

July 1992

# DS1631/DS3631/DS1632/DS3632/DS1633/DS3633/ DS1634/DS3634 CMOS Dual Peripheral Drivers

## General Description

The DS1631 series of dual peripheral drivers was designed to be a universal set of interface components for CMOS circuits.

Each circuit has CMOS compatible inputs with thresholds that track as a function of  $V_{CC}$  (approximately  $\frac{1}{2} V_{CC}$ ). The inputs are PNPs providing the high impedance necessary for interfacing with CMOS.

Outputs have high voltage capability, minimum breakdown voltage is 56V at 250  $\mu A$ .

The outputs are Darlington connected transistors. This allows high current operation (300 mA max) at low internal  $V_{CC}$  current levels since base drive for the output transistor is obtained from the load in proportion to the required loading conditions. This is essential in order to minimize loading on the CMOS logic supply.

Typical  $V_{CC} = 5V$  power is 28 mW with both outputs ON.  $V_{CC}$  operating range is 4.5V to 15V.

The circuit also features output transistor protection if the  $V_{CC}$  supply is lost by forcing the output into the high impedance

OFF state with the same breakdown levels as when  $V_{CC}$  was applied.

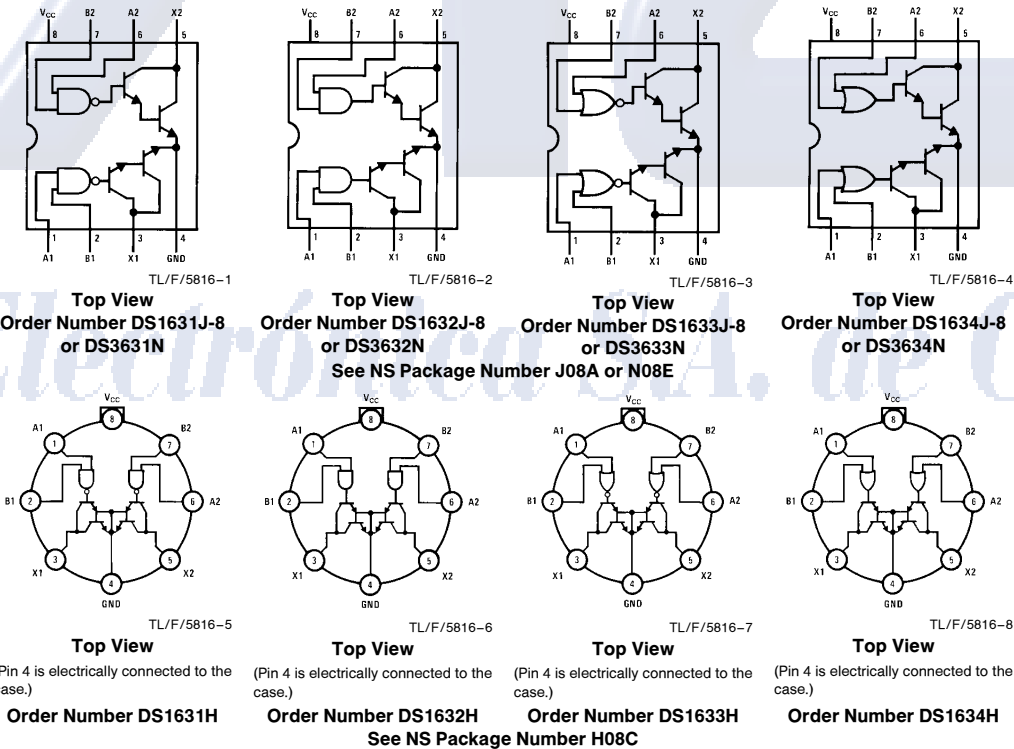
Pin-outs are the same as the respective logic functions found in the following popular series of circuits: DS75451, DS75461. This feature allows direct conversion of present systems to the MM74C CMOS family and DS1631 series circuits with great power savings.

The DS1631 series is also TTL compatible at  $V_{CC} = 5V$ .

## Features

- CMOS compatible inputs
  - High impedance inputs
  - High output voltage breakdown
  - High output current capability
  - Same pin-outs and logic functions as DS75451 and DS75461 series circuits
  - Low  $V_{CC}$  power dissipation (28 mW both outputs "ON" at 5V)
- PNP's  
56V min  
300 mA max

## Connection Diagrams (Dual-In-Line and Metal Can Packages)



DS1631/DS3631/DS1632/DS3632/DS1633/DS3633/DS1634/DS3634  
CMOS Dual Peripheral Drivers

**Absolute Maximum Ratings** (Note 1)

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

Supply Voltage	16V
Voltage at Inputs	-0.3V to $V_{CC} + 0.3V$
Output Voltage	56V
Storage Temperature Range	-65°C to +150°C
Maximum Power Dissipation* at 25°C	
Cavity Package	1133 mW
Molded Package	1022 mW
TO-5 Package	787 mW
Lead Temperature (Soldering, 4 sec.)	260°C

\*Derate cavity package 7.6 mW/°C above 25°C; derate molded package 8.2 mW/°C above 25°C; derate TO-5 package 5.2 mW/°C above 25°C.

**Operating Conditions**

	Min	Max	Units
Supply Voltage, $V_{CC}$			
DS1631/DS1632/ DS1633/DS1634	4.5	15	V
DS3631/DS3632/ DS3633/DS3634	4.75	15	V
Temperature, $T_A$			
DS1631/DS1632/ DS1633/DS1634	-55	+125	°C
DS3631/DS3632/ DS3633/DS3634	0	+70	°C

**Electrical Characteristics** (Notes 2 and 3)

Symbol	Parameter	Conditions	Min	Typ	Max	Units		
<b>ALL CIRCUITS</b>								
$V_{IH}$	Logical "1" Input Voltage	(Figure 1)	$V_{CC} = 5V$	3.5	2.5		V	
			$V_{CC} = 10V$	8.0	5		V	
			$V_{CC} = 15V$	12.5	7.5		V	
$V_{IL}$	Logical "0" Input Voltage	(Figure 1)	$V_{CC} = 5V$		2.5	1.5	V	
			$V_{CC} = 10V$		5.5	2.0	V	
			$V_{CC} = 15V$		7.5	2.5	V	
$I_{IH}$	Logical "1" Input Current	$V_{CC} = 15V, V_{IN} = 15V$ , (Figure 2)		0.1	10	$\mu A$		
$I_{IL}$	Logical "0" Input Current	$V_{IN} = 0.4V$ , (Figure 3)	$V_{CC} = 5V$		-50	-120	$\mu A$	
			$V_{CC} = 15V$		-200	-360	$\mu A$	
$V_{OH}$	Output Breakdown Voltage	$V_{CC} = 15V, I_{OH} = 250 \mu A$ , (Figure 1)	56	65		V		
$V_{OL}$	Output Low Voltage	$V_{CC} = \text{Min}$ , (Figure 1), DS1631, DS1632, DS1633, DS1634	$I_{OL} = 100 \text{ mA}$		0.85	1.1	V	
			$I_{OL} = 300 \text{ mA}$		1.1	1.4	V	
		$V_{CC} = \text{Min}$ , (Figure 1), DS3631, DS3632, DS3633, DS3634	$I_{OL} = 100 \text{ mA}$		0.85	1.0	V	
			$I_{OL} = 300 \text{ mA}$		1.1	1.3	V	
<b>DS1631/DS3631</b>								
$I_{CC(0)}$	Supply Currents	$V_{IN} = 0V$ , (Figure 4)	$V_{CC} = 5V$	Output Low		7	11	mA
			$V_{CC} = 15V$	Both Drivers		14	20	mA
$I_{CC(1)}$		(Figure 4)	$V_{CC} = 5V, V_{IN} = 5V$	Output High		2	3	mA
			$V_{CC} = 15V, V_{IN} = 15V$	Both Drivers		7.5	10	mA
$t_{PD1}$	Propagation to "1"	$V_{CC} = 5V, T_A = 25^\circ C, C_L = 15 \text{ pF}, R_L = 50\Omega, V_L = 10V$ , (Figure 5)		500			ns	
$t_{PD0}$	Propagation to "0"	$V_{CC} = 5V, T_A = 25^\circ C, C_L = 15 \text{ pF}, R_L = 50\Omega, V_L = 10V$ , (Figure 5)		750			ns	
<b>DS1632/DS3632</b>								
$I_{CC(0)}$	Supply Currents	(Figure 4)	$V_{CC} = 5V, V_{IN} = 5V$	Output Low		8	12	mA
			$V_{CC} = 15V, V_{IN} = 15V$			18	23	mA
$I_{CC(1)}$		$V_{IN} = 0V$ , (Figure 4)	$V_{CC} = 5V$	Output High		2.5	3.5	mA
			$V_{CC} = 15V$			9	14	mA
$t_{PD1}$	Propagation to "1"	$V_{CC} = 5V, T_A = 25^\circ C, C_L = 15 \text{ pF}, R_L = 50\Omega, V_L = 10V$ , (Figure 5)		500			ns	
$t_{PD0}$	Propagation to "0"	$V_{CC} = 5V, T_A = 25^\circ C, C_L = 15 \text{ pF}, R_L = 50\Omega, V_L = 10V$ , (Figure 5)		750			ns	

**Electrical Characteristics** (Notes 2 and 3) (Continued)

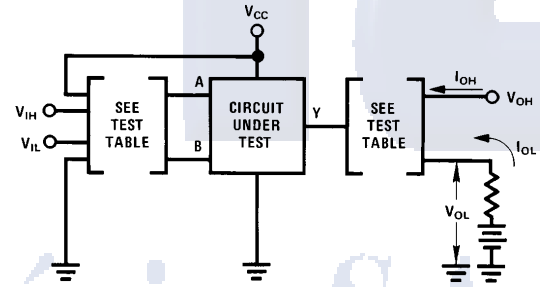
Symbol	Parameter	Conditions	Min	Typ	Max	Units	
<b>DS1633/DS3633</b>							
$I_{CC(0)}$	Supply Currents	$V_{IN} = 0V$ , (Figure 4)	$V_{CC} = 5V$	Output Low	7.5	12	mA
			$V_{CC} = 15V$		16	23	
$I_{CC(1)}$		(Figure 4)	$V_{CC} = 5V, V_{IN} = 5V$	Output High	2	4	mA
			$V_{CC} = 15V, V_{IN} = 15V$		7.2	15	
$t_{PD1}$	Propagation to "1"	$V_{CC} = 5V, T_A = 25^\circ C, C_L = 15 pF, R_L = 50\Omega, V_L = 10V$ , (Figure 5)		500		ns	
$t_{PD0}$	Propagation to "0"	$V_{CC} = 5V, T_A = 25^\circ C, C_L = 15 pF, R_L = 50\Omega, V_L = 10V$ , (Figure 5)		750		ns	
<b>DS1634/DS3634</b>							
$I_{CC(0)}$	Supply Currents	(Figure 4)	$V_{CC} = 5V, V_{IN} = 5V$	Output Low	7.5	12	mA
			$V_{CC} = 15V, V_{IN} = 15V$		18	23	
$I_{CC(1)}$		$V_{IN} = 0V$ , (Figure 4)	$V_{CC} = 5V$	Output High	3	5	mA
			$V_{CC} = 15V$		11	18	
$t_{PD1}$	Propagation to "1"	$V_{CC} = 5V, T_A = 25^\circ C, C_L = 15 pF, R_L = 50\Omega, V_L = 10V$ , (Figure 5)		500		ns	
$t_{PD0}$	Propagation to "0"	$V_{CC} = 5V, T_A = 25^\circ C, C_L = 15 pF, R_L = 50\Omega, V_L = 10V$ , (Figure 5)		750		ns	

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

**Note 2:** Unless otherwise specified min/max limits apply across the  $-55^\circ C$  to  $+125^\circ C$  temperature range for the DS1631, DS1632, DS1633 and DS1634 and across the  $0^\circ C$  to  $+70^\circ C$  range for the DS3631, DS3632, DS3633 and DS3634. All typical values are for  $T_A = 25^\circ C$ .

**Note 3:** All currents into device pins shown as positive, out of device pins as negative, all voltages referenced to ground unless otherwise noted. All values shown as max or min on absolute value basis.

**Test Circuits**

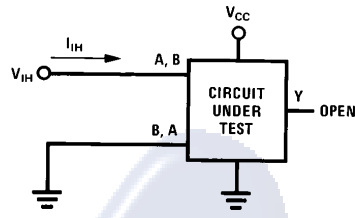


TL/F/5816-9

Circuit	Input Under Test	Other Input	Output	
			Apply	Measure
DS3631	$V_{IH}$	$V_{IH}$	$I_{OH}$	$V_{OH}$
	$V_{IL}$	$V_{CC}$	$I_{OL}$	$V_{OL}$
DS3632	$V_{IH}$	$V_{IH}$	$I_{OL}$	$V_{OL}$
	$V_{IL}$	$V_{CC}$	$I_{OH}$	$V_{OH}$
DS3633	$V_{IH}$	GND	$I_{OH}$	$V_{OH}$
	$V_{IL}$	$V_{IL}$	$I_{OL}$	$V_{OL}$
DS3634	$V_{IH}$	GND	$I_{OL}$	$V_{OL}$
	$V_{IL}$	$V_{IL}$	$I_{OH}$	$V_{OH}$

**Note:** Each input is tested separately.  
**FIGURE 1.  $V_{IH}, V_{IL}, V_{OH}, V_{OL}$**

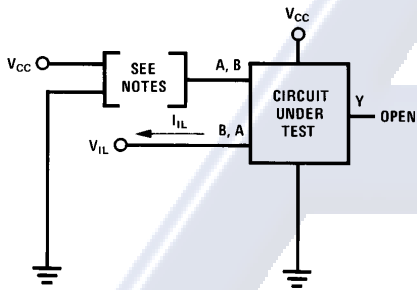
**Test Circuits** (Continued)



Each input is tested separately.

**FIGURE 2.  $I_{IH}$**

TL/F/5816-10

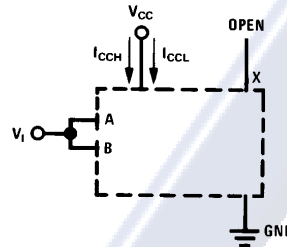


**Note A:** Each input is tested separately.

**Note B:** When testing DS1633 and DS1634 input not under test is grounded. For all other circuits it is at  $V_{CC}$ .

**FIGURE 3.  $I_{IL}$**

TL/F/5816-11

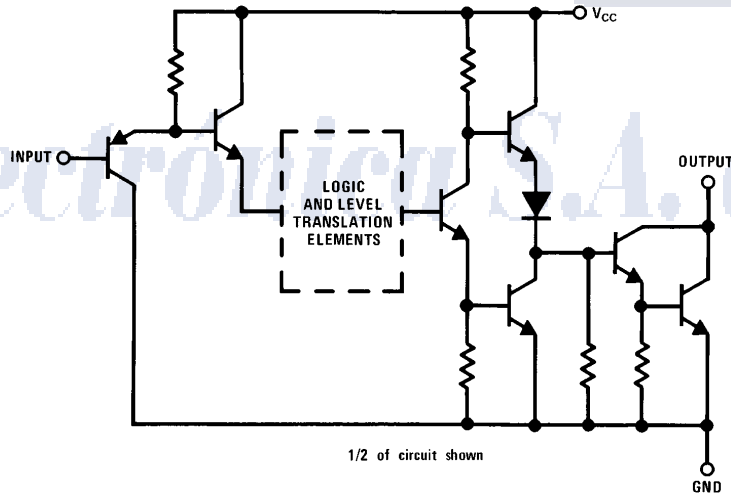


Both gates are tested simultaneously.

**FIGURE 4.  $I_{CC}$  for AND and NAND Circuits**

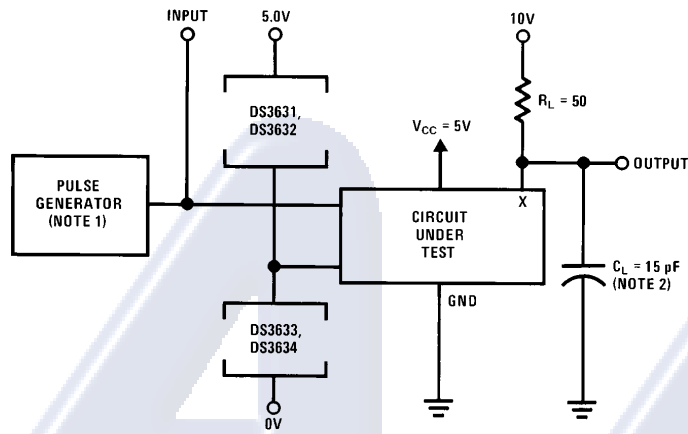
TL/F/5816-12

**Schematic Diagram** (Equivalent Circuit)

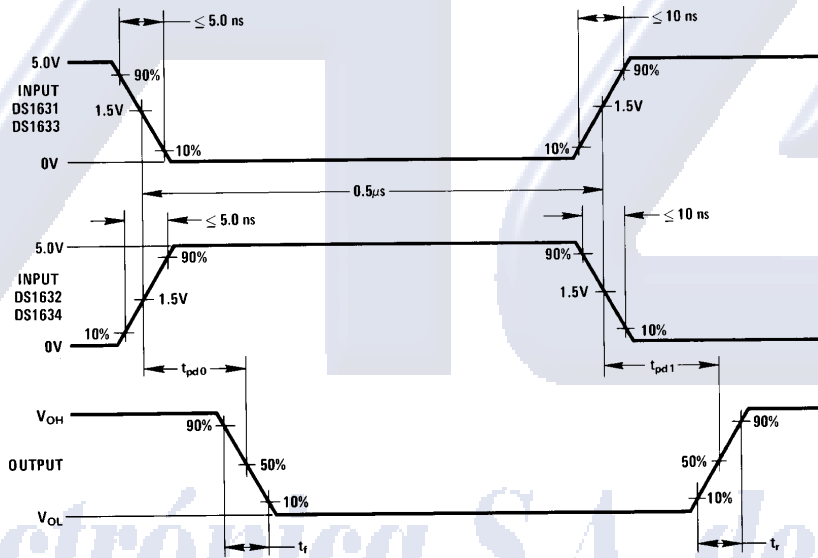


TL/F/5816-15

### Switching Time Waveforms



TL/F/5816-13



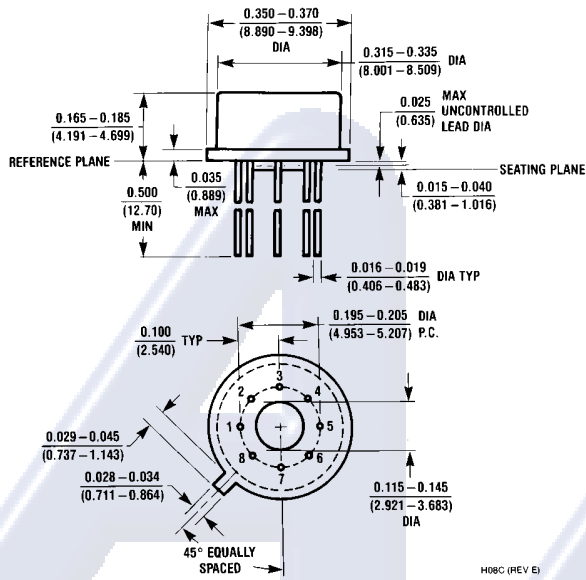
TL/F/5816-14

**Note 1:** The pulse generator has the following characteristics: PRR = 500 kHz,  $Z_{OUT} \approx 50\Omega$

**Note 2:**  $C_L$  includes probe and jig capacitance

**FIGURE 5. Switching Times**

**Physical Dimensions** inches (millimeters)

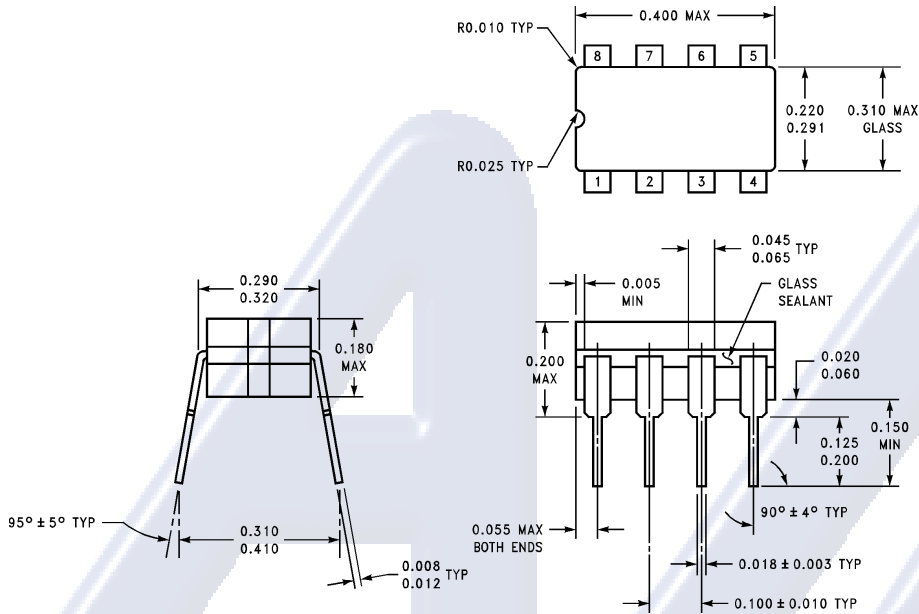


**Metal Can Package (H)**  
Order Number DS1631H, DS1632H, DS1633H or DS1634H  
NS Package Number H08C

H08C (REV E)

*Electrónica S.A. de C.V.*

**Physical Dimensions** inches (millimeters) (Continued)



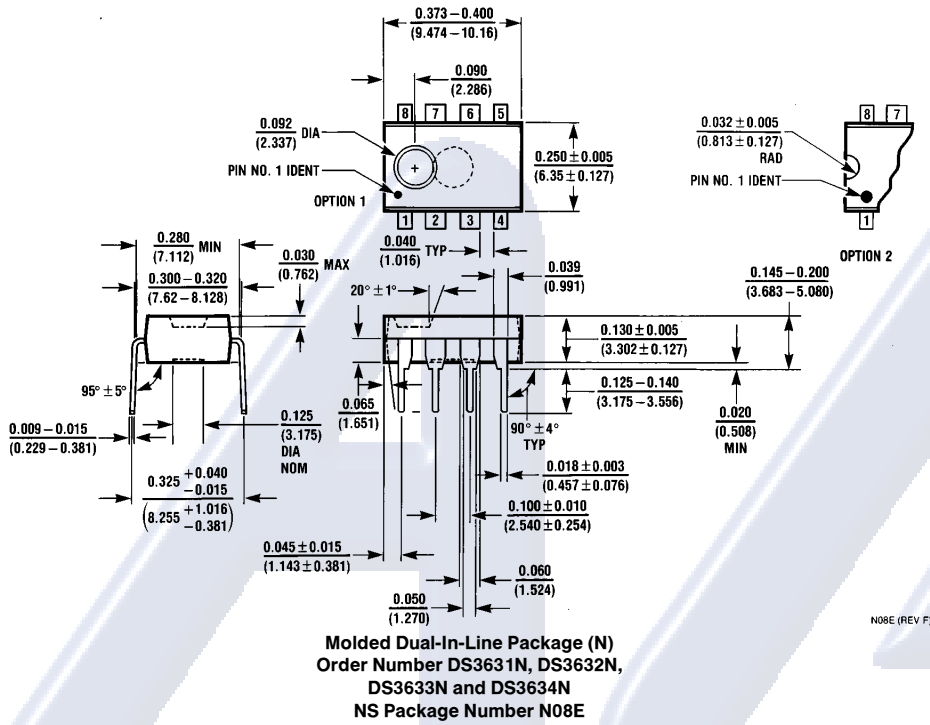
**Ceramic Dual-In-Line Package (J)**  
**Order Number DS1631J-8, DS1632J-8, DS1633J-8 or DS1634J-8**  
**NS Package Number J08A**

J08A (REV K)

*Electrónica S.A. de C.V.*

DS1631/DS3631/DS1632/DS3632/DS1633/DS3633/DS1634/DS3634  
CMOS Dual Peripheral Drivers

**Physical Dimensions** inches (millimeters) (Continued)



**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: onjwge@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.**  
19th 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

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.