

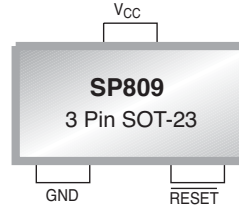


# SP809 / SP810

## 3 Pin Microprocessor Supervisor Circuit

### FEATURES

- Ultra Low Supply Current 1 $\mu$ A (typ.)
- Guaranteed Reset valid to  $V_{CC} = 0.9V$
- 140 ms Min. Power-On Reset Pulse Width
- Internally Fixed Threshold 2.3V, 2.6V, 2.9V, 3.1V, 4.0V, 4.4V, 4.6V
- Tight Voltage Threshold Tolerance: 1.5%
- Offered in a 3 Pin SOT-23 Package



Now Available in Lead Free Packaging

### APPLICATIONS

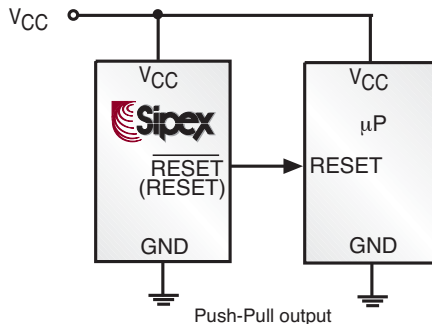
- Portable Electronic Devices
- Electrical Power Meter
- Digital Still Camera
- $\mu$ P Power Monitoring

Part Number	Output Type
SP809N	Open-Drain Active Low
SP809	Push-Pull Active Low
SP810	Push-Pull Active High

### DESCRIPTION

The SP809/SP810 are low power microprocessor ( $\mu$ P) supervisory circuits used to monitor power supplies in  $\mu$ P and digital systems. They provide applications with benefits of circuit reliability and low cost by eliminating external components. If the  $V_{CC}$  supply voltage falls below preset threshold then a reset signal is asserted for at least 140ms after  $V_{CC}$  has risen above the reset threshold. Both the SP809 and SP810 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 (1 $\mu$ A) makes SP809/SP810 ideal for portable equipment. The devices are available in 3 pin SOT-23 package.

### TYPICAL APPLICATION CIRCUIT



## ABSOLUTE MAXIMUM RATINGS

$V_{CC}$ .....	-0.3V to 6.5V
RESET, $\overline{\text{RESET}}$ .....	-0.3 to $V_{CC} + 0.3V$
Input Current ( $V_{CC}$ ) .....	20mA
Output Current (RESET, $\overline{\text{RESET}}$ ) .....	20mA
Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ ) .....	320mW
Operating Junction Temperature .....	$-40^\circ\text{C}$ to $+85^\circ\text{C}$
Junction Temperature .....	$125^\circ\text{C}$

Storage Temperature .....  $-65^\circ\text{C}$  to  $+150^\circ\text{C}$

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

## ELECTRICAL CHARACTERISTICS

Typical values are at  $T_A = 25^\circ\text{C}$ , unless otherwise specified. (Note 1)

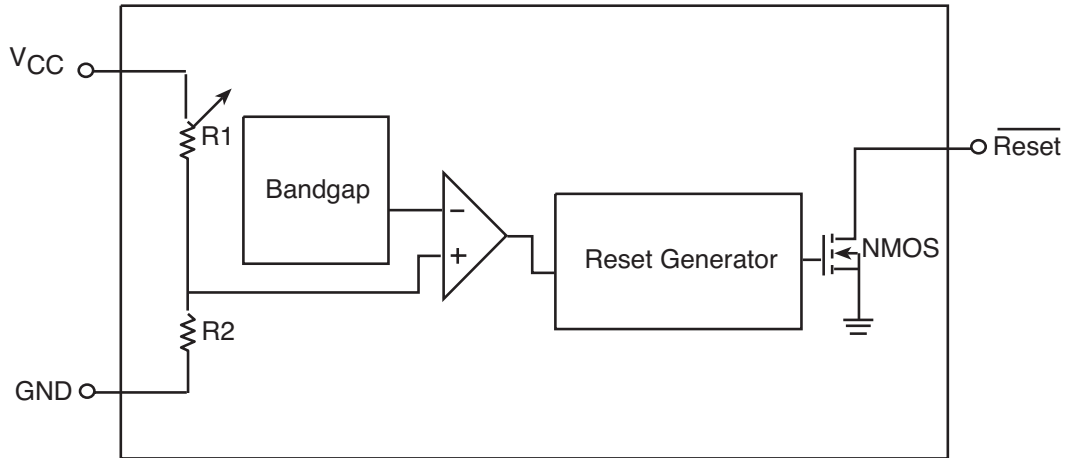
Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions	
Operating Voltage Range	$V_{CC}$	0.9		6.0	V		
Supply Current	$I_{CC}$		1.0	3.0	$\mu\text{A}$	$V_{CC} = V_{TH} + 0.1V$	
Reset Threshold	$V_{TH}$	2.265	2.3	2.335	V	SP809-23	$T_A = +25^\circ\text{C}$
		2.254		2.346			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$
		2.561	2.6	2.639		SP809-26	$T_A = +25^\circ\text{C}$
		2.548		2.652			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$
		2.857	2.9	2.944		SP809-29	$T_A = +25^\circ\text{C}$
		2.842		2.958			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$
		3.054	3.1	3.147		SP809-31	$T_A = +25^\circ\text{C}$
		3.038		3.162			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$
		3.940	4.0	4.060		SP809-40	$T_A = +25^\circ\text{C}$
		3.920		4.080			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$
		4.334	4.4	4.466		SP809-44	$T_A = +25^\circ\text{C}$
		4.312		4.488			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$
		4.531	4.6	4.669		SP809-46	$T_A = +25^\circ\text{C}$
		4.508		4.692			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$
		$V_{CC}$ Reset Delay	$V_{TRIP}$			20	
Reset Active Timeout Period	$T_{RP}$	140	230	560	ms	$V_{CC} = V_{TH(MAX)}$	$T_A = +25^\circ\text{C}$
		100		1030			$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$
RESET Output Voltage	$V_{OH}$	$0.8V_{CC}$			V	$V_{CC} = V_{TH} - 0.1V$ , $I_{SOURCE} = 1.2mA$	
	$V_{OL}$			0.3			$V_{CC} = V_{TH} + 0.1V$ , $I_{SINK} = 1.2mA$
RESET Output Voltage	$V_{OH}$	$0.8V_{CC}$			V	$V_{CC} = V_{TH} + 0.1V$ , $I_{SOURCE} = 1.2mA$	
	$V_{OL}$			0.3			$V_{CC} = V_{TH} - 0.1V$ , $I_{SINK} = 1.2mA$

## ELECTRICAL CHARACTERISTICS

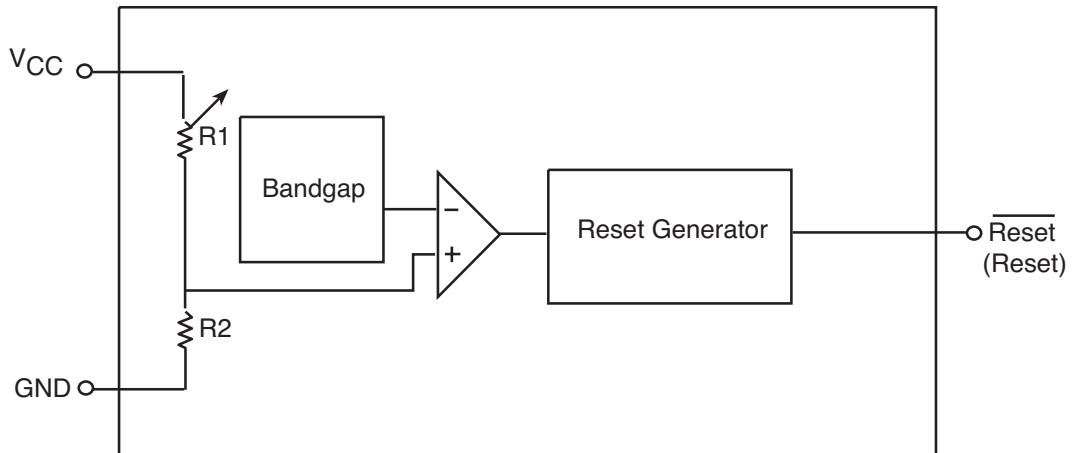
Note 1. Specifications are production tested at  $T_A = 25^\circ\text{C}$ . Specifications over the  $-40^\circ\text{C}$  to  $85^\circ\text{C}$  operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls

Note 2. RESET output is for SP809; RESET output is for SP810.

## BLOCK DIAGRAMS

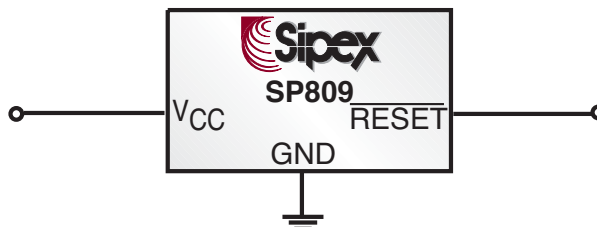


*N-ch Open-Drain Type*



*Push-Pull Type*

## TEST CIRCUIT



# TYPICAL PERFORMANCE CHARACTERISTICS

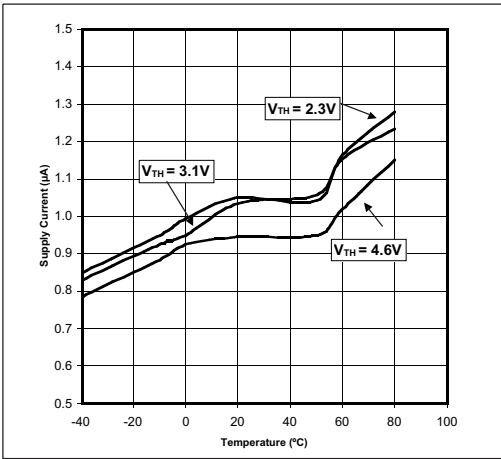


Figure 1. Supply Current vs. Temperature

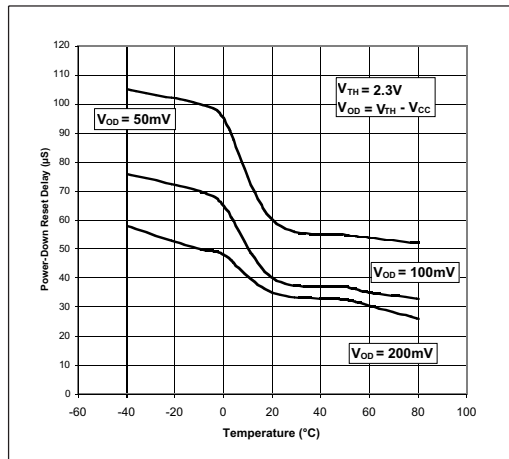


Figure 2. Power-Down Reset Delay vs. Temperature

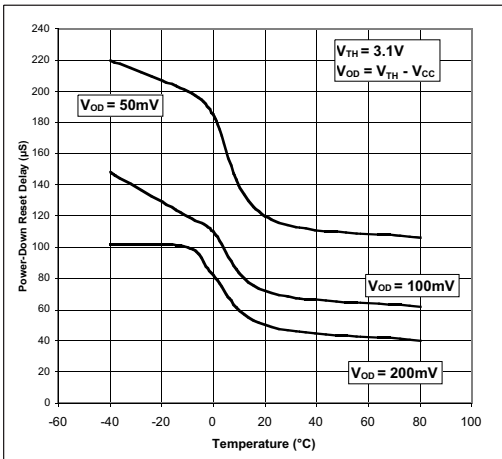


Figure 3. Power-Down Reset Delay vs. Temperature

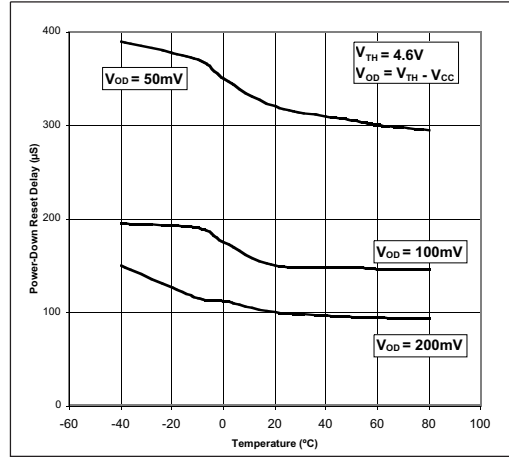


Figure 4. Power-Down Reset Delay vs. Temperature

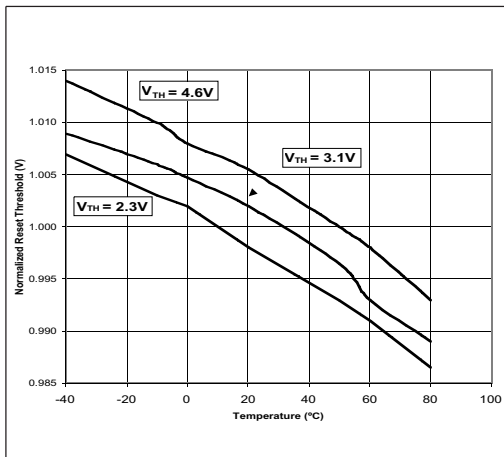


Figure 5. Normalized Reset Threshold vs. Temperature

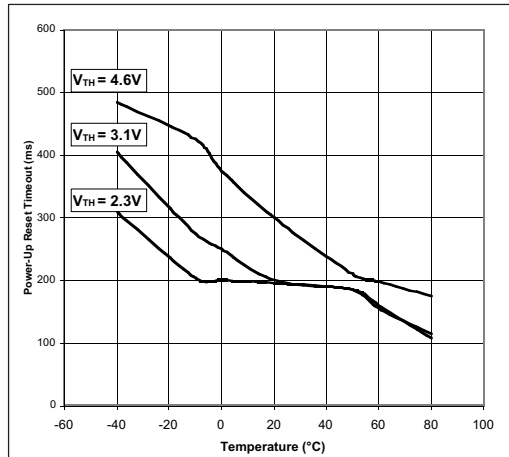


Figure 6. Power-Up Reset Time-out vs. Temperature

Pin Name	Description
GND	Ground.
$\overline{\text{RESET}}$ (SP809)	Active low output pin. $\overline{\text{RESET}}$ Output remains low while VCC is below the reset threshold.
RESET (SP810)	Active high output pin. RESET Output remains high while VCC is below the reset threshold.
V <sub>CC</sub>	Supply Voltage

## DETAILED DESCRIPTION

$\mu\text{P}$  will be activated at a valid reset state. These  $\mu\text{P}$  supervisory circuits assert reset to prevent code execution errors during power-up, power-down, or brownout conditions.

Reset is guaranteed to be a logic low for  $V_{\text{TH}} > V_{\text{CC}} > 0.9\text{V}$ . Once  $V_{\text{CC}}$  exceeded 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 ( $V_{\text{CC}}$  drops below the 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 is activated after  $V_{\text{CC}}$  returns above the reset threshold, and  $\overline{\text{RESET}}$  remains low for the reset timeout period.

### Benefits of Highly Accurate Reset Threshold

SP809/810 with specified voltage as  $5\text{V} \pm 10\%$  or  $3\text{V} \pm 10\%$  are ideal for systems using a  $5\text{V} \pm 5\%$  or  $3\text{V} \pm 5\%$  power supply. The reset is guaranteed to assert after the power supply falls below the minimum specified operating voltage range of the system ICs. The pretrimmed thresholds are reducing the range over which an undesirable reset may occur.

## APPLICATION INFORMATION

### Negative-Going V<sub>CC</sub> Transients

In addition to issuing a reset to the  $\mu\text{P}$  during power-up, power-down, and brownout conditions, SP809 series are relatively resistant to short-duration negative-going V<sub>CC</sub> transient.

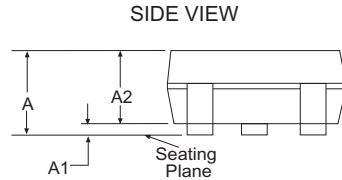
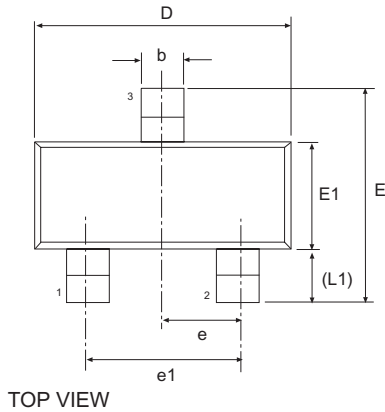
### Ensuring a Valid Reset Output Down to VCC= 0

When  $V_{\text{CC}}$  falls below 0.9V, SP809  $\overline{\text{RESET}}$  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, SP809/810 with CMOS is perfect for most applications of V<sub>CC</sub> down to 0.9V.

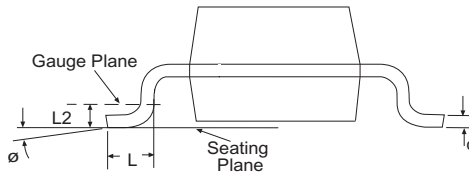
However in applications where  $\overline{\text{RESET}}$  must be valid down to 0V, adding a pull-down resistor to  $\overline{\text{RESET}}$  causes any leakage currents to flow to ground, holding  $\overline{\text{RESET}}$  low.

### Interfacing to $\mu\text{P}$ with Bidirectional Reset Pins

The  $\overline{\text{RESET}}$  output on the SP809N is open drain, this device interfaces easily with  $\mu\text{P}$ s that have bidirectional reset pins. Connecting the  $\mu\text{P}$  supervisor's  $\overline{\text{RESET}}$  output directly to the microcontroller's RESET pin with a single pull-up resistor allows either device to assert reset.



FRONT VIEW



3 Pin SOT-23		JEDEC TO-236		Variation AB		
SYMBOL	Dimensions in Millimeters: Controlling Dimension			Dimensions in Inches Conversion Factor: 1 Inch = 25.40 mm		
	MIN	NOM	MAX	MIN	NOM	MAX
b	0.30	-	0.50	0.012	-	0.020
c	0.08	-	0.20	0.003	-	0.008
D	2.80	2.90	3.04	0.110	0.114	0.120
E	2.10	-	2.64	0.083	-	0.104
E1	1.20	1.30	1.40	0.047	0.051	0.055
e	0.95 BSC			0.038 BSC		
e1	1.90 BSC			0.075 BSC		
L	0.40	0.50	0.60	0.016	0.020	0.024
L1	0.54 REF			0.021 REF		
L2	0.25 BSC			0.010 BSC		
∅	0°	-	8°	0°	-	8°
A	0.89	-	1.12	0.035	-	0.044
A1	0.01	-	0.10	0.000	-	0.004
A2	0.88	0.95	1.02	0.035	0.037	0.040
SIPEX Pkg Signoff Date/Rev:				JL Oct25-05 / Rev A		

## ORDERING INFORMATION

Part Number	Top Mark	Temperature Range	Package Type
SP809EK-2-3	N4WW	-40°C to 85°C	3 Pin SOT-23
SP809EK-2-3/TR	N4WW	-40°C to 85°C	3 Pin SOT-23
SP809EK-2-6	P4WW	-40°C to 85°C	3 Pin SOT-23
SP809EK-2-6/TR	P4WW	-40°C to 85°C	3 Pin SOT-23
SP809EK-2-9	Q4WW	-40°C to 85°C	3 Pin SOT-23
SP809EK-2-9/TR	Q4WW	-40°C to 85°C	3 Pin SOT-23
SP809EK-3-1	R4WW	-40°C to 85°C	3 Pin SOT-23
SP809EK-3-1/TR	R4WW	-40°C to 85°C	3 Pin SOT-23
SP809EK-4-0	S4WW	-40°C to 85°C	3 Pin SOT-23
SP809EK-4-0/TR	S4WW	-40°C to 85°C	3 Pin SOT-23
SP809EK-4-4	T4WW	-40°C to 85°C	3 Pin SOT-23
SP809EK-4-4/TR	T4WW	-40°C to 85°C	3 Pin SOT-23
SP809EK-4-6	U4WW	-40°C to 85°C	3 Pin SOT-23
SP809EK-4-6/TR	U4WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-2-3	V4WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-2-3/TR	V4WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-2-6	W4WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-2-6/TR	W4WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-2-9	X4WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-2-9/TR	X4WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-3-1	Y4WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-3-1/TR	Y4WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-4-0	A5WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-4-0/TR	A5WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-4-4	B5WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-4-4/TR	B5WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-4-6	C5WW	-40°C to 85°C	3 Pin SOT-23
SP809NEK-4-6/TR	C5WW	-40°C to 85°C	3 Pin SOT-23

Available in lead free packaging. To order add "-L" suffix to part number.

Example: SP809EK-2-3/TR = standard; SP809EK-L-2-3/TR = lead free

/TR = Tape and Reel

Pack quantity is 2,500 for SOT-23.



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## ORDERING INFORMATION

Part Number	Top Mark	Temperature Range	Package Type
SP810EK-2-3	D5WW	-40°C to 85°C	3 Pin SOT-23
SP810EK-2-3/TR	D5WW	-40°C to 85°C	3 Pin SOT-23
SP810EK-2-6	E5WW	-40°C to 85°C	3 Pin SOT-23
SP810EK-2-6/TR	E5WW	-40°C to 85°C	3 Pin SOT-23
SP810EK-2-9	F5WW	-40°C to 85°C	3 Pin SOT-23
SP810EK-2-9/TR	F5WW	-40°C to 85°C	3 Pin SOT-23
SP810EK-3-1	G5WW	-40°C to 85°C	3 Pin SOT-23
SP810EK-3-1/TR	G5WW	-40°C to 85°C	3 Pin SOT-23
SP810EK-4-0	H5WW	-40°C to 85°C	3 Pin SOT-23
SP810EK-4-0/TR	H5WW	-40°C to 85°C	3 Pin SOT-23
SP810EK-4-4	J5WW	-40°C to 85°C	3 Pin SOT-23
SP810EK-4-4/TR	J5WW	-40°C to 85°C	3 Pin SOT-23
SP810EK-4-6	K5WW	-40°C to 85°C	3 Pin SOT-23
SP810EK-4-6/TR	K5WW	-40°C to 85°C	3 Pin SOT-23

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