



# 5-Pin Watchdog Timer Circuit

MAX6814

## General Description

The MAX6814 is a low-power watchdog circuit in a tiny 5-pin SC70 package. This device improves system reliability by monitoring the system for software code execution errors. When the watchdog input detects a transitional edge, the internal watchdog timer clears and restarts, then begins counting again. If the watchdog timer exceeds the watchdog timeout period (1.6s typ), the active-low, push-pull watchdog output asserts for the watchdog pulse period (140ms min) to alert the system of the fault.

The MAX6814 consumes only 4 $\mu$ A of supply current and is fully specified over the extended temperature range.

## Features

- ◆ 4 $\mu$ A Operating Current
- ◆ Watchdog Timer with 1.6s Timeout
- ◆ 140ms (min)  $\overline{\text{WDO}}$  Pulse Period
- ◆ Push-Pull Active-Low  $\overline{\text{WDO}}$
- ◆ Fully Specified Over Extended Temperature Range
- ◆ No External Components

## Applications

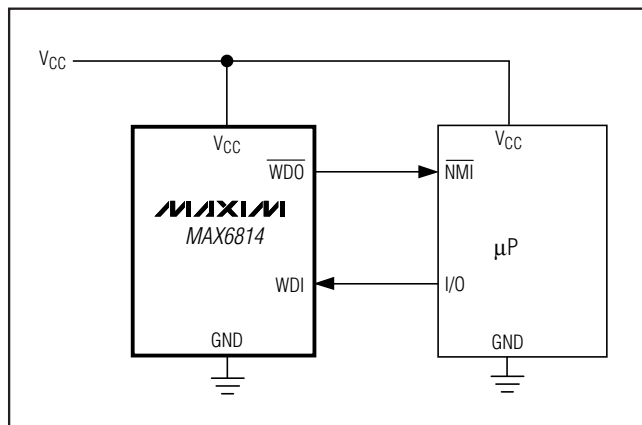
Computers and Controllers  
 Embedded Controllers  
 Intelligent Instruments  
 Automotive Systems  
 Critical  $\mu$ P Monitoring

## Ordering Information

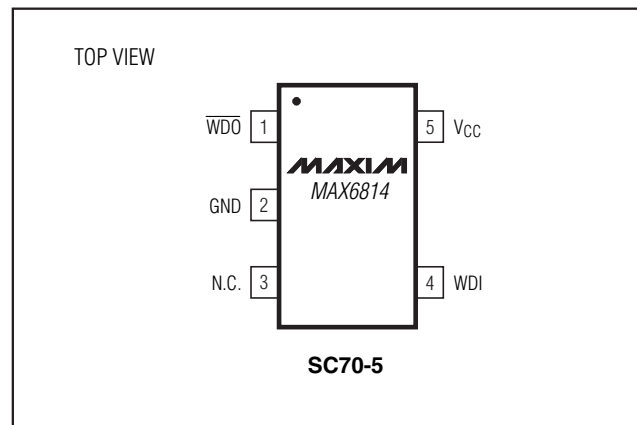
PART	TEMP RANGE	PIN-PACKAGE	TOP MARK
MAX6814XK-T	-40°C to +85°C	5 SC70-5	AEK

Devices are available in both leaded and lead-free packaging. Specify lead-free by replacing "-T" with "+T" when ordering.

## Typical Operating Circuit



## Pin Configuration



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## ABSOLUTE MAXIMUM RATINGS

V <sub>CC</sub> .....	-0.3V to +6.0V	5-Pin SC70 (derate 3.1mW/°C above +70°C) .....	247mW
All Other Pins .....	-0.3V to (V <sub>CC</sub> + 0.3V)	Operating Temperature Range .....	-40°C to +85°C
Input Current, WDI .....	20mA	Storage Temperature Range .....	-65°C to +150°C
Output Current, $\overline{\text{WDO}}$ .....	20mA	Junction Temperature .....	+150°C
Continuous Power Dissipation (T <sub>A</sub> = +70°C)		Lead Temperature (soldering, 10s) .....	+300°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## ELECTRICAL CHARACTERISTICS

(V<sub>CC</sub> = +2.25V to +5.5V, T<sub>A</sub> = T<sub>MIN</sub> to T<sub>MAX</sub>, T<sub>A</sub> = -40°C to +85°C, unless otherwise noted. Typical values are at T<sub>A</sub> = +25°C.)  
(Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Voltage Range	V <sub>CC</sub>	T <sub>A</sub> = 0°C to +70°C	2.25		5.5	V
Supply Current	I <sub>SUPPLY</sub>	WDI unconnected	V <sub>CC</sub> = 5.5V	10	24	μA
			V <sub>CC</sub> = 2.5V	4	12	
Undervoltage Lockout Threshold	UVLO	(Note 2)		2.19		V
Watchdog Pulse Period	t <sub>PP</sub>	(Note 3)	140	200	280	ms
$\overline{\text{WDO}}$ Output Voltage	V <sub>OH</sub>	I <sub>SOURCE</sub> = 30μA, V <sub>CC</sub> = 2.3V	0.8 × V <sub>CC</sub>			V
	V <sub>OL</sub>	I <sub>SINK</sub> = 1.2mA, V <sub>CC</sub> = 2.1V			0.3	
$\overline{\text{WDO}}$ Output Short-Circuit Current	I <sub>SOURCE</sub>	V <sub>CC</sub> = 3.6V (Note 4)			400	μA
Watchdog Timeout Period	t <sub>WD</sub>		1.12	1.60	2.40	s
WDI Pulse Width	t <sub>WDI</sub>	V <sub>IL</sub> = 0.4V, V <sub>IH</sub> = 0.8 × V <sub>CC</sub>	50			ns
WDI Input Voltage (Note 5)	V <sub>IL</sub>		0.3 × V <sub>CC</sub>			V
	V <sub>IH</sub>		0.7 × V <sub>CC</sub>			
WDI Input Current (Note 6)		WDI = V <sub>CC</sub> , time average		120	160	μA
		WDI = 0, time average	-20	-15		

**Note 1:** Overtemperature limits are guaranteed by design, production testing performed at +25°C only.

**Note 2:**  $\overline{\text{WDO}}$  is low when V<sub>CC</sub> falls below the undervoltage threshold. When V<sub>CC</sub> rises above the undervoltage threshold,  $\overline{\text{WDO}}$  goes high after the watchdog pulse period.

**Note 3:** Watchdog pulse period occurs when the watchdog times out or after V<sub>CC</sub> rises above the undervoltage threshold.

**Note 4:** The  $\overline{\text{WDO}}$  short-circuit current is the maximum pullup current when  $\overline{\text{WDO}}$  is driven low.

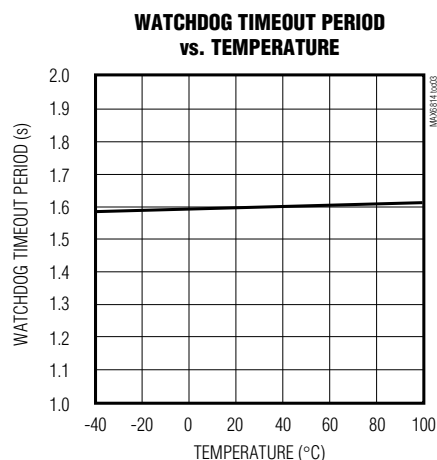
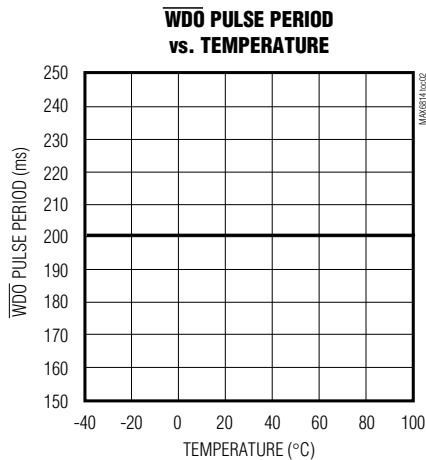
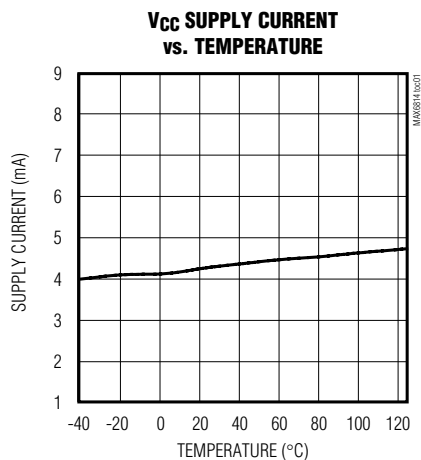
**Note 5:** WDI is internally serviced within the watchdog period if WDI is left unconnected.

**Note 6:** The WDI input current is specified as the average input current when the WDI input is driven high or low. The WDI input is designed to drive a three-stated output device with a 10μA maximum leakage current and a maximum capacitive load of 200pF. This output device must be able to source and sink at least 200μA when active.

# 5-Pin Watchdog Timer Circuit

## Typical Operating Characteristics

( $V_{CC} = +5V$ ,  $T_A = +25^{\circ}C$ , unless otherwise noted.)



## Pin Description

PIN	NAME	FUNCTION
1	$\overline{WDO}$	Active-Low Watchdog Output. Pulses low for 140ms (min) when the watchdog timer exceeds the watchdog timeout period. $\overline{WDO}$ is low when $V_{CC}$ is below the UVLO threshold and remains low for 140ms (min) after $V_{CC}$ exceeds the UVLO threshold.
2	GND	Ground
3	N.C.	No Connection. Leave unconnected or connect to $V_{CC}$ .
4	WDI	Watchdog Input. If WDI remains either high or low for longer than the watchdog timeout period, the internal watchdog timer runs out and a watchdog pulse period is triggered. The internal watchdog timer clears whenever a watchdog pulse period is asserted, or whenever WDI sees a rising or falling edge. If WDI is left unconnected or is connected to a three-stated buffer output, the watchdog is disabled.
5	$V_{CC}$	Supply Voltage



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## Watchdog Software Considerations

One way to help the watchdog timer monitor software execution more closely is to set and clear the watchdog input at different points in the program, rather than pulsing the watchdog input high-low-high or low-high-low. This technique avoids a stuck loop, in which the watchdog timer would continue to be cleared inside the loop, keeping the watchdog from timing out.

Figure 4 shows an example of a flow diagram where the I/O driving the watchdog input is set high at the beginning of the program, set low at the beginning of

every subroutine or loop, then set high again when the program returns to the beginning. If the program should hang in any subroutine, the problem would quickly be corrected, since the I/O is continually set low and the watchdog timer is allowed to time out, causing an interrupt to be issued. This scheme results in higher time average WDI input current than does leaving WDI low for the majority of the timeout period and periodically pulsing it low-high-low (see the *Watchdog Input Current* section).

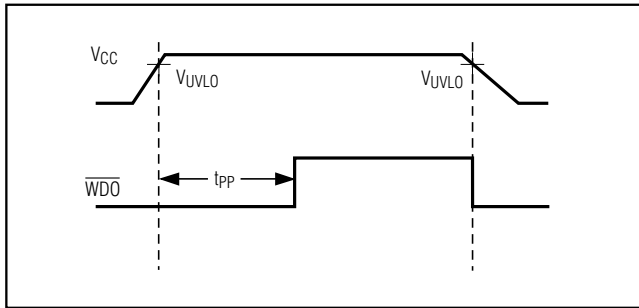


Figure 2. Power-Up Timing Diagram

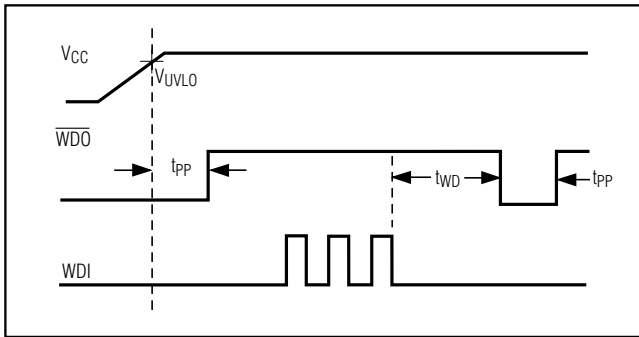


Figure 3. Watchdog Timing Relationship

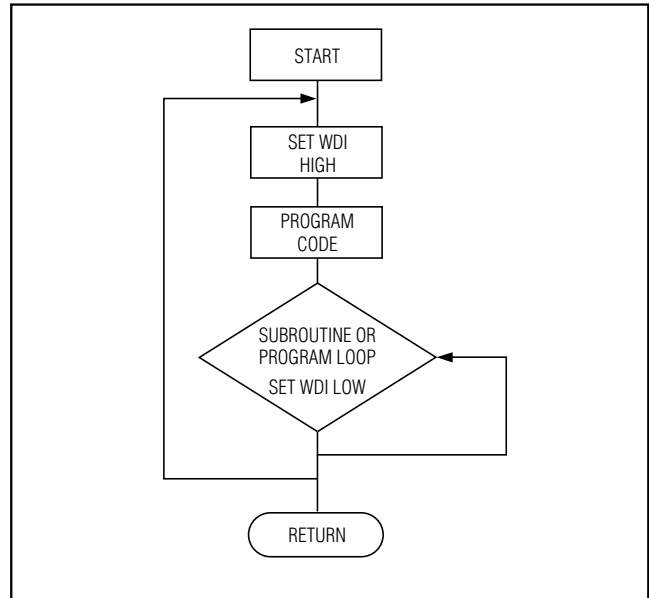


Figure 4. Watchdog Flow Diagram

## Chip Information

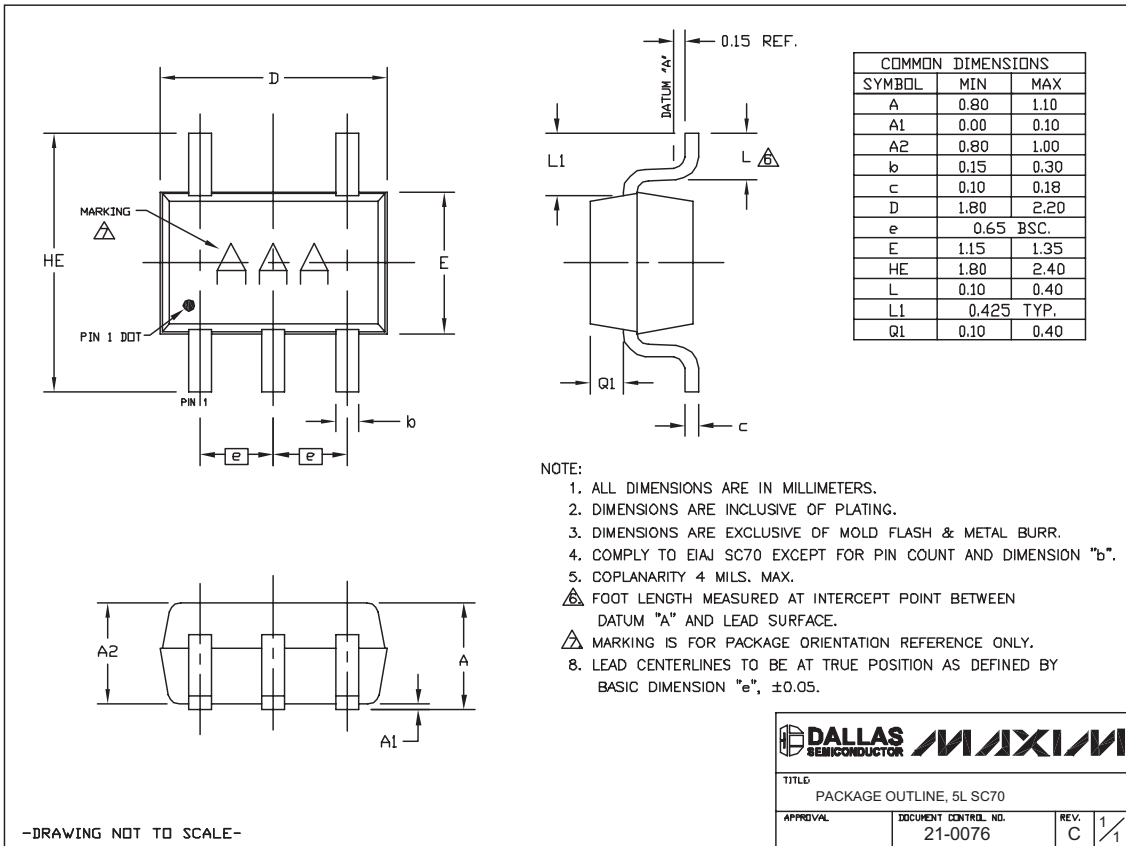
TRANSISTOR COUNT: 607

PROCESS: BiCMOS

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## Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to [www.maxim-ic.com/packages](http://www.maxim-ic.com/packages).)



SC70, 5LEPS

**DALLAS SEMICONDUCTOR** **MAXIM**

TITLE: PACKAGE OUTLINE, 5L SC70

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