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[Diodes Incorporated](#)  
[APX809-23SAG-7](#)

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# APX809/810

## 3-PIN MICROPROCESSOR RESET CIRCUITS

### 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  $\overline{\text{RESET}}$  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

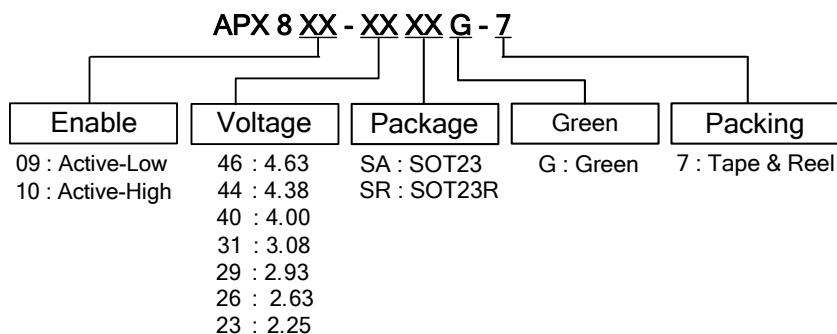
The APX809/810 are used for microprocessor ( $\mu$ P) supervisory circuits to monitor the power supplies in  $\mu$ P and digital systems. They provide excellent circuit reliability and low cost by eliminating external components and adjustments when used with +5V, +3.3V, +3.0V powered circuits.

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  $\overline{\text{RESET}}$  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

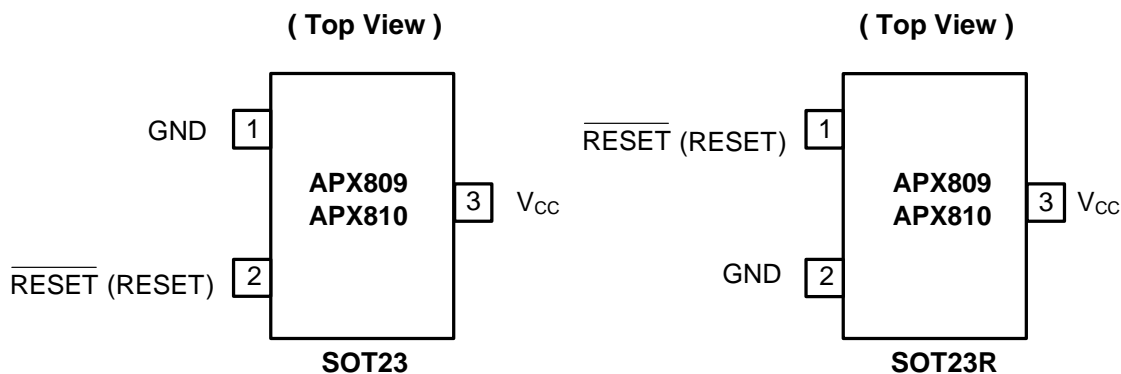
Notes: 1. EU Directive 2002/95/EC (RoHS). All applicable RoHS exemptions applied. Please visit our website at [http://www.diodes.com/products/lead\\_free.html](http://www.diodes.com/products/lead_free.html).  
 2. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be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



# APX809/810

## 3-PIN MICROPROCESSOR RESET CIRCUITS

### 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	$^\circ\text{C}$



# APX809/810

## 3-PIN MICROPROCESSOR RESET CIRCUITS

### 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	$V_{TH} + 0.2V$		30	40	$\mu$ A	
$V_{TH}$	Reset Threshold	$T_A = 0^\circ\text{C} \sim 85^\circ\text{C}$	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	
		$T_A = -40^\circ\text{C} \sim 85^\circ\text{C}$	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	
$T_S$	Set-up Time	$V_{CC} = V_{TH}$ to ( $V_{TH} - 100\text{mV}$ )		20		$\mu$ 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		
		$V_{CC} > 1.0V, I_{SINK} = 50\mu\text{A}$			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)	$1.8V < V_{CC} < V_{TH} - 0.2, I_{SOURCE} = 150\mu\text{A}$	$0.8 V_{CC}$			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	

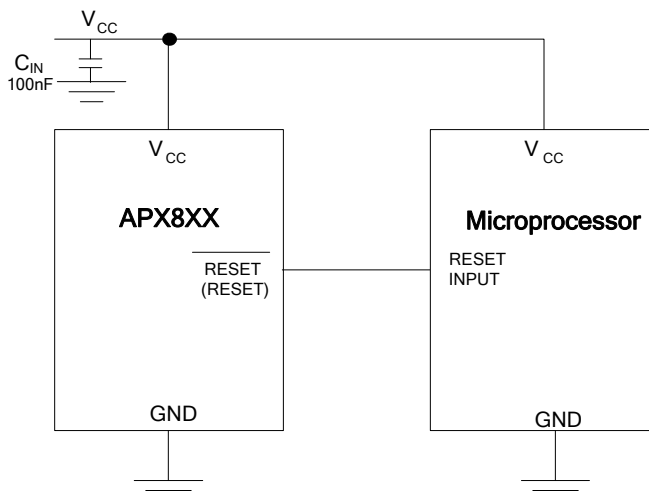
Notes: 3. Test condition for SOT23/ SOT23R: Devices mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.



# APX809/810

## 3-PIN MICROPROCESSOR RESET CIRCUITS

### Typical Application Circuit



### 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

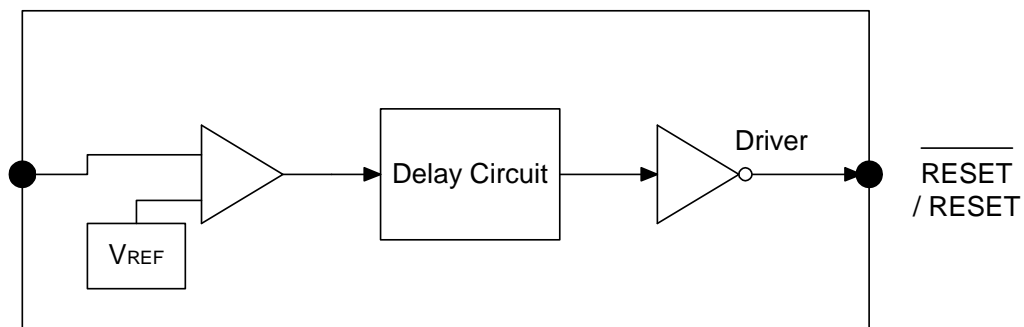
Most  $\mu P$  supervisor ICs has reset threshold voltages between 5% and 10% below the value of nominal supply voltages. This ensures a reset will not occur within 5% of the nominal supply, but will occur when the supply is 10% below nominal. When using ICs rated at only the nominal supply  $\pm 5\%$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



## APX809/810

### 3-PIN MICROPROCESSOR RESET CIRCUITS

#### Block Diagram





# APX809/810

## 3-PIN MICROPROCESSOR RESET CIRCUITS

### Performance Characteristics

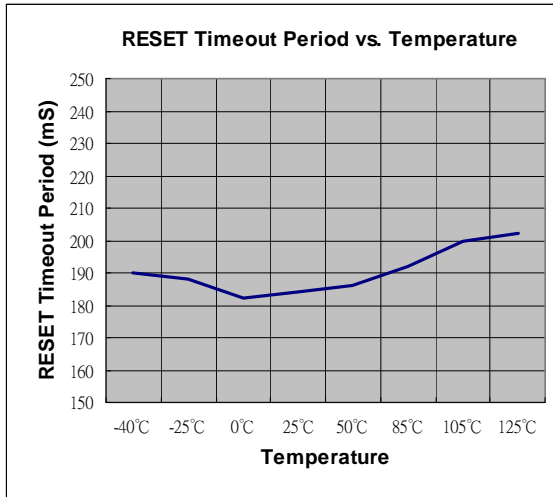


Figure 1

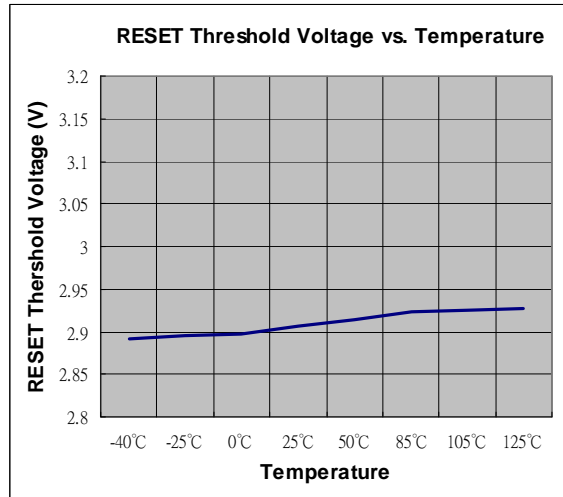


Figure 2

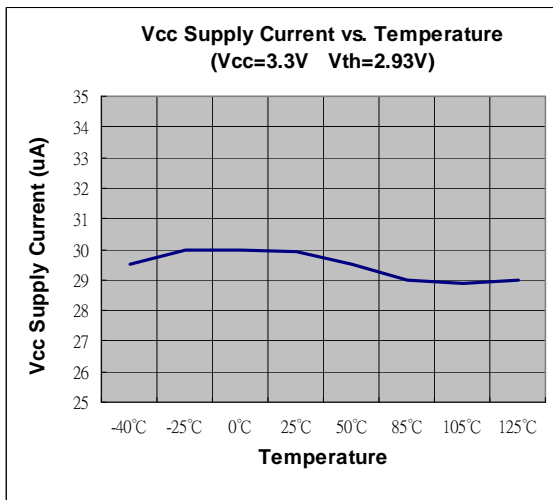


Figure 3

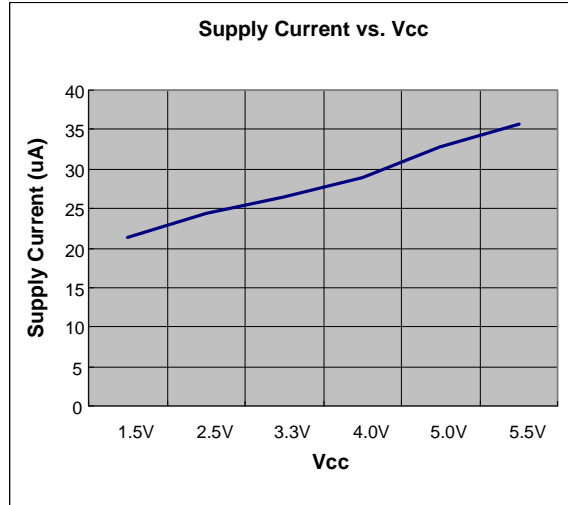


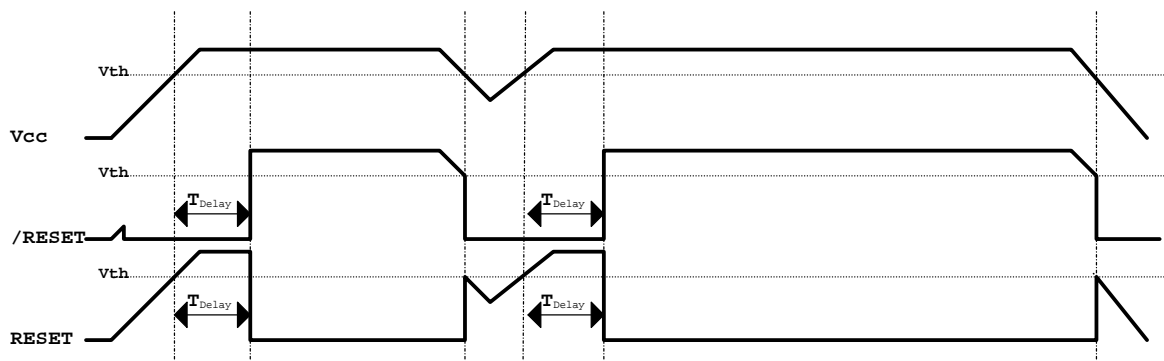
Figure 4



# APX809/810

## 3-PIN MICROPROCESSOR RESET CIRCUITS

### Timing Diagram







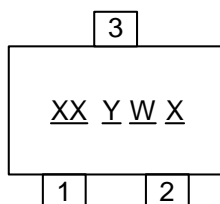
# APX809/810

## 3-PIN MICROPROCESSOR RESET CIRCUITS

### 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

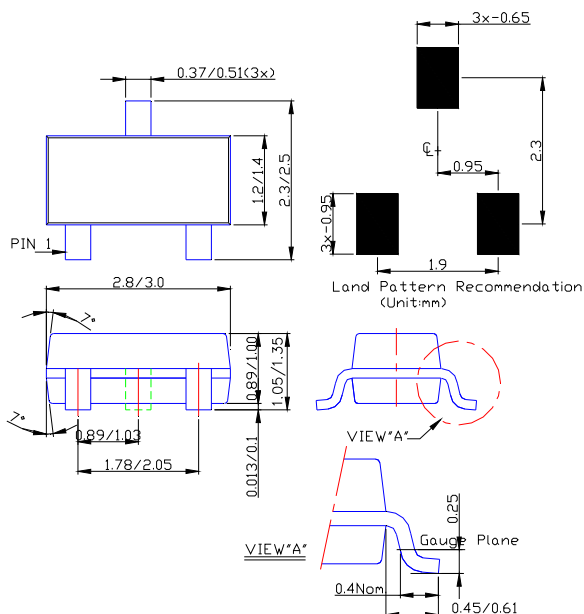


# APX809/810

## 3-PIN MICROPROCESSOR RESET CIRCUITS

### 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>

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