

### 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  $\text{RESET}$  Active High (APX810)
- 200ms Typ Power-On Reset Pulse Width
- 30 $\mu$ A Supply Current (Typ.)
- Guaranteed Reset Valid to  $V_{CC} = +1V$
- No External Components
- SOT23 and SOT23R: Available in "Green" Molding Compound (No Br, Sb)
- Lead Free Finish/RoHS Compliant (Note 1)

### General Description

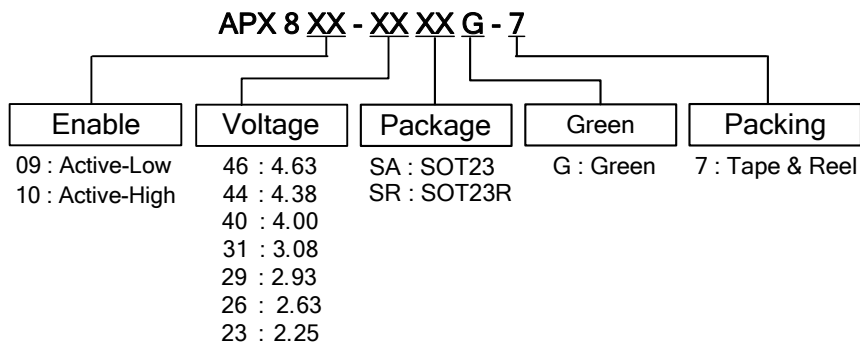
The APX809/810 are used for microprocessor ( $\mu$ P) supervisory circuits to monitor the power supplies in  $\mu$ P and digital systems. They provide excellent circuit reliability and low cost by eliminating external components and adjustments when used with +5V, +3.3V, +3.0V powered circuits.

These circuits perform a single function: they assert a reset signal whenever the  $V_{CC}$  supply voltage declines below a preset threshold, keeping it asserted for at least 240ms after  $V_{CC}$  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  $\text{RESET}$  output. The reset comparator is designed to ignore fast transients on  $V_{CC}$ , and the outputs are guaranteed to be in the correct logic state for  $V_{CC}$  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 and SOT23R packages.

### Applications

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

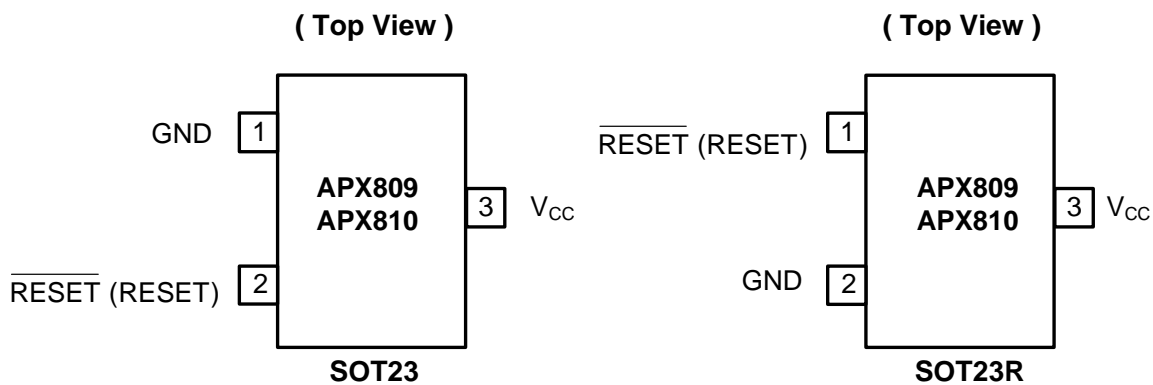
### Ordering Information



Device	Package Code	Packaging (Note 2)	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	SOT23R	3000/Tape & Reel	-7
APX810-XXSRG-7	SR	SOT23R	3000/Tape & Reel	-7

Notes: 1. EU Directive 2002/95/EC (RoHS). All applicable RoHS exemptions applied. Please visit our website at [http://www.diodes.com/products/lead\\_free.html](http://www.diodes.com/products/lead_free.html).  
 2. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.

### Pin Assignments



### Pin Descriptions

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

### Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
ESD HBM	Human Body Model ESD Protection	5	KV
ESD MM	Machine Model ESD Protection	500	V
$V_{CC}$	Supply Voltage	-0.3 to +6.0	V
$V_{\text{RESET}}$	RESET, $\overline{\text{RESET}}$ (push-pull)	-0.3 to ( $V_{CC} + 0.3$ )	V
$I_{CC}$	Input Current, $V_{CC}$	20	mA
$I_O$	Output Current, RESET, $\overline{\text{RESET}}$	20	mA
$P_D$	Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ ), de-rate 4mW/ $^\circ\text{C}$ above +70 $^\circ\text{C}$	400	mW
$T_{OP}$	Operating Junction Temperature Range	-40 to +105	$^\circ\text{C}$
$T_{ST}$	Storage Temperature Range	-65 to +150	$^\circ\text{C}$

### Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
$V_{CC}$	Supply Voltage	1.1	5.5	V
$V_{IN}$	Input Voltage	0	( $V_{CC}+0.3$ )	V
$T_A$	Operating Ambient Temperature Range	-40	85	°C
$T_R$	Vcc Rising Time ( $V_{CC} = 0 \sim V_T$ )		100	V/ $\mu$ S

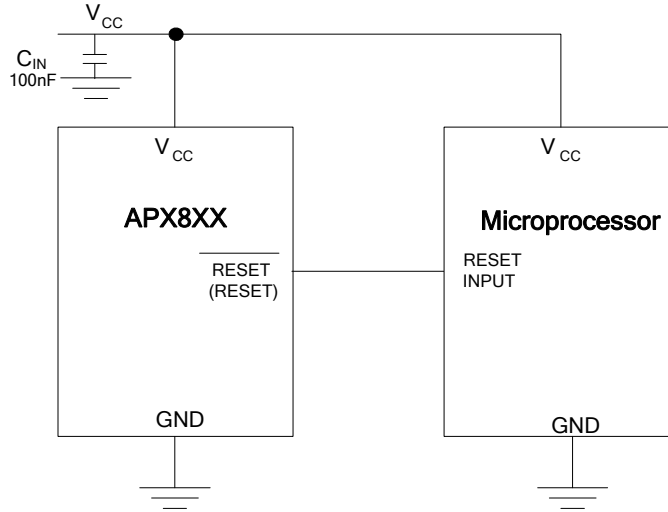
### Electrical Characteristics ( $T_A = 25^\circ\text{C}$ )

$T_A = -40$  to  $85^\circ\text{C}$  unless otherwise note. Typical values are at  $T_A = +25^\circ\text{C}$ .

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Unit	
$V_{CC}$	$V_{CC}$ Range	$T_A = 0^\circ\text{C}$ to $+70^\circ\text{C}$	1.0		5.5	V	
$I_{CC}$	Supply Current	$V_{TH} + 0.2\text{V}$		30	40	$\mu\text{A}$	
$V_{TH}$	Reset Threshold	APX809/810-23	$T_A = 0^\circ\text{C} \sim 85^\circ\text{C}$	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	
	Reset Threshold	APX809/810-23	$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$	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	
$T_S$	Set-up Time	$V_{CC} = V_{TH}$ to $(V_{TH} - 100\text{mV})$		20		$\mu\text{s}$	
$T_{DELAY}$	Reset Active Timeout Period	$T_A = 0^\circ\text{C}$ to $+85^\circ\text{C}$	140	200	280	ms	
$V_{OL}$	RESET Output Voltage Low (APX809)	$V_{CC} = V_{TH} - 0.2$ , $I_{SINK} = 1.2\text{mA}$			0.3	V	
		$V_{CC} = V_{TH} - 0.2$ , $I_{SINK} = 3.2\text{mA}$			0.4		
		$V_{CC} > 1.0\text{V}$ , $I_{SINK} = 50\mu\text{A}$			0.3		
$V_{OH}$	RESET Output Voltage-High (APX809)	$V_{CC} > V_{TH} + 0.2$ , $I_{SOURCE} = 500\mu\text{A}$	$0.8V_{CC}$			V	
		$V_{CC} > V_{TH} + 0.2$ , $I_{SOURCE} = 800\mu\text{A}$	$V_{CC} - 1.5$				
$V_{OL}$	RESET Output Voltage-Low (APX810)	$V_{CC} = V_{TH} + 0.2$ , $I_{SINK} = 1.2\text{mA}$			0.3	V	
		$V_{CC} = V_{TH} + 0.2$ , $I_{SINK} = 3.2\text{mA}$			0.4		
$V_{OH}$	RESET Output Voltage-High (APX810)	$1.8\text{V} < V_{CC} < V_{TH} - 0.2$ , $I_{SOURCE} = 150\mu\text{A}$	$0.8 V_{CC}$			V	
$\theta_{JA}$	Thermal Resistance Junction-to-Ambient	SOT23/SOT23R (Note 3)		201		°C/W	
$\theta_{JC}$	Thermal Resistance Junction-to-Case	SOT23/SOT23R (Note 3)		56		°C/W	

Notes: 3. Test condition for SOT23/ SOT23R: Devices mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

### Typical Application Circuit



### Functional Description

A microprocessor's ( $\mu\text{P}$ 's) reset input starts the  $\mu\text{P}$  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  $V_{\text{CC}}$  supply voltage declines below a preset threshold, keeping it asserted for at least 240ms after  $V_{\text{CC}}$  has risen above the reset threshold. The APX809/810 have a push-pull output stage.

#### Ensuring a Valid Reset Output Down to $V_{\text{CC}} = 0$

$\overline{\text{RESET}}$  is guaranteed to be a logic low for  $V_{\text{CC}} > 1\text{V}$ . Once  $V_{\text{CC}}$  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 ( $V_{\text{CC}}$  dips below the  $\overline{\text{RESET}}$  reset threshold),  $\overline{\text{RESET}}$  goes low. Any time  $V_{\text{CC}}$  goes below the reset threshold, the internal timer resets to zero, and  $\overline{\text{RESET}}$  goes low. The internal timer starts after  $V_{\text{CC}}$  returns above the reset threshold, and  $\overline{\text{RESET}}$  remains low for the reset timeout period.

When  $V_{\text{CC}}$  falls below 1V, the APX809  $\overline{\text{RESET}}$  output no longer sinks current—it becomes an open circuit. Therefore,

high-impedance CMOS logic inputs connected to  $\overline{\text{RESET}}$  can drift to undetermined voltages.

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

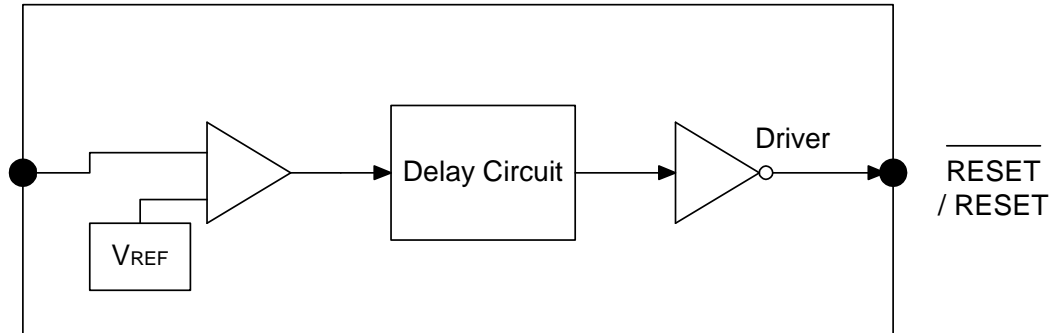
#### Benefits of Highly Accurate Reset Threshold

Most  $\mu\text{P}$  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.

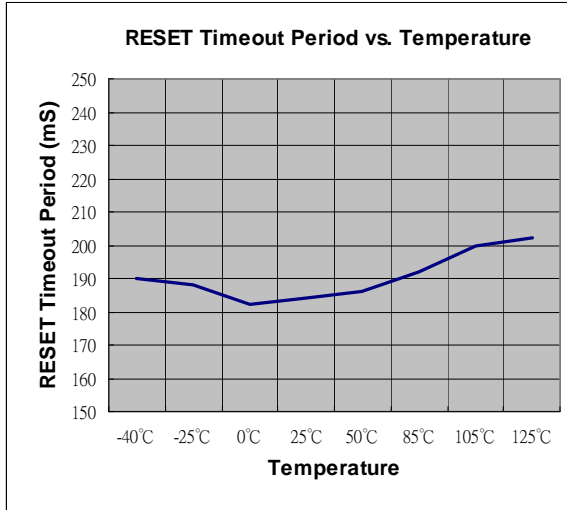
---

**Block Diagram**

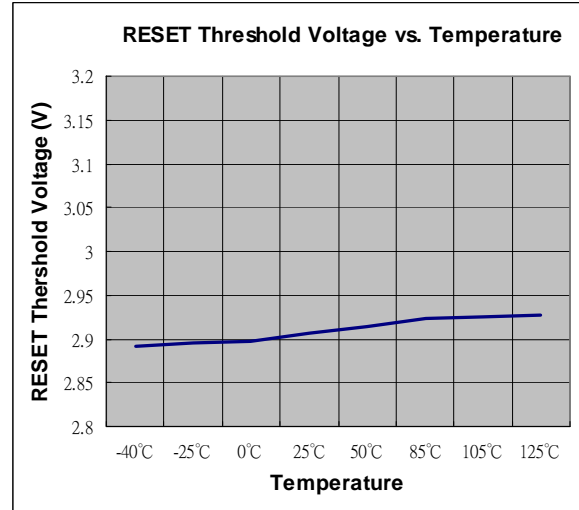
---



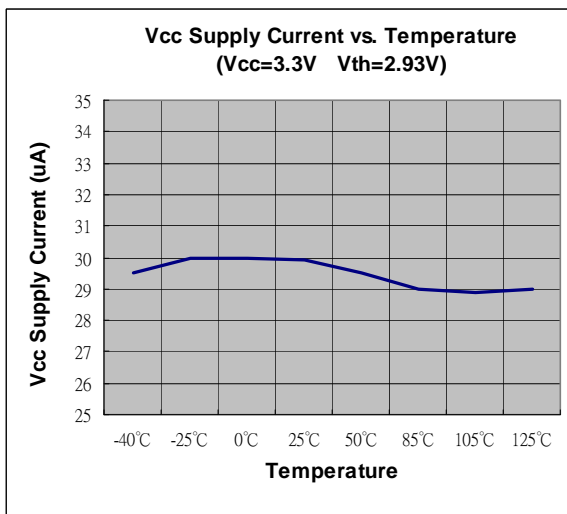
**Performance Characteristics**



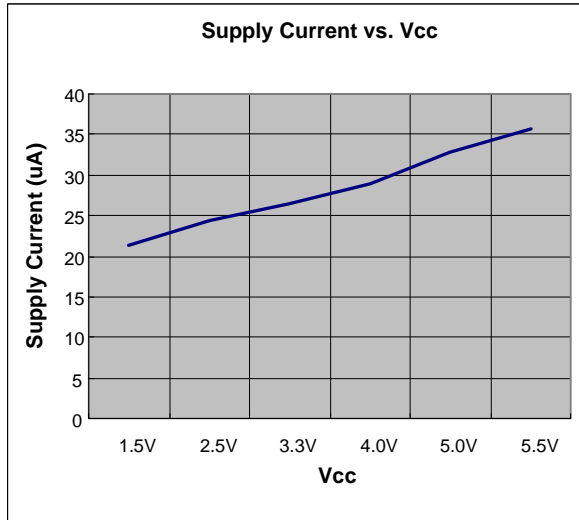
**Figure 1**



**Figure 2**



**Figure 3**

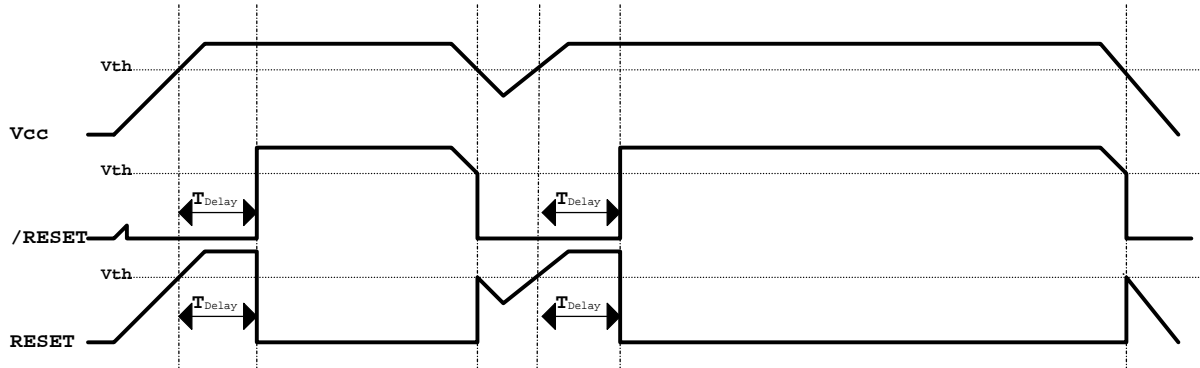


**Figure 4**

---

**Timing Diagram**

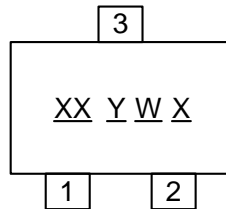
---



### Marking Information

(1) SOT23/SOT23R

( 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

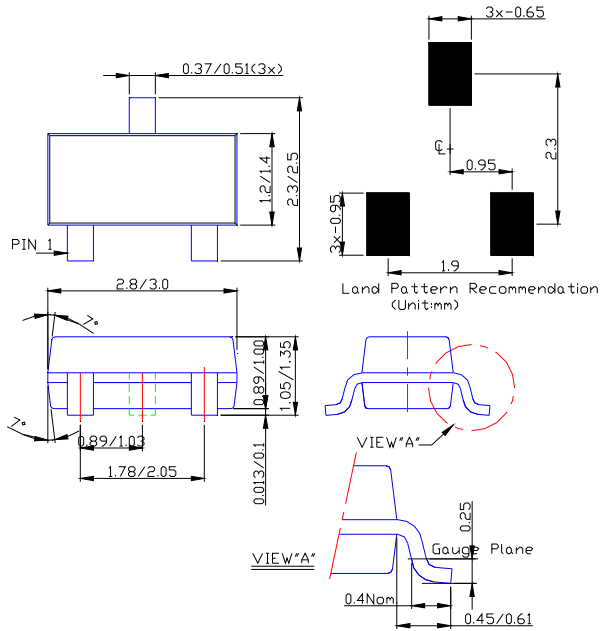
X : A~Z : Green

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	SOT23R	Y2
APX809-44SR	SOT23R	Y3
APX809-40SR	SOT23R	Y4
APX809-31SR	SOT23R	Y5
APX809-29SR	SOT23R	Y6
APX809-26SR	SOT23R	Y7
APX809-23SR	SOT23R	Y8
APX810-46SR	SOT23R	YA
APX810-44SR	SOT23R	YB
APX810-40SR	SOT23R	YC
APX810-31SR	SOT23R	YD
APX810-29SR	SOT23R	YE
APX810-26SR	SOT23R	YF
APX810-23SR	SOT23R	YG



**Package Information (All Dimensions in mm)**

**(1) Package Type: SOT23/SOT23R**



Notes: 4. Package outline dimensions as shown on Diodes Inc. package outline dimensions document AP02002, which can be found on our website at <http://www.diodes.com/datasheets/ap02002.pdf>

**IMPORTANT NOTICE**

Diodes Incorporated and its subsidiaries reserve the right to make modifications, enhancements, improvements, corrections or other changes without further notice to any product herein. Diodes Incorporated does not assume any liability arising out of the application or use of any product described herein; neither does it convey any license under its patent rights, nor the rights of others. The user of products in such applications shall assume all risks of such use and will agree to hold Diodes Incorporated and all the companies whose products are represented on our website, harmless against all damages.

**LIFE SUPPORT**

Diodes Incorporated products are not authorized for use as critical components in life support devices or systems without the expressed written approval of the President of Diodes Incorporated.