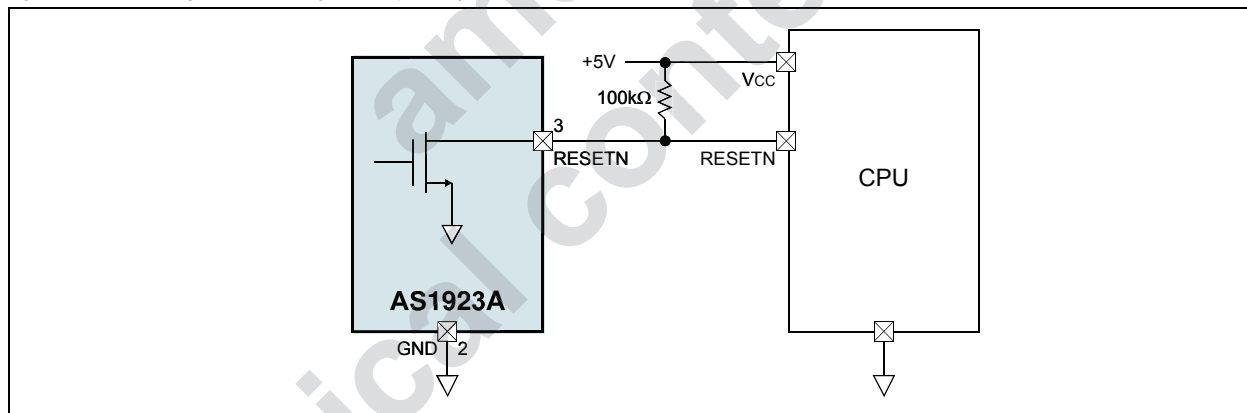
User-Adjustable Thresholds

The AS1923 provides several voltage monitoring values as well as user-adjustable reset thresholds.
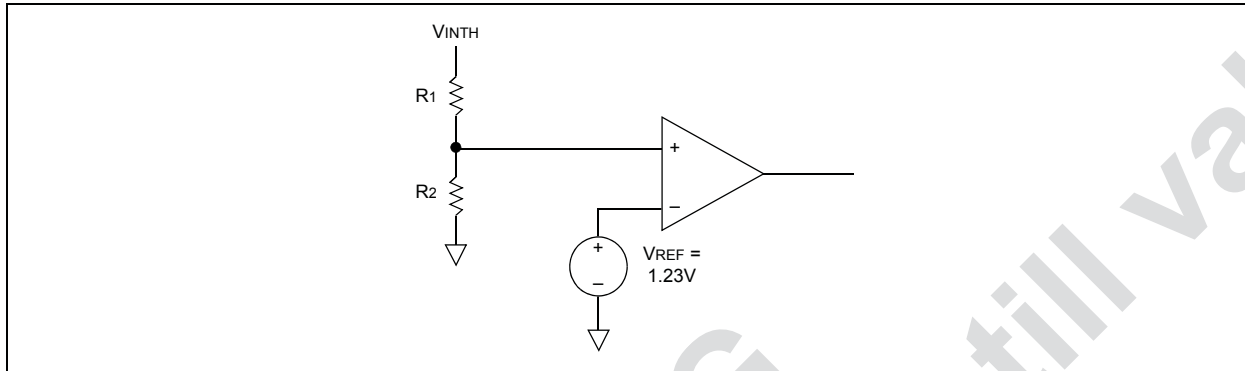
The threshold voltage at each adjustable IN*x* input is typically 1.23V. To monitor a voltage >1.23V, connect a resistor-divider network to the circuit as shown in Figure 13.

Figure 13. Setting User-Adjustable Thresholds

For the circuit shown in Figure 13, calculate R_1 and R_2 as:

$$V_{INTH} = 1,23V \times \frac{R_1 + R_2}{R_2}$$

(EQ 1)

or, calculated in terms of R_1:

$$R_1 = R_2 \times \left(\frac{V_{INTH}}{1,23V} - 1\right)$$

(EQ 2)

Note: Because the AS1923 has a guaranteed input current of ±0.1μA on its adjustable inputs, resistor values up to 100kΩ can be used for R_2 with <1% error.

Unused Inputs

The IN2 input must always be used for normal operation (AS1923 power-supply pin). Otherwise, in cases where one or more of the AS1923 monitoring inputs will not be used, these inputs must be tied to a supply voltage greater in magnitude than their specified threshold voltages.

Notes:

1. For unused IN3 or IN4 applications with positive thresholds (fixed or adjustable), the inputs can be connected directly to the IN2 supply.
2. For unused IN4 options with negative thresholds, the input must be tied to a more negative supply.
3. Unused pins must not be connected to ground or allowed to float.

Negative Voltage Monitoring Beyond -5V

The AS1923 is available with options to monitor -5V supplies using internally trimmed thresholds. In cases where monitored supplies are more negative than -5V, an external low-impedance resistor-divider network can be used as shown in Figure 14.

The current through the external resistor-divider should be greater than the input current for the -5V monitor options. For an input monitor current error of <1%, the resistor-divider current should be $\geq$ 2mA (for I_{IN4} = 20µA max).

Figure 14. Negative Voltage Monitoring Beyond -5V
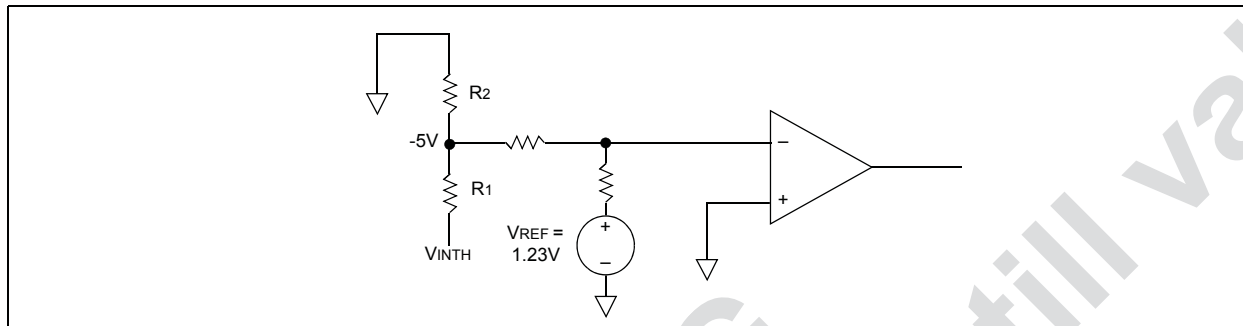
For the circuit shown in Figure 14, calculate R_1 based on the desired V_{INx} reset threshold voltage:

$$R_1 = R_2 \times \left(\frac{V_{INTH}}{1{,}23V} - 1 \right)$$

(EQ 3)

Where:

$R_2 \leq 2.49k\Omega$
V_{INTH} is the desired threshold voltage.
V_{TH} is the internal threshold voltage.

For $-V_{IN}$ = -12V nominal:

V_{INTH} = -11.1V,
V_{TH} = -4.63V,
R_2 = 2.49kΩ.

Using the equation given in (EQ 3), R_1 can be calculated as:

$$R_1 = 2{,}49k\Omega \times \left(\frac{-11{,}1V}{-4{,}63V} - 1 \right)$$

Therefore, R_1 = 3.48kΩ

Power-Supply Bypassing and Grounding

The AS1923 is powered from the IN2 supply input. All monitor inputs are immune to fast supply transients.

If higher immunity is required in noisy systems, connect 0.1µF bypass capacitors from the IN2 input to ground (see Figure 15). Additional capacitance can be added to IN1, IN3, and IN4 to improve noise immunity at these inputs.

Figure 15. IN2 Additional Noise Immunity
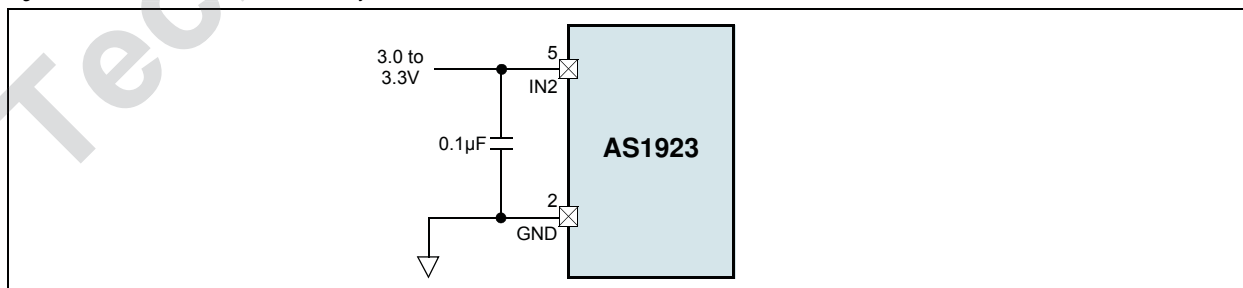
10 Package Drawings and Markings

Figure 16.   6-pin SOT23 Marking

Top Marking

ASJD

Bottom Marking

XXXX

xxxx- encoded Datacode

Figure 17. 6-pin SOT23 Package

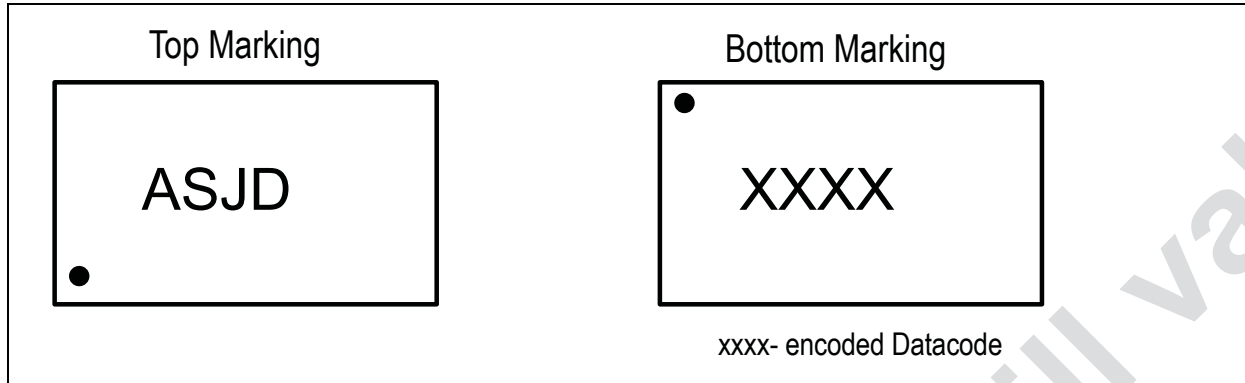| REF.	MIN	NOM	MAX
A	–	–	1.45
A1	0.00	–	0.15
A2	0.90	1.15	1.30
b	0.30	–	0.50
c	0.08	–	0.22
D		2.90 BSC	
E		2.80 BSC	
E1		1.60 BSC	
e		0.95 BSC	
e1		1.90 BSC	
L	0.30	0.45	0.60
L1		0.60 REF	
L2		0.25 BSC	
Θ	0°	4°	8°
Θ1	5°	10°	15°
aaa	–	0.15	–
bbb	–	0.20	–
ccc	–	0.10	–
ddd	–	0.20	–
N		6	

NOTE:

1. DIMENSIONS & TOLERANCEING CONFIRM TO ASME Y14.5M−1994.

2. ALL DIMENSIONS ARE IN MILLIMETERS. ANGELS ARE IN DEGREES.

3. DATUMS A & B TO BE DETERMINED AT DATUM H.

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ASSEMBLY ENGINEERING

TITLE	REFERENCE DOCUMENT	
SOT23, 6 LEAD	JEDEC MO − 178 LATEST REVISION	

DRAWN RH8	DATE 2010.12.21	REV. N/C
CHECKED GBO	DATE 2010.12.21	
APPROVED MKR	DATE 2010.12.21	SHEET 1 OF 1

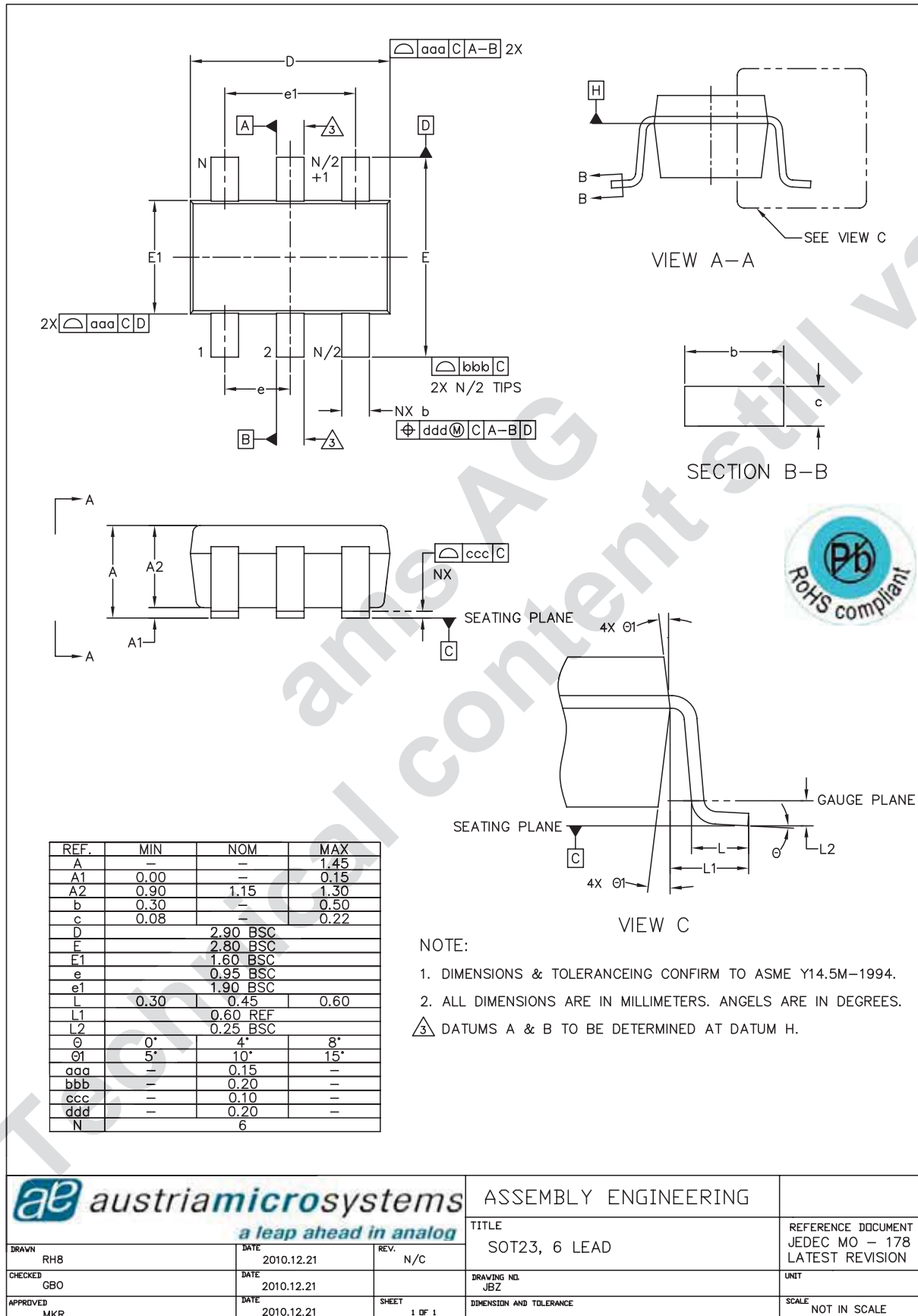| DRAWING NO. JBZ	UNIT
DIMENSION AND TOLERANCE	SCALE NOT IN SCALE

11 Ordering Information

The device is available as the standard products listed in Table 4.

Table 4. Ordering Information

Ordering Code	Marking	Descriptiom	Delivery Form	Package
AS1923A-BSTT-A	ASJD	Quad-Voltage Microprocessor Supervisory Circuit with Open Drain Output	Tape and Reel	6-pin SOT23
AS1923A-BSTT-C	ASJF	Quad-Voltage Microprocessor Supervisory Circuit with Open Drain Output	Tape and Reel	6-pin SOT23
AS1923A-BSTT-I	ASJP	Quad-Voltage Microprocessor Supervisory Circuit with Open Drain Output	Tape and Reel	6-pin SOT23
AS1923A-BSTT-K	ASJR	Quad-Voltage Microprocessor Supervisory Circuit with Open Drain Output	Tape and Reel	6-pin SOT23
AS1923A-BSTT-O	ASJV	Quad-Voltage Microprocessor Supervisory Circuit with Open Drain Output	Tape and Reel	6-pin SOT23
AS1923A-BSTT-x*	tbd	Quad-Voltage Microprocessor Supervisory Circuit with Open Drain Output	Tape and Reel	6-pin SOT23
AS1923B-BSTT-x*	tbd	Quad-Voltage Microprocessor Supervisory Circuit with Internal 10µA Current Source Pullup Output	Tape and Reel	6-pin SOT23

*) on request

Note: All products are RoHS compliant.
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For further information and requests, please contact us mailto:sales@austriamicrosystems.com
or find your local distributor at http://www.austriamicrosystems.com/distributor

These devices are available in factory-set input voltage thresholds. Choose the desired reset threshold suffix from Table 5 and insert it instead of "x" in the part number.

Table 5. Variants Suffix Guide (x)

Variant (x)	Thresholds				Tolerance
	IN1	IN2	IN3	IN4	
A	5.0V	3.3V	2.5V	adjustable	10%
B [1]	5.0V	3.3V	2.5V [2]	adjustable	5%
C	5.0V	3.3V	1.8V	adjustable	10%
D [1]	5.0V	3.3V	1.8V [2]	adjustable	5%
E [1]	5.0V	3.0V	2.5V	adjustable	10%
F [1]	5.0V	3.0V	2.5V [2]	adjustable	5%
G [1]	5.0V	3.0V	1.8V	adjustable	10%
H [1]	5.0V	3.0V	1.8V [2]	adjustable	5%

Table 5. Variants Suffix Guide (x)

Variant (x)	Thresholds				Tolerance
	IN1	IN2	IN3	IN4	
I	5.0V	3.3V	2.5V [2]	1.8V	10%
J	5.0V	3.3V	2.5V [2]	1.8V [2]	5%
K	adjustable	3.3V	2.5V	adjustable	10%
L [1]	adjustable	3.3V	2.5V [2]	adjustable	5%
M [1]	5.0V	3.0V	adjustable	-5.0V	10%
N [1]	5.0V	3.0V	adjustable	-5.0V	5%
O	5.0V	3.3V	adjustable	-5.0V	10%
P	5.0V	3.3V	adjustable	-5.0V	5%

1. Available upon request
2. Specified for 10% tolerances

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