

February 1995

## LM3909 LED Flasher/Oscillator

### General Description

The LM3909 is a monolithic oscillator specifically designed to flash Light Emitting Diodes. By using the timing capacitor for voltage boost, it delivers pulses of 2 or more volts to the LED while operating on a supply of 1.5V or less. The circuit is inherently self-starting, and requires addition of only a battery and capacitor to function as an LED flasher.

Packaged in an 8-lead plastic mini-DIP, the LM3909 will operate over the extended consumer temperature range of  $-25^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ . It has been optimized for low power drain and operation from weak batteries so that continuous operation life exceeds that expected from battery rating.

Application is made simple by inclusion of internal timing resistors and an internal LED current limit resistor. As shown in the first two application circuits, the timing resistors supplied are optimized for nominal flashing rates and minimum power drain at 1.5V and 3V.

Timing capacitors will generally be of the electrolytic type, and a small 3V rated part will be suitable for any LED flasher using a supply up to 6V. However, when picking flash rates, it should be remembered that some electrolytics have very broad capacitance tolerances, for example  $-20\%$  to  $+100\%$ .

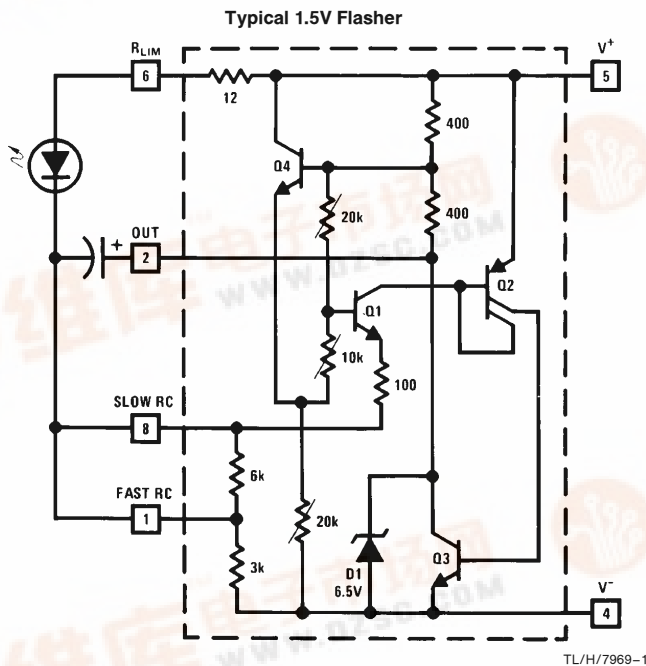
### Features

- Operation over one year from one C size flashlight cell
- Bright, high current LED pulse
- Minimum external parts
- Low cost
- Low voltage operation, from just over 1V to 5V
- Low current drain, averages under 0.5 mA during battery life
- Powerful; as an oscillator directly drives an  $8\Omega$  speaker
- Wide temperature range

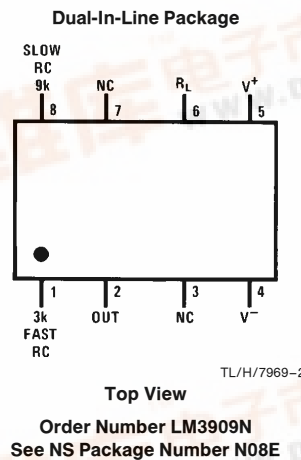
### Applications

- Finding flashlights in the dark, or locating boat mooring floats
- Sales and advertising gimmicks
- Emergency locators, for instance on fire extinguishers
- Toys and novelties
- Electronic applications such as trigger and sawtooth generators
- Siren for toy fire engine, (combined oscillator, speaker driver)
- Warning indicators powered by 1.4V to 200V

### Schematic Diagram



### Connection Diagram



## Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Power Dissipation 500 mW  
V<sup>+</sup> Voltage 6.4V

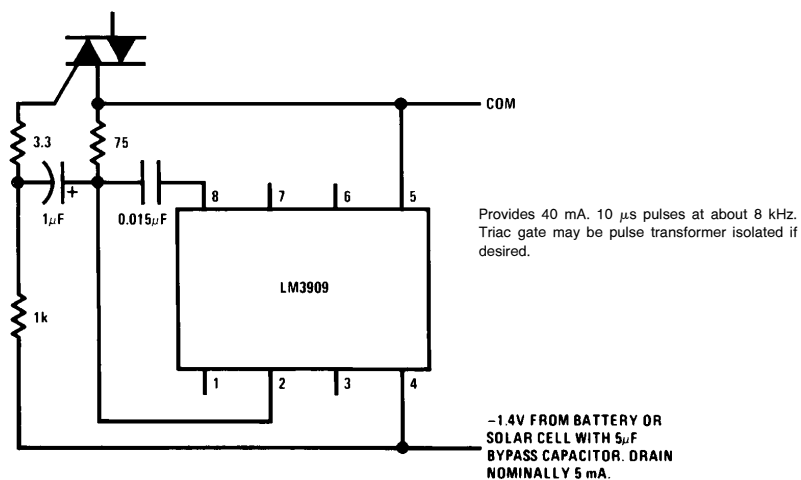
Operating Temperature Range -25°C to +70°C  
Lead Temperature (Soldering, 10 sec.) 260°C

## Electrical Characteristics

Parameter	Conditions (Applications Note 3)	Min	Typ	Max	Units
Supply Voltage	(In Oscillation)	1.15		6.0	V
Operating Current			0.55	0.75	mA
Flash Frequency	300 $\mu$ F, 5% Capacitor	0.65	1.0	1.3	Hz
High Flash Frequency	0.30 $\mu$ F, 5% Capacitor		1.1		kHz
Compatible LED Forward Drop	1 mA Forward Current	1.35		2.1	V
Peak LED Current	350 $\mu$ F Capacitor		45		mA
Pulse Width	350 $\mu$ F Capacitors at 1/2 Amplitude		6.0		ms

## Typical Applications (See applications notes on following page)

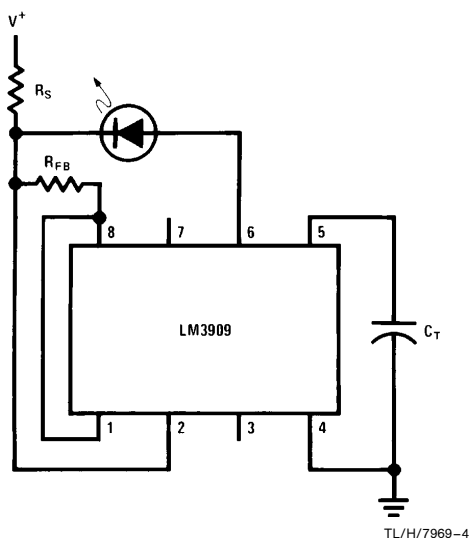
### Triac Trigger



TL/H/7969-3

## Typical Applications (Continued)(See applications notes below)

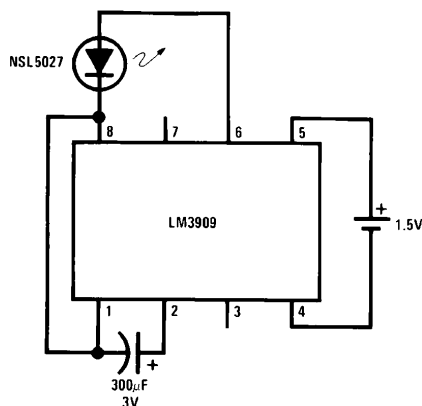
### Warning Flasher High Voltage Powered



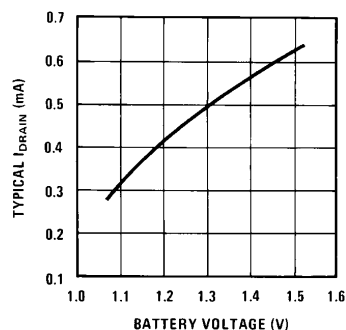
### Typical Operating Conditions

V <sup>+</sup>	Nominal Flash Hz	C <sub>T</sub>	R <sub>S</sub>	R <sub>FB</sub>	V <sup>+</sup> RANGE
6V	2	400 $\mu$ F	1k	1.5k	5V–25V
15V	2	180 $\mu$ F	3.9k	1k	13V–50V
100V	1.7	180 $\mu$ F	43k 1W	1k	85V–200V

### 1.5V Flasher



**Note:** Nominal flash rate: 1 Hz.



TL/H/7969-6

### Estimated Battery Life (Continuous 1.5V Flasher Operation)

Size Cell	Type	
	Standard	Alkaline
AA	3 months	6 months
C	7 months	15 months
D	1.3 years	2.6 years

**Note:** Estimates are made from our tests and manufacturers data. Conditions are fresh batteries and room temperature. Clad or "leak-proof" batteries are recommended for any application of five months or more. Nickel Cadmium cells are not recommended.

### APPLICATIONS NOTES

**Note 1:** All capacitors shown are electrolytic unless marked otherwise.

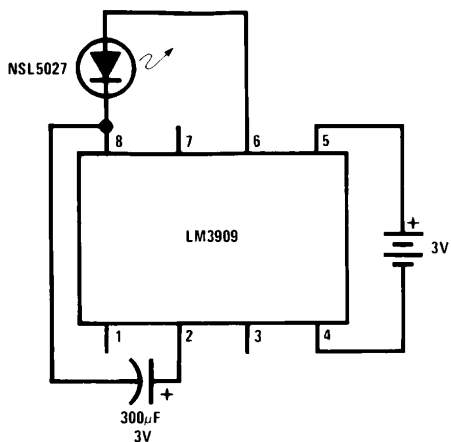
**Note 2:** Flash rates and frequencies assume a  $\pm 5\%$  capacitor tolerance. Electrolytics may vary  $-20\%$  to  $+100\%$  of their stated value.

**Note 3:** Unless noted, measurements above are made with a 1.4V supply, a 25°C ambient temperature, and an LED with a forward drop of 1.5V to 1.7V at 1 mA forward current.

**Note 4:** Occasionally a flasher circuit will fail to oscillate due to an LED defect that may be missed because it only reduces light output 10% or so. Such LEDs can be identified by a large increase in conduction between 0.9V and 1.2V.

## Typical Applications (Continued) (See applications notes on previous page)

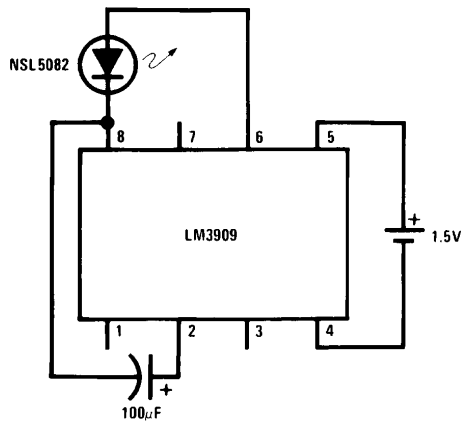
**3V Flasher**



TL/H/7969-7

**Note:** Nominal flash rate: 1 Hz. Average  $I_{DRAIN} = 0.77$  mA.

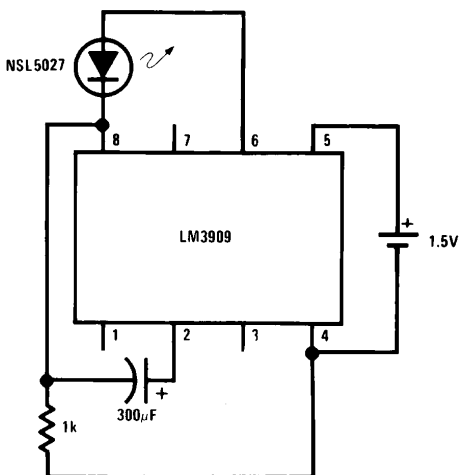
**Minimum Power at 1.5V**



TL/H/7969-8

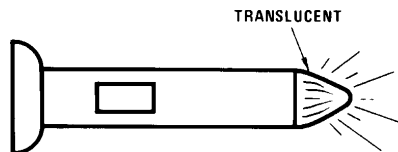
**Note:** Nominal flash rate: 1.1 Hz. Average  $I_{DRAIN} = 0.32$  mA.

**Fast Blinker**



TL/H/7969-9

**Note:** Nominal flash rate: 2.6 Hz. Average  $I_{DRAIN} = 1.2$  mA.

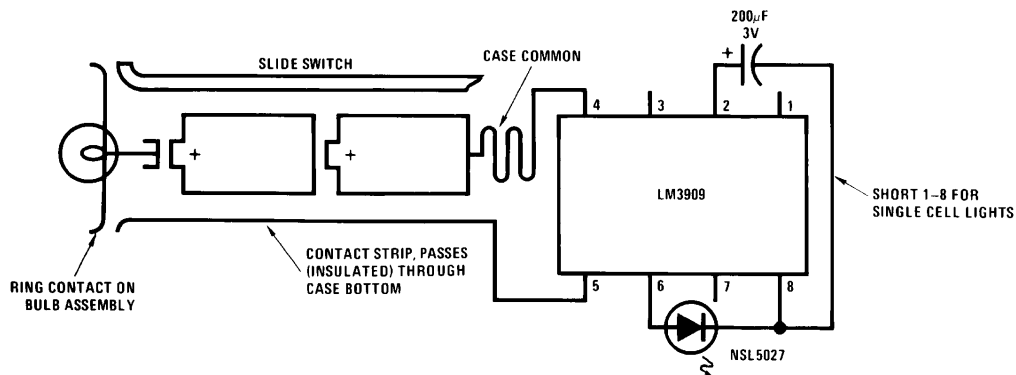


TL/H/7969-11

**Note:** Winking LED inside, locates light in total darkness.

## Typical Applications (Continued) (See applications notes above)

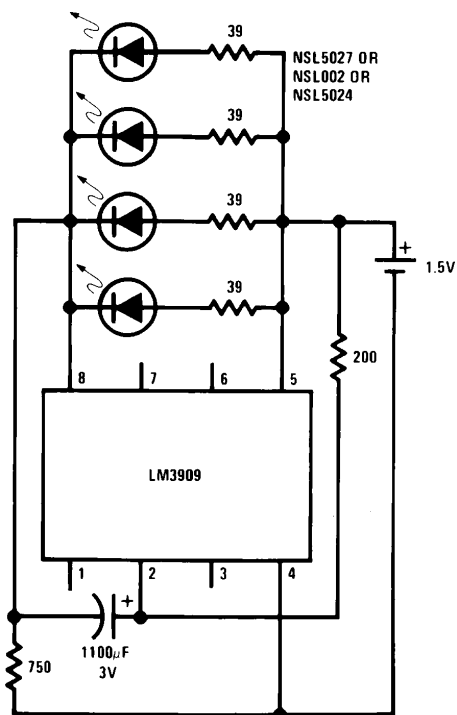
### Flashlight Finder



TL/H/7969-10

**Note:** LM3909, capacitor, and LED are installed in a white translucent cap on the flashlight's back end. Only one contact strip (in addition to the case connection) is needed for flasher power. Drawing current through the bulb simplifies wiring and causes negligible loss since bulb resistance cold is typically less than  $2\Omega$ .

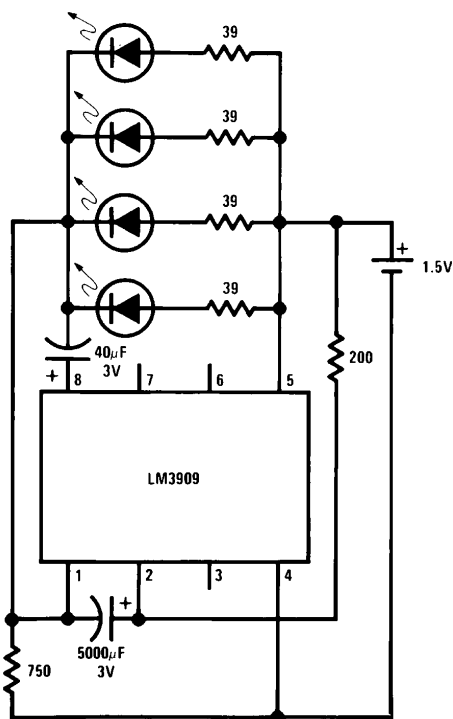
### 4 Parallel LEDs



TL/H/7969-12

**Note:** Nominal flash rate: 1.3 Hz. Average  $I_{DRAIN} = 2$  mA.

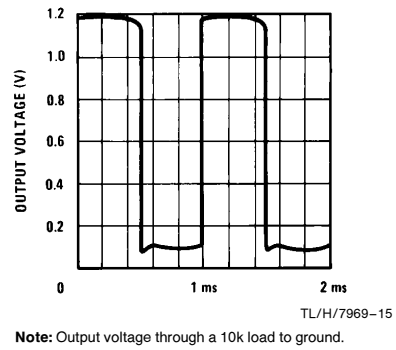
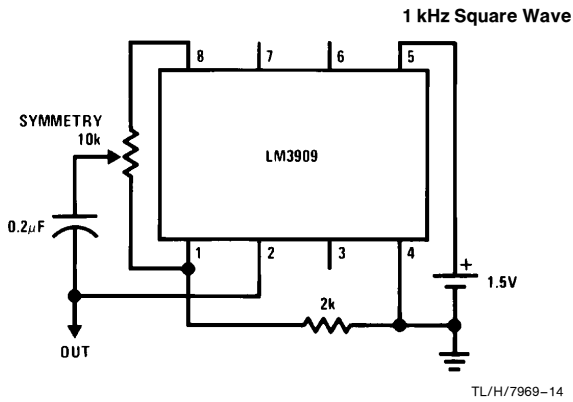
### High Efficiency Parallel Circuit



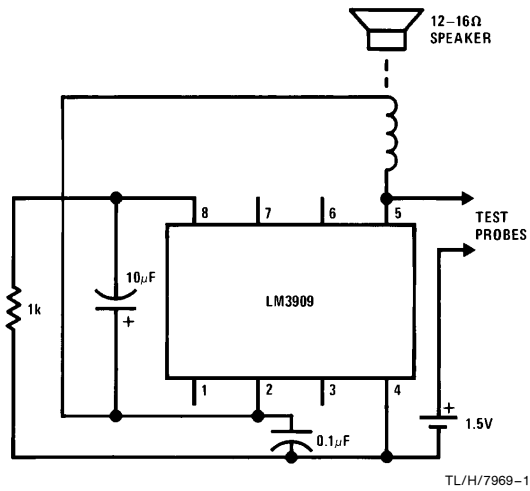
TL/H/7969-13

**Note:** Nominal flash rate: 1.5 Hz. Average  $I_{DRAIN} = 1.5$  mA.

## Typical Applications (Continued) (See applications notes above)

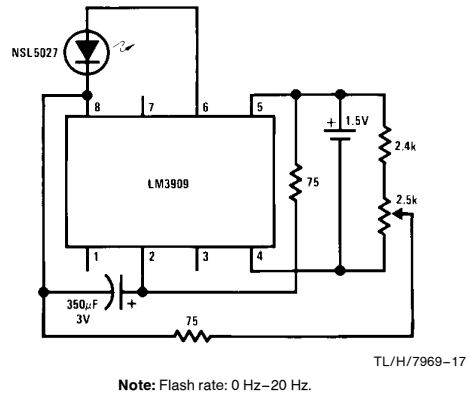


### "Buzz Box" Continuity and Coil Checker

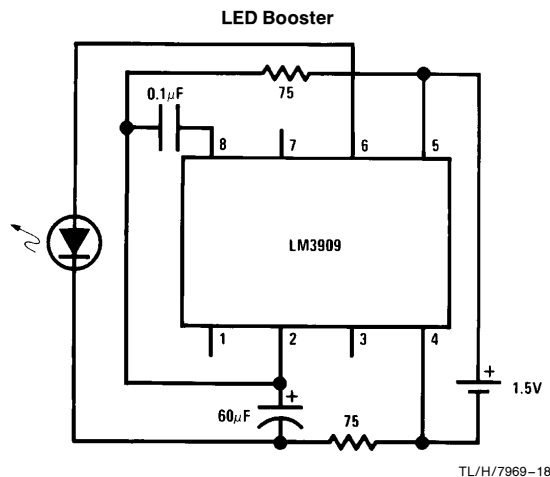


**Note:** Differences between shorts, coils, and a few ohms of resistance can be heard.

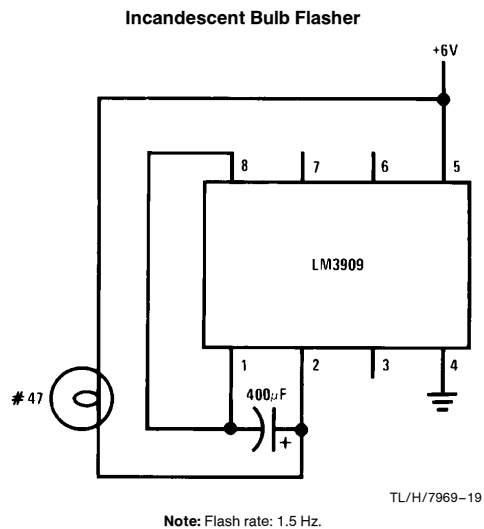
### Variable Flasher



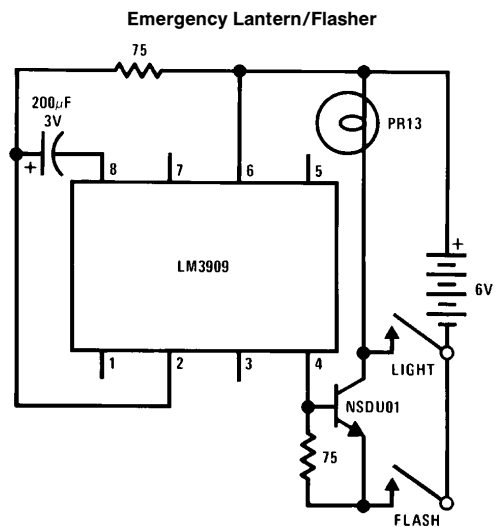
## Typical Applications (Continued) (See applications notes above)



**Note:** High efficiency, 4 mA drain. Continuous appearing light obtained by supplying short, high current, pulses (2 kHz) to LEDs with higher than battery voltage available.

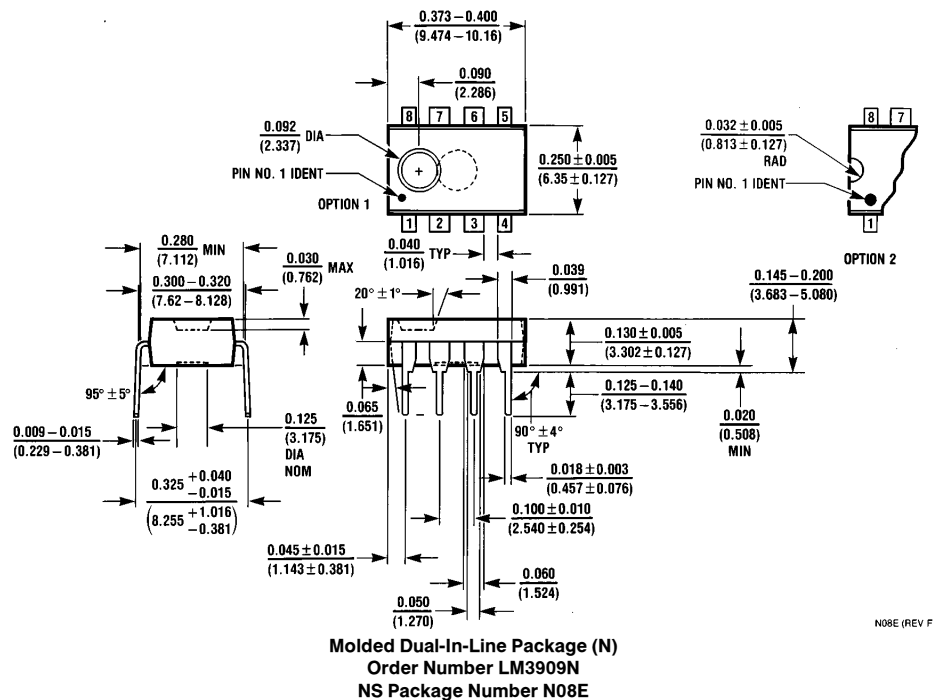


**Note:** Flash rate: 1.5 Hz.



**Note:** Nominal flash rate: 1.5 Hz.

# Physical Dimensions inches (millimeters)



## LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



**National Semiconductor Corporation**  
 1111 West Bardin Road  
 Arlington, TX 76017  
 Tel: 1(800) 272-9959  
 Fax: 1(800) 737-7018

**National Semiconductor Europe**  
 Fax: (+49) 0-180-530 85 86  
 Email: cnjwge@tevm2.nsc.com  
 Deutsch Tel: (+49) 0-180-530 85 85  
 English Tel: (+49) 0-180-532 78 32  
 Français Tel: (+49) 0-180-532 93 58  
 Italiano Tel: (+49) 0-180-534 16 80

**National Semiconductor Hong Kong Ltd.**  
 13th Floor, Straight Block,  
 Ocean Centre, 5 Canton Rd.  
 Tsimshatsui, Kowloon  
 Hong Kong  
 Tel: (852) 2737-1600  
 Fax: (852) 2736-9960

**National Semiconductor Japan Ltd.**  
 Tel: 81-043-299-2309  
 Fax: 81-043-299-2408