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 RESET Active High (APX810)
- 200ms Typ Power-On Reset Pulse Width
- 30µA 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 (µP) supervisory circuits to monitor the power supplies in µP 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 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 µP and µC Power Monitoring
- Portable/Battery Powered Equipment
- Automotive

Ordering Information

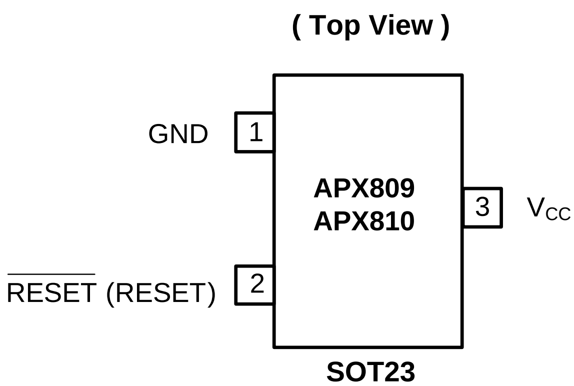
APX 8 XX - XX XX G - 7

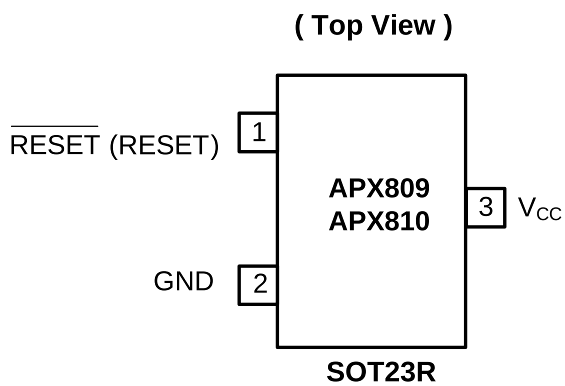
Enable	Voltage	Package	Green	Packing
09 : Active-Low	46 : 4.63	SA : SOT23	G : Green	7 : Tape & Reel
10 : Active-High	44 : 4.38	SR : SOT23R		
	40 : 4.00			
	31 : 3.08			
	29 : 2.93			
	26 : 2.63			
	23 : 2.25			

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.
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
$\overline{RESET}$ (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_{RESET}	RESET, $\overline{RESET}$ (push-pull)	-0.3 to (V_{CC} + 0.3)	V
I_{CC}	Input Current, V_{CC}	20	mA
I_O	Output Current, RESET, $\overline{RESET}$	20	mA
P_D	Continuous Power Dissipation (T_A = +70°C), de-rate 4mW/°C above +70°C	400	mW
T_{OP}	Operating Junction Temperature Range	-40 to +105	°C
T_{ST}	Storage Temperature Range	-65 to +150	°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	^oC
T_R	Vcc Rising Time (Vcc = 0~VT)		100	V/ uS

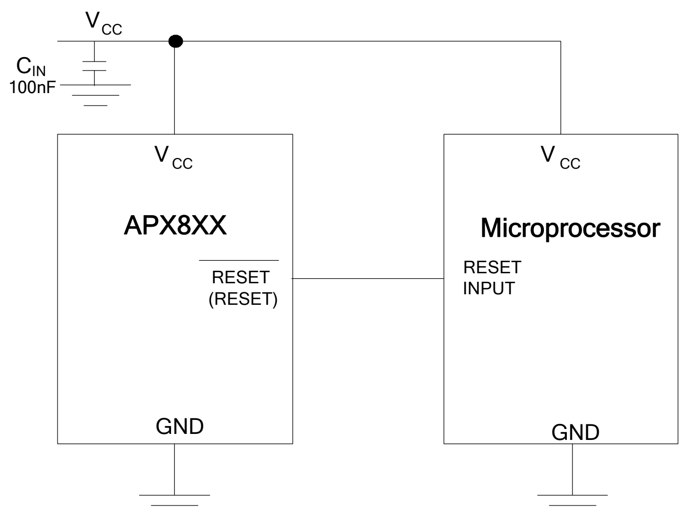
Electrical Characteristics (T$_A$ = 25ºC)

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

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Unit
V_{CC}	V_{CC} Range	T_A = 0^{o}C to +70^{o}C	1.0		5.5	V
I_{CC}	Supply Current	V_{TH} + 0.2V		30	40	μA
V_{TH}	Reset Threshold APX809/810-23	T_A = 0^{o}C-85^{o}C	2.21	2.25	2.30	V
V_{TH}	Reset Threshold APX809/810-26	T_A = 0^{o}C-85^{o}C	2.59	2.63	2.69	V
V_{TH}	Reset Threshold APX809/810-29	T_A = 0^{o}C-85^{o}C	2.88	2.93	3.00	V
V_{TH}	Reset Threshold APX809/810-31	T_A = 0^{o}C-85^{o}C	3.02	3.08	3.15	V
V_{TH}	Reset Threshold APX809/810-40	T_A = 0^{o}C-85^{o}C	3.93	4.00	4.08	V
V_{TH}	Reset Threshold APX809/810-44	T_A = 0^{o}C-85^{o}C	4.31	4.38	4.47	V
V_{TH}	Reset Threshold APX809/810-46	T_A = 0^{o}C-85^{o}C	4.56	4.63	4.72	V
V_{TH}	Reset Threshold APX809/810-23	T_A = -40^{o}C-85^{o}C	2.20	2.25	2.30	V
V_{TH}	Reset Threshold APX809/810-26	T_A = -40^{o}C-85^{o}C	2.57	2.63	2.69	V
V_{TH}	Reset Threshold APX809/810-29	T_A = -40^{o}C-85^{o}C	2.86	2.93	3.00	V
V_{TH}	Reset Threshold APX809/810-31	T_A = -40^{o}C-85^{o}C	3.00	3.08	3.15	V
V_{TH}	Reset Threshold APX809/810-40	T_A = -40^{o}C-85^{o}C	3.92	4.00	4.08	V
V_{TH}	Reset Threshold APX809/810-44	T_A = -40^{o}C-85^{o}C	4.29	4.38	4.47	V
V_{TH}	Reset Threshold APX809/810-46	T_A = -40^{o}C-85^{o}C	4.54	4.63	4.72	V
V_{TH}	Reset Threshold Tempco			30		ppm/ ^{o}C
T_S	Set-up Time	$V_{CC} = V_{TH}$ to (V_{TH} – 100mV)		20		μs
T_{DELAY}	Reset Active Timeout Period	T_A = 0^{o}C to +85^{o}C	140	200	280	ms
V_{OL}	$\overline{RESET}$ Output Voltage Low (APX809)	$V_{CC} = V_{TH}$ -0.2, I_{SINK} = 1.2mA			0.3	V
V_{OL}	$\overline{RESET}$ Output Voltage Low (APX809)	$V_{CC} = V_{TH}$ -0.2, I_{SINK} = 3.2mA			0.4	V
V_{OL}	$\overline{RESET}$ Output Voltage Low (APX809)	V_{CC} > 1.0V, I_{SINK} = 50uA			0.3	V
V_{OH}	$\overline{RESET}$ Output Voltage-High (APX809)	$V_{CC} > V_{TH}$ +0.2, I_{SOURCE} = 500uA	0.8V_{CC}			V
V_{OH}	$\overline{RESET}$ Output Voltage-High (APX809)	$V_{CC} > V_{TH}$ +0.2, I_{SOURCE} = 800uA	V_{CC} –1.5			V
V_{OL}	RESET Output Voltage-Low (APX810)	$V_{CC} = V_{TH}$ +0.2, I_{SINK} = 1.2mA			0.3	V
V_{OL}	RESET Output Voltage-Low (APX810)	$V_{CC} = V_{TH}$ +0.2, I_{SINK} = 3.2mA			0.4	V
V_{OH}	RESET Output Voltage-High (APX810)	1.8V < V_{CC} < V_{TH} -0.2, I_{SOURCE} = 150uA	0.8 V_{CC}			V
θ_{JA}	Thermal Resistance Junction-to-Ambient	SOT23/SOT23R (Note 3)		201		^{o}C/W
θ_{JC}	Thermal Resistance Junction-to-Case	SOT23/SOT23R (Note 3)		56		^{o}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 (µP's) reset input starts the µP 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

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

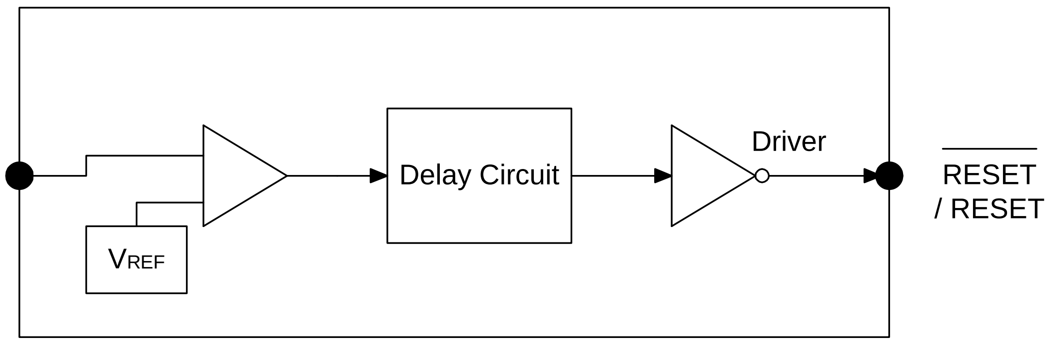
When V_{CC} falls below 1V, the APX809 $\overline{\text{RESET}}$ output no longer sinks current—it becomes an open circuit. Therefore, high-impedance CMOS logic inputs connected to $\overline{\text{RESET}}$ can drift to undetermined voltages.

This presents no problem in most applications since most µP and other circuitry is inoperative with V_{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_{CC} < 1V.

Benefits of Highly Accurate Reset Threshold

Most µP 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 ±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

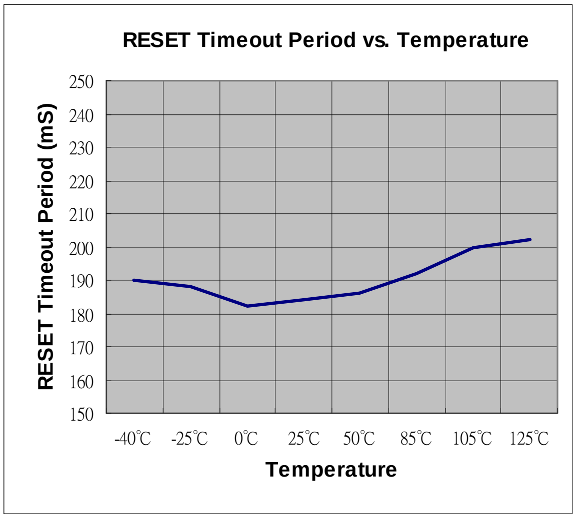


Figure 1

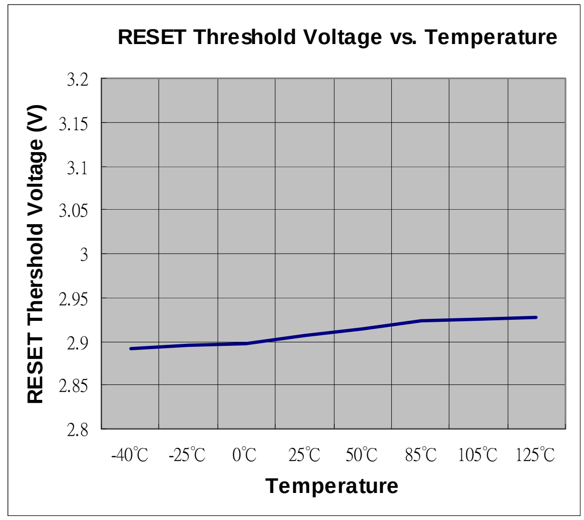


Figure 2

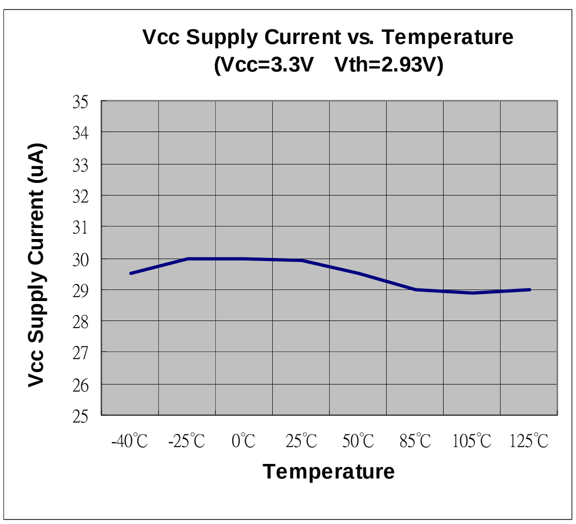


Figure 3

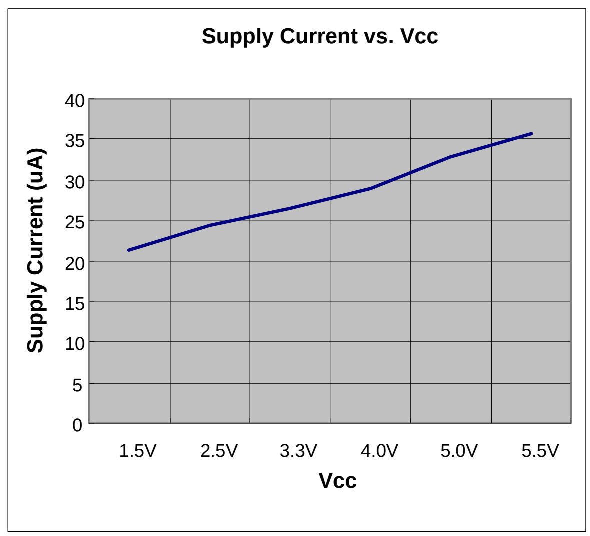
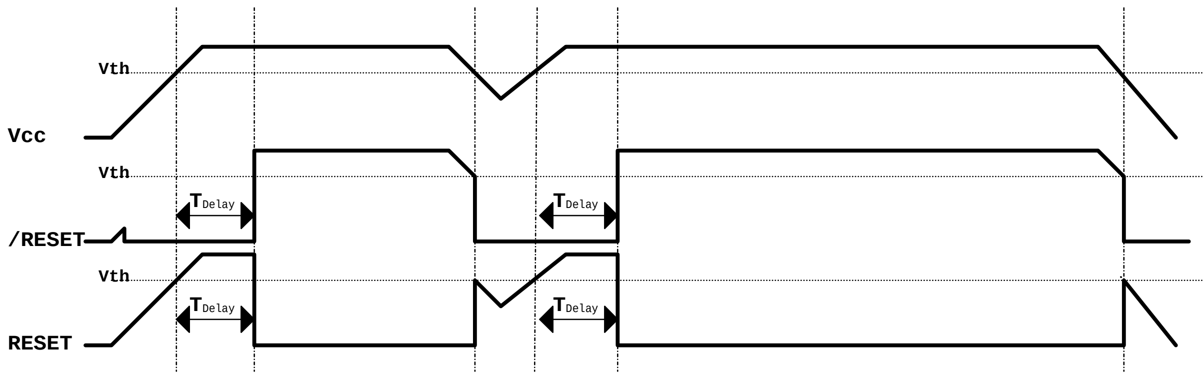


Figure 4

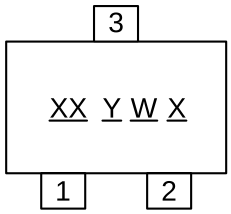
Timing Diagram



Marking Information

(1) SOT23/SOT23R

(Top View)

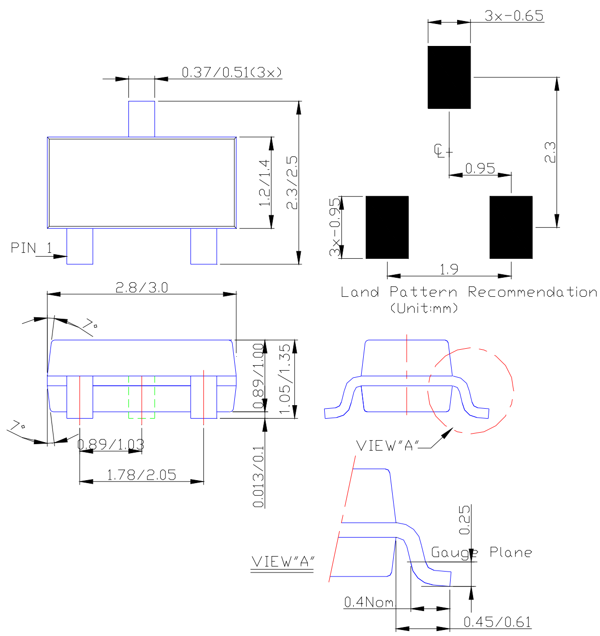


XX : Identification code
Y : Year 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents
52 and 53 week
X : A~Z : Green

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