



**THE DATASHEET OF  
APX809-29SAG-7**



## Description

The APX809/810 are used for microprocessor ( $\mu\text{P}$ ) supervisory circuits to monitor the power supplies in  $\mu\text{P}$  and digital systems. They provide excellent circuit reliability and low cost by eliminating external components and adjustments when used with 5V, 3.3V, 3.0V powered circuits.

These circuits perform a single function: they assert a reset signal whenever the  $V_{\text{CC}}$  supply voltage declines below a preset threshold, keeping it asserted for at least 240ms after  $V_{\text{CC}}$  has risen above the reset threshold. Reset thresholds suitable for operation with a variety of supply voltages are available. The APX809/810 have push pull outputs. The APX809 have an active low  $\overline{\text{RESET}}$  output, while the APX810 has an active high RESET output. The reset comparator is designed to ignore fast transients on  $V_{\text{CC}}$ , and the outputs are guaranteed to be in the correct logic state for  $V_{\text{CC}}$  down to 1V. Low supply current makes the APX809/810 ideal for use in portable equipment. The APX809/810 is available in a 3-pin SOT23 package.

## Features

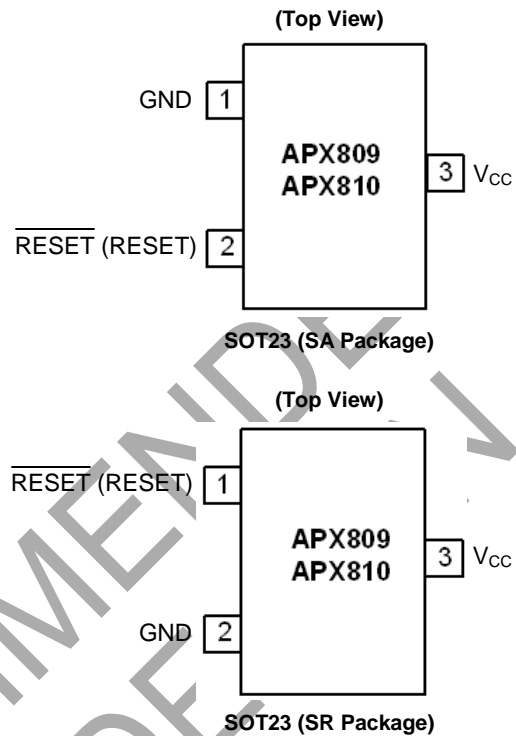
- Precision Monitoring of 2.5V, 3V, 3.3V, and 5V Power-Supply Voltages
- Fully Specified Over Temperature
- Available in Three Output Configurations
- Push-Pull  $\overline{\text{RESET}}$  Active Low (APX809)
- Push-Pull RESET Active High (APX810)
- 200ms Typ Power-On Reset Pulse Width
- 30 $\mu\text{A}$  Supply Current (Typ.)
- Guaranteed Reset Valid to  $V_{\text{CC}} = 1\text{V}$
- No External Components
- SOT23: Available in "Green" Molding Compound (No Br, Sb)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

## Typical Applications Circuit



## Pin Assignments



## Applications

- Computers
- Controllers
- Intelligent Instruments
- Critical  $\mu\text{P}$  and  $\mu\text{C}$  Power Monitoring
- Portable/Battery Powered Equipment

## Pin Descriptions

Pin Name	Description
GND	Ground
$\overline{\text{RESET}}$ (RESET)	Reset Output Pin L: for APX809 H: for APX810
V <sub>CC</sub>	Operating Voltage Input

## Functional Block Diagram



## Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
ESD HBM	Human Body Model ESD Protection	5	kV
ESD MM	Machine Model ESD Protection	500	V
V <sub>CC</sub>	Supply Voltage	-0.3 to +6.0	V
V <sub>RESET</sub>	RESET, $\overline{\text{RESET}}$ (Push-pull)	-0.3 to (V <sub>CC</sub> + 0.3)	V
I <sub>CC</sub>	Input Current, V <sub>CC</sub>	20	mA
I <sub>O</sub>	Output Current, RESET, $\overline{\text{RESET}}$	20	mA
P <sub>D</sub>	Continuous Power Dissipation (T <sub>A</sub> = +70°C), De-rate 4mW/°C above +70°C	400	mW
T <sub>OP</sub>	Operating Junction Temperature Range	-40 to +105	°C
T <sub>ST</sub>	Storage Temperature Range	-65 to +150	°C

## Recommended Operating Conditions

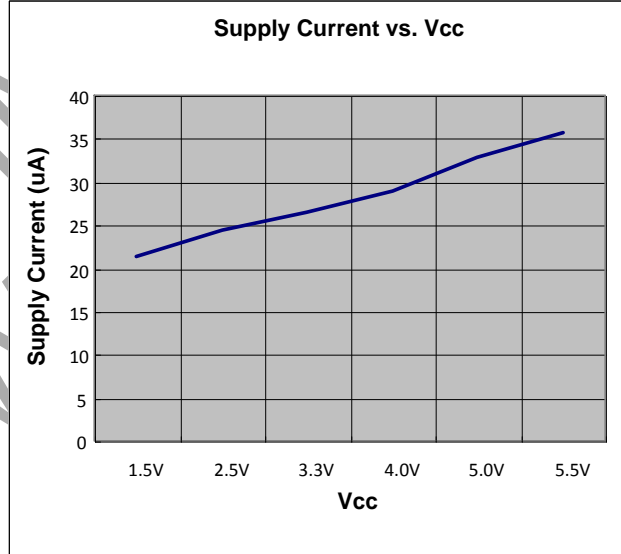
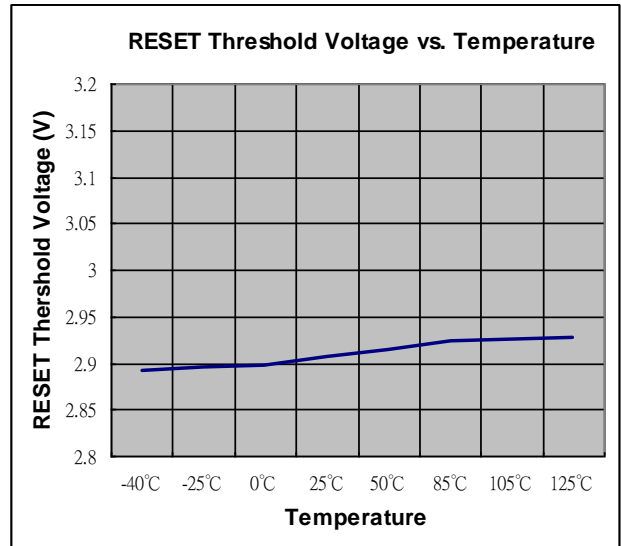
Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	Supply Voltage	1.1	5.5	V
V <sub>IN</sub>	Input Voltage	0	(V <sub>CC</sub> + 0.3)	V
T <sub>A</sub>	Operating Ambient Temperature Range	-40	+85	°C
t <sub>R</sub>	V <sub>CC</sub> Rising Time (V <sub>CC</sub> = 0 to V <sub>T</sub> )	—	100	µs

## Electrical Characteristics (@T<sub>A</sub> = -40 to +85°C, unless otherwise note. Typical values are at T<sub>A</sub> = +25°C.)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit	
V <sub>CC</sub>	V <sub>CC</sub> Range	T <sub>A</sub> = 0°C to +70°C	1.0	—	5.5	V	
I <sub>CC</sub>	Supply Current	V <sub>TH</sub> + 0.2V	—	30	40	µA	
V <sub>TH</sub>	Reset Threshold	T <sub>A</sub> = 0°C to +85°C	APX809/810-23	2.21	2.25	2.30	V
			APX809/810-26	2.59	2.63	2.69	
			APX809/810-29	2.88	2.93	3.00	
			APX809/810-31	3.02	3.08	3.15	
			APX809/810-40	3.93	4.00	4.08	
			APX809/810-44	4.31	4.38	4.47	
			APX809/810-46	4.56	4.63	4.72	
		T <sub>A</sub> = -40°C to +85°C	APX809/810-23	2.20	2.25	2.30	V
			APX809/810-26	2.57	2.63	2.69	
			APX809/810-29	2.86	2.93	3.00	
			APX809/810-31	3.00	3.08	3.15	
			APX809/810-40	3.92	4.00	4.08	
			APX809/810-44	4.29	4.38	4.47	
			APX809/810-46	4.54	4.63	4.72	
	Reset Threshold Tempco	—	—	30	—	ppm/°C	
t <sub>S</sub>	Set-up Time	V <sub>CC</sub> = V <sub>TH</sub> to (V <sub>TH</sub> - 100mV)	—	20	—	µs	
t <sub>DELAY</sub>	Reset Active Timeout Period	T <sub>A</sub> = 0°C to +85°C	140	200	280	ms	
V <sub>OL</sub>	RESET Output Voltage Low (APX809)	V <sub>CC</sub> = V <sub>TH</sub> - 0.2, I <sub>SINK</sub> = 1.2mA	—	—	0.3	V	
		V <sub>CC</sub> = V <sub>TH</sub> - 0.2, I <sub>SINK</sub> = 3.2mA	—	—	0.4		
		V <sub>CC</sub> > 1.0V, I <sub>SINK</sub> = 50µA	—	—	0.3		
V <sub>OH</sub>	RESET Output Voltage-High (APX809)	V <sub>CC</sub> > V <sub>TH</sub> + 0.2, I <sub>SOURCE</sub> = 500µA	0.8V <sub>CC</sub>	—	—	V	
		V <sub>CC</sub> > V <sub>TH</sub> + 0.2, I <sub>SOURCE</sub> = 800µA	V <sub>CC</sub> - 1.5	—	—		
V <sub>OL</sub>	RESET Output Voltage-Low (APX810)	V <sub>CC</sub> = V <sub>TH</sub> + 0.2, I <sub>SINK</sub> = 1.2mA	—	—	0.3	V	
		V <sub>CC</sub> = V <sub>TH</sub> + 0.2, I <sub>SINK</sub> = 3.2mA	—	—	0.4		
V <sub>OH</sub>	RESET Output Voltage-High (APX810)	1.8V < V <sub>CC</sub> < V <sub>TH</sub> - 0.2, I <sub>SOURCE</sub> = 150µA	0.8V <sub>CC</sub>	—	—	V	
θ <sub>JA</sub>	Thermal Resistance Junction-to-Ambient	SOT23 (Note 4)	—	201	—	°C/W	
θ <sub>JC</sub>	Thermal Resistance Junction-to-Case	SOT23 (Note 4)	—	56	—	°C/W	

Note: 4. Test condition for SOT23: Devices mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

**Performance Characteristics**



**Timing Diagram**



## Functional Description

A microprocessor's ( $\mu P$ 's) reset input starts the  $\mu P$  in a known state. The APX809/810 assert reset to prevent code-execution errors during power-up, power-down, or brownout conditions. They assert a reset signal whenever the  $V_{CC}$  supply voltage declines below a preset threshold, keeping it asserted for at least 240ms after  $V_{CC}$  has risen above the reset threshold. The APX809/810 have a push-pull output stage.

### Ensuring a Valid Reset Output

#### Down to $V_{CC} = 0$

$\overline{RESET}$  is guaranteed to be a logic low for  $V_{CC} > 1V$ . Once  $V_{CC}$  exceeds the reset threshold, an internal timer keeps  $\overline{RESET}$  low for the reset timeout period; after this interval,  $\overline{RESET}$  goes high. If a brownout condition occurs ( $V_{CC}$  dips below the  $\overline{RESET}$  reset threshold),  $\overline{RESET}$  goes low. Any time  $V_{CC}$  goes below the reset threshold, the internal timer resets to zero, and  $\overline{RESET}$  goes low. The internal timer starts after  $V_{CC}$  returns above the reset threshold, and  $\overline{RESET}$  remains low for the reset timeout period.

When  $V_{CC}$  falls below 1V, the APX809  $\overline{RESET}$  output no longer sinks current — it becomes an open circuit. Therefore, high-impedance CMOS logic inputs connected to  $\overline{RESET}$  can drift to undetermined voltages.

This presents no problem in most applications since most  $\mu P$  and other circuitry is inoperative with  $V_{CC}$  below 1V. However, in applications where  $\overline{RESET}$  must be valid down to 0V, adding a pull down resistor to  $\overline{RESET}$  causes any stray leakage currents to flow to ground, holding  $\overline{RESET}$  low. R1's value is not critical; 100k are large enough not to load  $\overline{RESET}$  and small enough to pull  $\overline{RESET}$  to ground. For the APX810 if  $\overline{RESET}$  is required to remain valid for  $V_{CC} < 1V$ .

### Benefits of Highly Accurate Reset Threshold

Most  $\mu P$  supervisor ICs has reset threshold voltages between 5% and 10% below the value of nominal supply voltages. This ensures a reset will not occur within 5% of the nominal supply, but will occur when the supply is 10% below nominal. When using ICs rated at only the nominal supply  $\pm 5\%$ , this leaves a zone of uncertainty where the supply is between 5% and 10% low, and where the reset may or may not be asserted.

## Ordering Information



Part Number	Package Code	Packaging (Note 5)	7" Tape and Reel	
			Quantity	Part Number Suffix
APX809-XXSAG-7	SA	SOT23	3000/Tape & Reel	-7
APX810-XXSAG-7	SA	SOT23	3000/Tape & Reel	-7
APX809-XXSRG-7	SR	SOT23	3000/Tape & Reel	-7
APX810-XXSRG-7	SR	SOT23	3000/Tape & Reel	-7

Note: 5. Pad layout as shown in Diodes Incorporated's package outline PDFs, which can be found on our website at <http://www.diodes.com/package-outlines.html>.

## Marking Information

(1) SOT23

( Top View )



XX : Identification code

Y : Year 0~9

W : Week : A~Z : 1~26 week;  
a~z : 27~52 week; z represents  
52 and 53 week

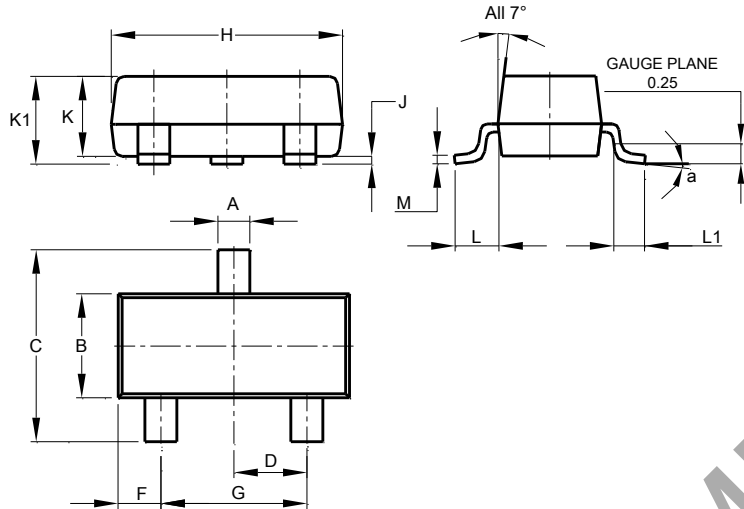
X : A~Z : Green

Device	Package	Identification Code
APX809-46SA	SOT23	X2
APX809-44SA	SOT23	X3
APX809-40SA	SOT23	X4
APX809-31SA	SOT23	X5
APX809-29SA	SOT23	X6
APX809-26SA	SOT23	X7
APX809-23SA	SOT23	X8
APX810-46SA	SOT23	XA
APX810-44SA	SOT23	XB
APX810-40SA	SOT23	XC
APX810-31SA	SOT23	XD
APX810-29SA	SOT23	XE
APX810-26SA	SOT23	XF
APX810-23SA	SOT23	XG
APX809-46SR	SOT23	Y2
APX809-44SR	SOT23	Y3
APX809-40SR	SOT23	Y4
APX809-31SR	SOT23	Y5
APX809-29SR	SOT23	Y6
APX809-26SR	SOT23	Y7
APX809-23SR	SOT23	Y8
APX810-46SR	SOT23	YA
APX810-44SR	SOT23	YB
APX810-40SR	SOT23	YC
APX810-31SR	SOT23	YD
APX810-29SR	SOT23	YE
APX810-26SR	SOT23	YF
APX810-23SR	SOT23	YG

**Package Outline Dimensions**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**SOT23**

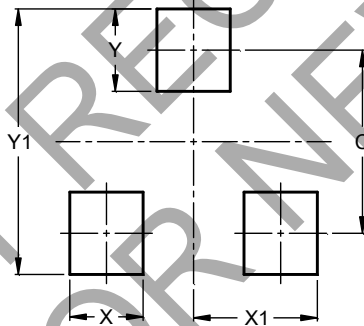


SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--
All Dimensions in mm			

**Suggested Pad Layout**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**SOT23**



Dimensions	Value (in mm)
C	2.0
X	0.8
X1	1.35
Y	0.9
Y1	2.9

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