3-Pin Microprocessor Reset Circuits

FEATURES

- Ultra Low Supply Current 1μA(typ.)
- Guaranteed Reset Valid to Vcc=0.9V
- Available in Three Output Type: Open-Drain Active Low (AIC809N), Push-Pull Active Low (AIC809), Push-Pull Active High (AIC810)
- 140ms Min. Power-On Reset Pulse Width
- Internally Fixed Threshold 2.3V, 2.6V, 2.9V, 3.1V, 4.0V, 4.2V, 4.4V, 4.6V
- Tight Voltage Threshold Tolerance: 1.5%
- Tiny Package in SOT-23

APPLICATIONS

- Notebook Computers
- Digital Still Cameras
- PDAs
- Critical Microprocessor Monitoring

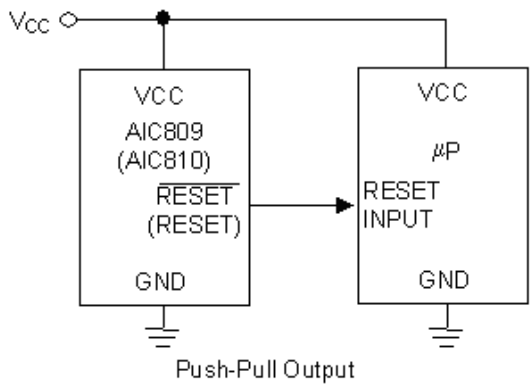
DESCRIPTION

AIC809/AIC810 are low-power microprocessor (μP) supervisory circuits used to monitor power supplies in μP and digital systems. They provide applications with benefits of circuit reliability and low cost by eliminating external components.

These devices perform as valid signals in applications with Vcc ranging from 6.0V down to 0.9V. The reset signal lasts for a minimum period of 140ms whenever VCC supply voltage falls below preset threshold. Both AIC809 and AIC810 were designed with a reset comparator to help identify invalid signals, which last less than 140ms. The only difference between them is that they have an active-low $\overline{\text{RESET}}$ output and active-high RESET output, respectively.

Low supply current (1μA) makes AIC809/AIC810 ideal for portable equipment. The devices are available in SOT-23 package.

TYPICAL APPLICATION CIRCUIT



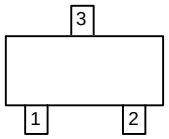
■ ORDERING INFORMATION

AIC809X-XXXXXXX
AIC810 -XXXXXXX

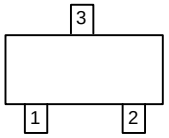
- PACKING TYPE
  TR: TAPE & REEL
  BG: BAG
- PACKAGE TYPE
  U: SOT-23
  UA: SOT-23
- P: LEAD FREE COMMERCIAL
  G: Green Package
- RESET THRESHOLD VOLTAGE
  23: 2.3V 40: 4.0V
  26: 2.6V 42: 4.2V
  29: 2.9V 44: 4.4V
  31: 3.1V 46: 4.6V
- OUTPUT TYPE
  DEFAULT: Push-Pull type
  N: N-ch Open-Drain type

PIN CONFIGURATION

SOT-23 (U)
TOP VIEW
1: GND
2: RESET (RESET)
3: VCC



SOT-23 (UA)
TOP VIEW
1: RESET (RESET)
2: GND
3: VCC



(Additional voltage versions with a unit of 0.1V within the voltage range from 1.5V to 5.5V for this product line may be available on demand with prior consultation with AIC.)

Example: AIC809-31PUTR

→ 3.1V and push-pull version, in Lead FreeSOT-23 Package & Tape & Reel Packing Type

- **SOT-23 Marking**

Part No.	Marking
AIC809-23PU	RA23P
AIC809-26PU	RA26P
AIC809-29PU	RA29P
AIC809-31PU	RA31P
AIC809-40PU	RA40P
AIC809-42PU	RA42P
AIC809-44PU	RA44P
AIC809-46PU	RA46P

Part No.	Marking
AIC809N-23PU	RB23P
AIC809N-26PU	RB26P
AIC809N-29PU	RB29P
AIC809N-31PU	RB31P
AIC809N-40PU	RB40P
AIC809N-42PU	RB42P
AIC809N-44PU	RB44P
AIC809N-46PU	RB46P

Part No.	Marking
AIC810-23PU	RD23P
AIC810-26PU	RD26P
AIC810-29PU	RD29P
AIC810-31PU	RD31P
AIC810-40PU	RD40P
AIC810-42PU	RD42P
AIC810-44PU	RD44P
AIC810-46PU	RD46P

- **SOT-23 Marking (continued)**

Part No.	Marking
AIC809-23PUA	RC23P
AIC809-26PUA	RC26P
AIC809-29PUA	RC29P
AIC809-31PUA	RC31P
AIC809-40PUA	RC40P
AIC809-42PUA	RC42P
AIC809-44PUA	RC44P
AIC809-46PUA	RC46P

Part No.	Marking
AIC809N-23PUA	RE23P
AIC809N-26PUA	RE26P
AIC809N-29PUA	RE29P
AIC809N-31PUA	RE31P
AIC809N-40PUA	RE40P
AIC809N-42PUA	RE42P
AIC809N-44PUA	RE44P
AIC809N-46PUA	RE46P

Part No.	Marking
AIC810-23PUA	RF23P
AIC810-26PUA	RF26P
AIC810-29PUA	RF29P
AIC810-31PUA	RF31P
AIC810-40PUA	RF40P
AIC810-42PUA	RF42P
AIC810-44PUA	RF44P
AIC810-46PUA	RF46P

Part No.	Marking
AIC809-23GU	RA23G
AIC809-26GU	RA26G
AIC809-29GU	RA29G
AIC809-31GU	RA31G
AIC809-40GU	RA40G
AIC809-42GU	RA42G
AIC809-44GU	RA44G
AIC809-46GU	RA46G

Part No.	Marking
AIC809N-23GU	RB23G
AIC809N-26GU	RB26G
AIC809N-29GU	RB29G
AIC809N-31GU	RB31G
AIC809N-40GU	RB40G
AIC809N-42GU	RB42G
AIC809N-44GU	RB44G
AIC809N-46GU	RB46G

Part No.	Marking
AIC810-23GU	RD23G
AIC810-26GU	RD26G
AIC810-29GU	RD29G
AIC810-31GU	RD31G
AIC810-40GU	RD40G
AIC810-42GU	RD42G
AIC810-44GU	RD44G
AIC810-46GU	RD46G

Part No.	Marking
AIC809-23GUA	RC23G
AIC809-26GUA	RC26G
AIC809-29GUA	RC29G
AIC809-31GUA	RC31G
AIC809-40GUA	RC40G
AIC809-42GUA	RC42G
AIC809-44GUA	RC44G
AIC809-46GUA	RC46G

Part No.	Marking
AIC809N-23GUA	RE23G
AIC809N-26GUA	RE26G
AIC809N-29GUA	RE29G
AIC809N-31GUA	RE31G
AIC809N-40GUA	RE40G
AIC809N-42GUA	RE42G
AIC809N-44GUA	RE44G
AIC809N-46GUA	RE46G

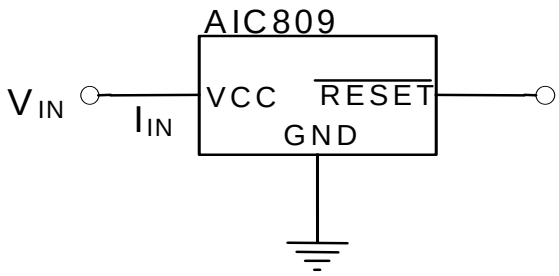
Part No.	Marking
AIC810-23GUA	RF23G
AIC810-26GUA	RF26G
AIC810-29GUA	RF29G
AIC810-31GUA	RF31G
AIC810-40GUA	RF40G
AIC810-42GUA	RF42G
AIC810-44GUA	RF44G
AIC810-46GUA	RF46G

ABSOLUTE MAXIMUM RATINGS

V_{CC}	-0.3V ~6.5V
RESET, $\overline{\text{RESET}}$	-0.3V ~ (VCC+0.3V)
Input Current (V_{CC})	20mA
Output Current (RESET or $\overline{\text{RESET}}$)	20mA
Continuous Power Dissipation (T_A = +70°C)	320mW
Operating Junction Temperature Range	-40°C ~ 85°C
Junction Temperature	125°C
Storage Temperature Range	-65°C ~ 150°C
Lead Temperature (Soldering) 10 sec	260°C

Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

TEST CIRCUIT



ELECTRICAL CHARACTERISTICS

(Typical values are at T_A=25°C, unless otherwise specified.) (Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Operating Voltage Range	V_{CC}			0.9		6	V
Supply Current	I_{CC}	V_{CC} = V_{TH} +0.1V			1	3	μA
Reset Threshold	V_{TH}	AIC809-23	T_A=+25°C	2.265	2.3	2.335	V
			T_A= -40°C to +85°C	2.254		2.346	
		AIC809-26	T_A=+25°C	2.561	2.6	2.639	
			T_A= -40°C to +85°C	2.548		2.652	
		AIC809-29	T_A=+25°C	2.857	2.9	2.944	
			T_A= -40°C to +85°C	2.842		2.958	
		AIC809-31	T_A=+25°C	3.054	3.1	3.147	
			T_A= -40°C to +85°C	3.038		3.162	
		AIC809-40	T_A=+25°C	3.940	4.0	4.060	
			T_A= -40°C to +85°C	3.920		4.080	
		AIC809-42	T_A=+25°C	4.137	4.2	4.263	
			T_A= -40°C to +85°C	4.116		4.284	
		AIC809-44	T_A=+25°C	4.334	4.4	4.466	
			T_A= -40°C to +85°C	4.312		4.488	
		AIC809-46	T_A=+25°C	4.531	4.6	4.669	
			T_A=-40°C to +85°C	4.508		4.692	
V_{CC} to Reset Delay	T_{RD}	V_{CC}=V_{TH} to (V_{TH} -0.1V), V_{TH}=3.1V			20		μS
Reset Active Timeout Period	T_{RP}	V_{CC} = $V_{TH\ (MAX)}$	T_A=+25°C	140	230	560	mS
			T_A= -40°C to +85°C	100		1030	
$\overline{\text{RESET}}$ Output Voltage	V_{OH}	V_{CC}=V_{TH}+0.1V, I_{SOURCE}=1mA		0.8V_{CC}			V
	V_{OL}	V_{CC}=V_{TH} - 0.1V, I_{SINK}=1mA				0.2Vcc	
RESET Output Voltage	V_{OH}	V_{CC}=V_{TH}-0.1V, I_{SOURCE}=1mA		0.8V_{CC}			V
	V_{OL}	V_{CC}=V_{TH}+0.1V, I_{SINK}=1mA				0.2Vcc	

Note1: Specifications are production tested at T_A=25°C. Specifications over the -40°C to 85°C operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls (SQC).

Note2: $\overline{\text{RESET}}$ output is for AIC809; RESET output is for AIC810.

TYPICAL PERFORMANCE CHARACTERISTICS

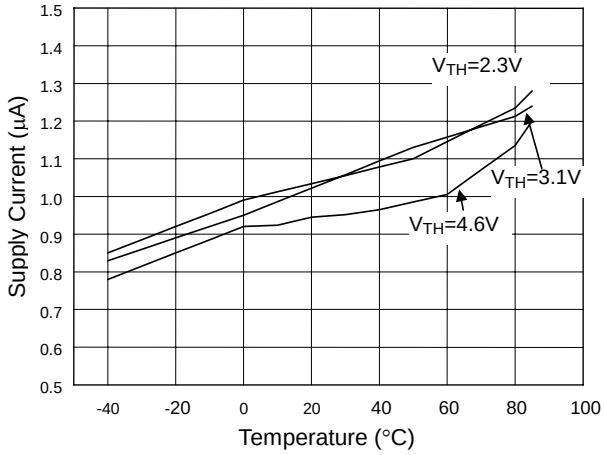


Fig 1 Supply Current vs. Temperature

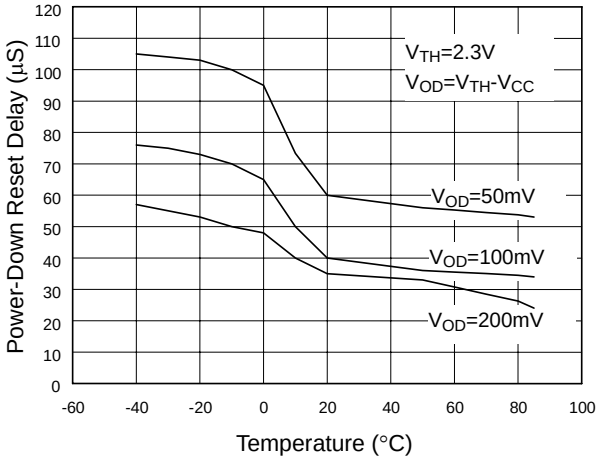


Fig 2 Power-Down Reset Delay vs. Temperature

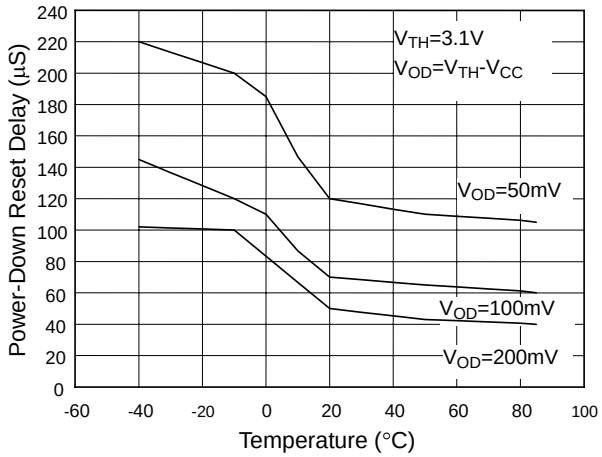


Fig 3 Power-Down Reset Delay vs. Temperature

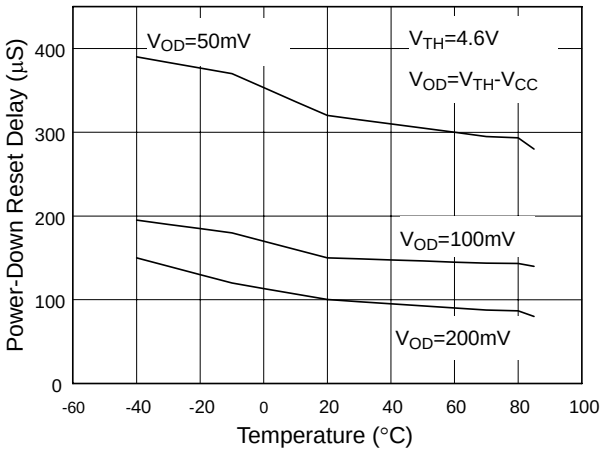


Fig 4 Power-Down Reset Delay vs. Temperature

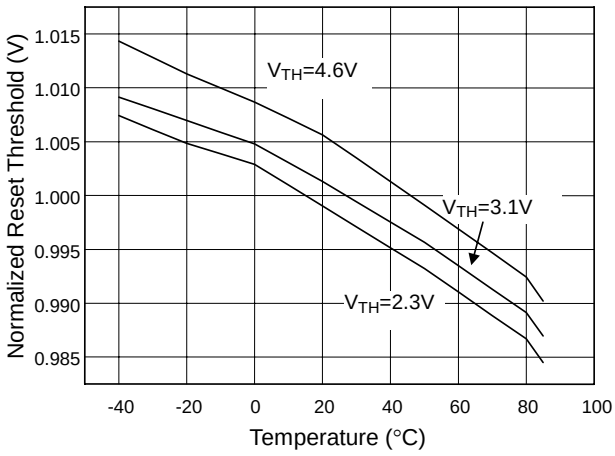


Fig 5 Normalized Reset Threshold vs. Temperature

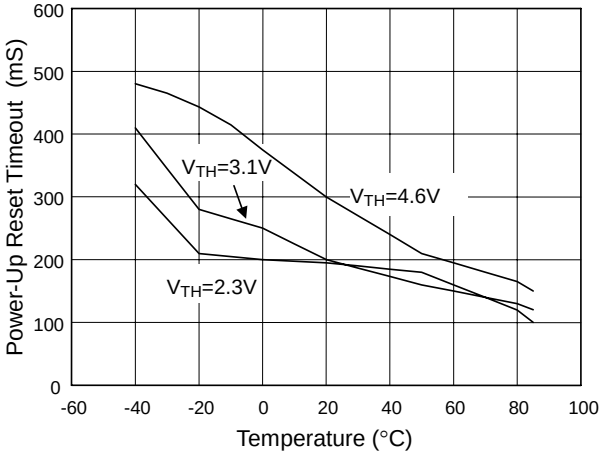
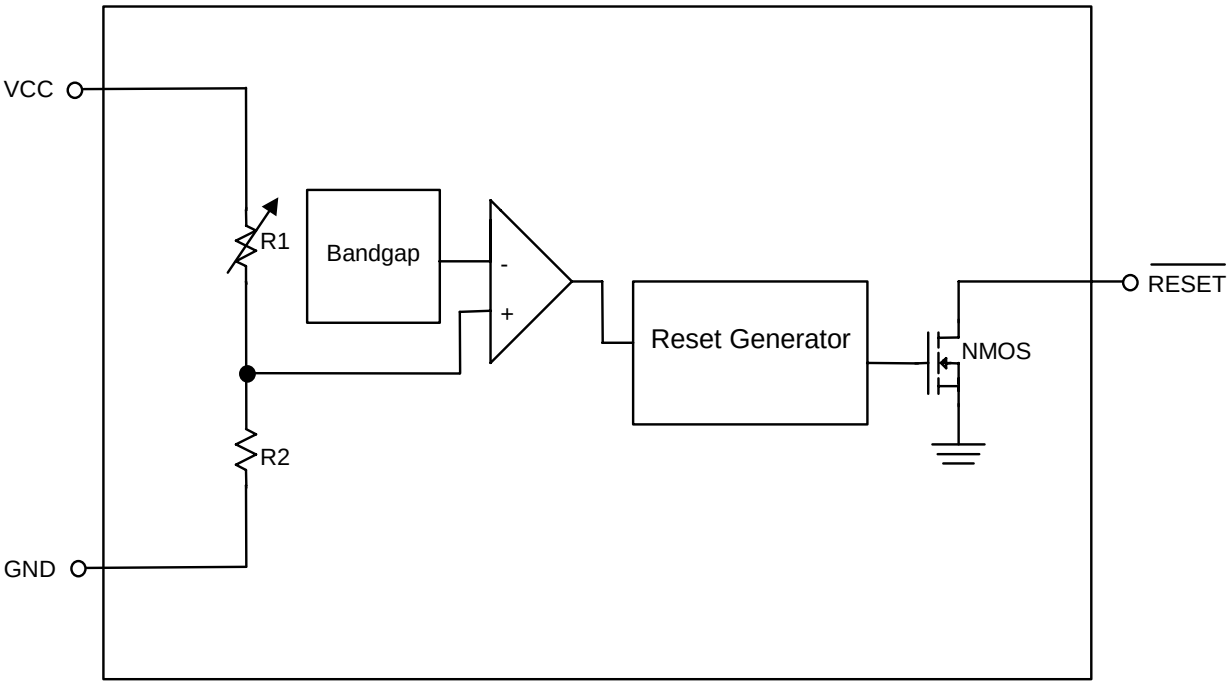
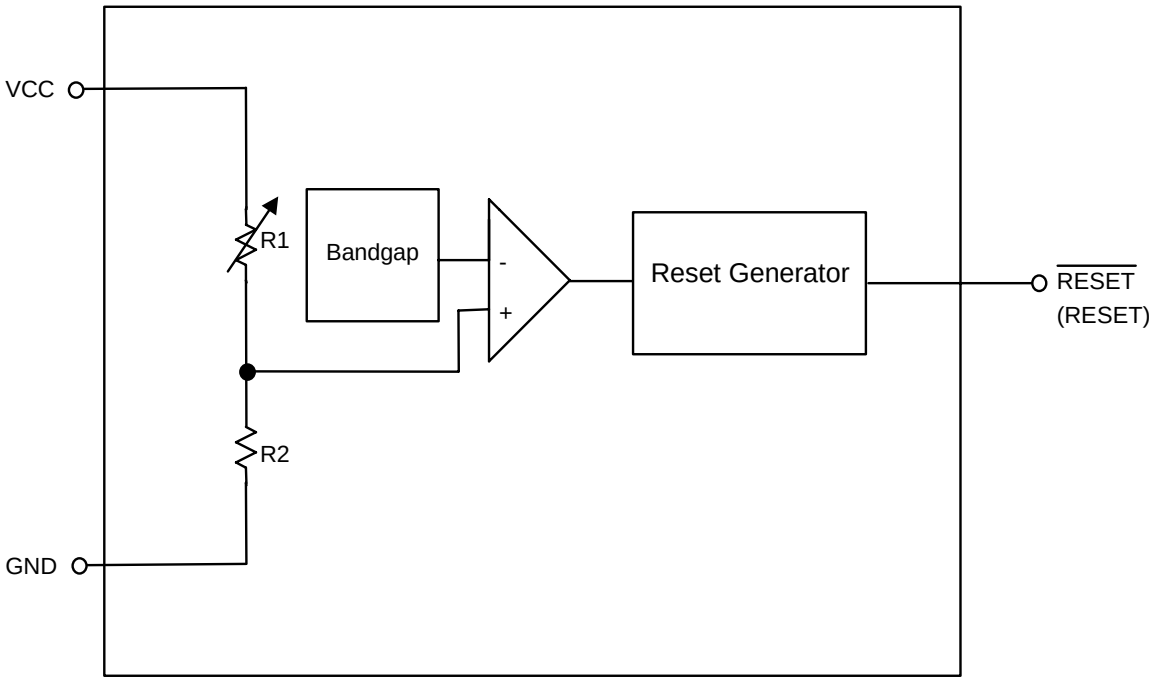


Fig 6 Power-Up Reset Timeout vs. Temperature

BLOCK DIAGRAMS



N-ch Open-Drain Type



Push-Pull Type

PIN DESCRIPTIONS

GND Pin : Ground.

$\overline{\text{RESET}}$ Pin (AIC809) : Active low output pin. $\overline{\text{RESET}}$ Output remains low while Vcc is below the reset threshold.

RESET Pin (AIC810) : Active high output pin. RESET output remains high while Vcc is below the reset threshold.

Vcc Pin : Supply voltage.

DETAIL DESCRIPTIONS OF TECHNICAL TERMS

RESET OUTPUT

μP will be activated at a valid reset state. These μP supervisory circuits assert reset to prevent code execution errors during power-up, power-down, or brownout conditions.

$\overline{\text{RESET}}$ is guaranteed to be a logic low for V_{TH}>VCC>0.9V. Once VCC exceeds the reset threshold, an internal timer keeps $\overline{\text{RESET}}$ low for the reset timeout period; after this interval, $\overline{\text{RESET}}$ goes high.

If a brownout condition occurs (VCC drops below the reset threshold), $\overline{\text{RESET}}$ goes low. Any time VCC goes below the reset threshold, the internal timer resets to zero, and $\overline{\text{RESET}}$ goes low. The internal timer is activated after VCC returns above the reset threshold, and $\overline{\text{RESET}}$ remains low for the reset timeout period.

BENEFITS OF HIGHLY ACCURATE RESET THRESHOLD

AIC809/810 with specified voltage as 5V±10% or 3V±10% are ideal for systems using a 5V±5% or 3V±5% power supply. The reset is guaranteed to assert after the power supply falls out of regulation, but before power drops below the minimum specified operating voltage range of the system ICs. The pre-trimmed thresholds are reducing the range over which an undesirable reset may occur.

APPLICATION INFORMATION

NEGATIVE-GOING VCC TRANSIENTS

In addition to issuing a reset to the μP during power-up, power-down, and brownout conditions, AIC809 series are relatively resistant to short-duration negative-going VCC transient.

ENSURING A VALID RESET OUTPUT DOWN TO VCC=0

When VCC falls below 0.9V, AIC809 $\overline{\text{RESET}}$ output no longer sinks current; it becomes an open circuit. In this case, high-impedance CMOS logic inputs connecting to $\overline{\text{RESET}}$ can drift to undetermined voltages. Therefore, AIC809/810 with CMOS is perfect for most applications of VCC below 0.9V. However in applications where $\overline{\text{RESET}}$ must be valid down to 0V, adding a pull-down resistor to $\overline{\text{RESET}}$ causes any leakage currents to flow to ground, holding $\overline{\text{RESET}}$ low.

INTERFACING TO μP WITH BIDIRECTIONAL RESET PINS

The $\overline{\text{RESET}}$ output on the AIC809N is open drain, this device interfaces easily with μPs that have bidirectional reset pins. Connecting the μP supervisor's $\overline{\text{RESET}}$ output directly to the microcontroller's $\overline{\text{RESET}}$ pin with a single pull-up resistor allows either device to assert reset.

APPLICATION CIRCUIT

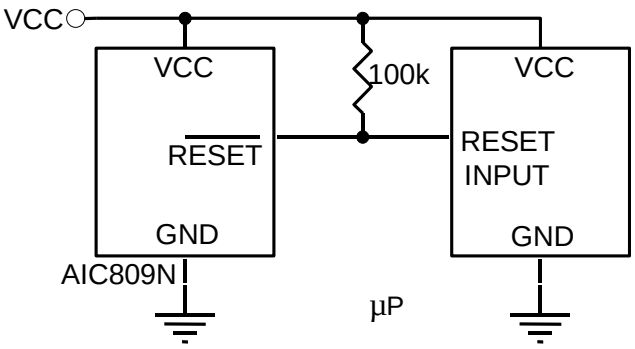


Fig. 7 Open-Drain Output

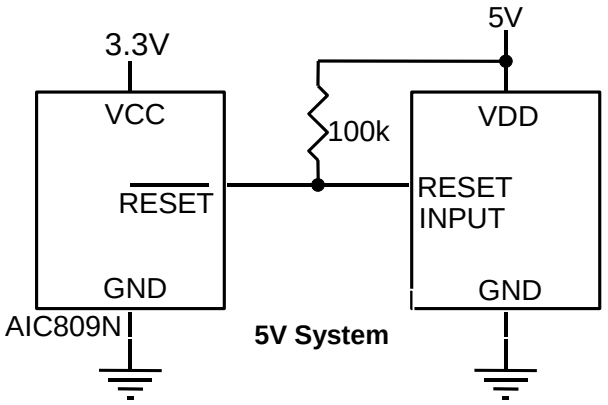
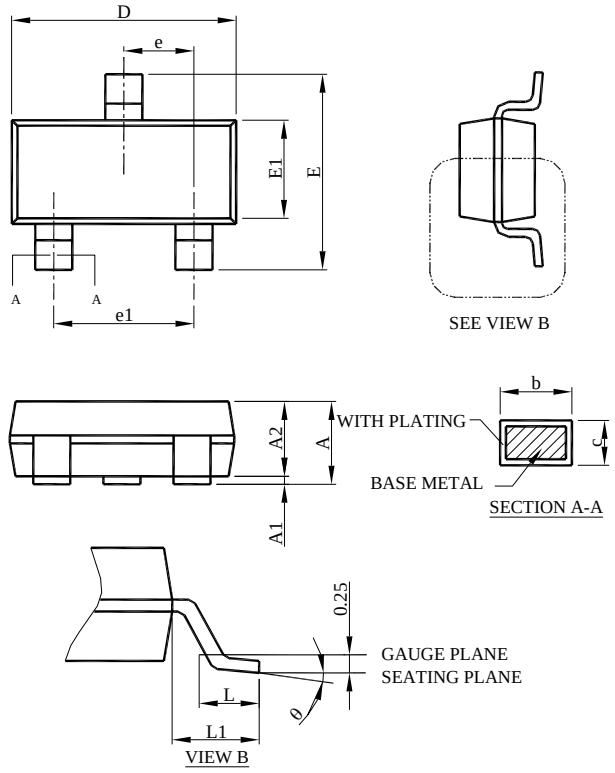


Fig. 8 Open-Drain Output Allows Use with Multiple Supplies

PHYSICAL DIMENSIONS (unit: mm)

- **SOT-23**



SYMBOL	SOT-23	
	MILLIMETERS	
	MIN.	MAX.
A	0.95	1.45
A1	0.05	0.15
A2	0.90	1.30
b	0.30	0.50
c	0.08	0.22
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
e	0.95 BSC	
e1	1.90 BSC	
L	0.30	0.60
L1	0.60 REF	
θ	0°	8°

Note:
1.Refer to JEDEC MO-178.
2.Dimension D and E1 do not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 10 mil per side.
3.Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

Note: