

## MM54C14/MM74C14 Hex Schmitt Trigger

### General Description

The MM54C14/MM74C14 Hex Schmitt Trigger is a monolithic complementary MOS (CMOS) integrated circuit constructed with N- and P-channel enhancement transistors. The positive and negative going threshold voltages,  $V_{T+}$  and  $V_{T-}$ , show low variation with respect to temperature (typ.  $0.0005V/^{\circ}C$  at  $V_{CC} = 10V$ ), and hysteresis,  $V_{T+} - V_{T-} \geq 0.2 V_{CC}$  is guaranteed.

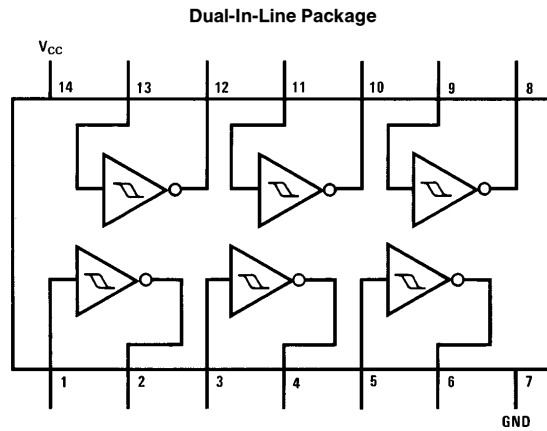
All inputs are protected from damage due to static discharge by diode clamps to  $V_{CC}$  and GND.

### Features

- Wide supply voltage range
- High noise immunity
- Low power
- TTL compatibility
- Hysteresis

3.0V to 15V  
 $0.70 V_{CC}$  (typ.)  
 $0.4 V_{CC}$  (typ.)  
 $0.2 V_{CC}$  guaranteed  
 $0.4 V_{CC}$  (typ.)  
 $0.2 V_{CC}$  guaranteed

### Connection Diagram



TL/F/5879-1

Order Number MM54C14 or MM74C14

## Absolute Maximum Ratings

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

Voltage at Any Pin	-0.3V to $V_{CC} + 0.3V$
Operating Temperature Range	-55°C to +125°C
MM54C14	-40°C to +85°C
MM74C14	

Storage Temperature Range	-65°C to +150°C
Power Dissipation	
Dual-In-Line	700 mW
Small Outline	500 mW
Operating $V_{CC}$ Range	3.0V to 15V
Absolute Maximum $V_{CC}$	18V
Lead Temperature	
(Soldering, 10 seconds)	260°C

## DC Electrical Characteristics

Min/Max limits apply across the guaranteed temperature range unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>CMOS TO CMOS</b>						
$V_{T+}$	Positive Going Threshold Voltage	$V_{CC} = 5V$	3.0	3.6	4.3	V
		$V_{CC} = 10V$	6.0	6.8	8.6	V
		$V_{CC} = 15V$	9.0	10.0	12.9	V
$V_{T-}$	Negative Going Threshold Voltage	$V_{CC} = 5V$	0.7	1.4	2.0	V
		$V_{CC} = 10V$	1.4	3.2	4.0	V
		$V_{CC} = 15V$	2.1	5.0	6.0	V
$V_{T+} - V_{T-}$	Hysteresis	$V_{CC} = 5V$	1.0	2.2	3.6	V
		$V_{CC} = 10V$	2.0	3.6	7.2	V
		$V_{CC} = 15V$	3.0	5.0	10.8	V
$V_{OUT(1)}$	Logical "1" Output Voltage	$V_{CC} = 5V, I_O = -10 \mu A$	4.5			V
		$V_{CC} = 10V, I_O = -10 \mu A$	9.0			V
$V_{OUT(0)}$	Logical "0" Output Voltage	$V_{CC} = 5V, I_O = 10 \mu A$			0.5	V
		$V_{CC} = 10V, I_O = 10 \mu A$			1.0	V
$I_{IN(1)}$	Logical "1" Input Current	$V_{CC} = 15V, V_{IN} = 15V$		0.005	1.0	$\mu A$
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC} = 15V, V_{IN} = 0V$	-1.0	-0.005		$\mu A$
$I_{CC}$	Supply Current	$V_{CC} = 15V, V_{IN} = 0V/15V$		0.05	15	$\mu A$
		$V_{CC} = 5V, V_{IN} = 2.5V$ (Note 4)		20		$\mu A$
		$V_{CC} = 10V, V_{IN} = 5V$ (Note 4)		200		$\mu A$
		$V_{CC} = 15V, V_{IN} = 7.5V$ (Note 4)		600		$\mu A$
<b>CMOS/LPTTL INTERFACE</b>						
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 5V$	4.3			V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5V$			0.7	V
$V_{OUT(1)}$	Logical "1" Output Voltage	54C, $V_{CC} = 4.5V, I_O = -360 \mu A$	2.4			V
		74C, $V_{CC} = 4.75V, I_O = -360 \mu A$	2.4			V
$V_{OUT(0)}$	Logical "0" Output Voltage	54C, $V_{CC} = 4.5V, I_O = 360 \mu A$			0.4	V
		74C, $V_{CC} = 4.75V, I_O = 360 \mu A$			0.4	V
<b>OUTPUT DRIVE (see 54C/74C Family Characteristics Data Sheet) <math>T_A = 25^\circ C</math> (Short Circuit Current)</b>						
$I_{SOURCE}$	Output Source Current (P-Channel)	$V_{CC} = 5V, V_{OUT} = 0V$	-1.75	-3.3		mA
$I_{SOURCE}$	Output Source Current (P-Channel)	$V_{CC} = 10V, V_{OUT} = 0V$	-8.0	-15		mA
$I_{SINK}$	Output Sink Current (N-Channel)	$V_{CC} = 5V, V_{OUT} = V_{CC}$	1.75	3.6		mA
$I_{SINK}$	Output Sink Current (N-Channel)	$V_{CC} = 10V, V_{OUT} = V_{CC}$	8.0	16		mA

## AC Electrical Characteristics\* $T_A = 25^\circ\text{C}$ , $C_L = 50\text{ pF}$ , unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{PD0}$ , $t_{PD1}$	Propagation Delay from Input to Output	$V_{CC} = 5\text{V}$		220	400	ns
		$V_{CC} = 10\text{V}$		80	200	ns
$C_{IN}$	Input Capacitance	Any Input (Note 2)		5.0		pF
$C_{PD}$	Power Dissipation Capacitance	(Note 3) Per Gate		20		pF

\*AC Parameters are guaranteed by DC correlated testing.

**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.

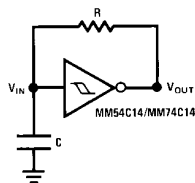
**Note 2:** Capacitance is guaranteed by periodic testing.

**Note 3:**  $C_{PD}$  determines the no load AC power consumption of any CMOS device. For complete explanation see 54C/74C Family Characteristics Application Note—AN-90.

**Note 4:** Only one of the six inputs is at  $\frac{1}{2} V_{CC}$ ; the others are either at  $V_{CC}$  or GND.

## Typical Applications

### Low Power Oscillator



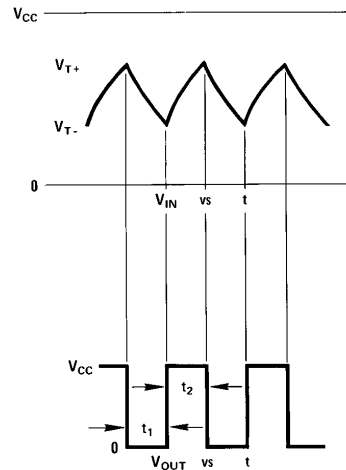
TL/F/5879-2

$$t_1 \approx RC \ln \frac{V_{T+}}{V_{T-}}$$

$$t_2 \approx RC \ln \frac{V_{CC} - V_{T-}}{V_{CC} - V_{T+}}$$

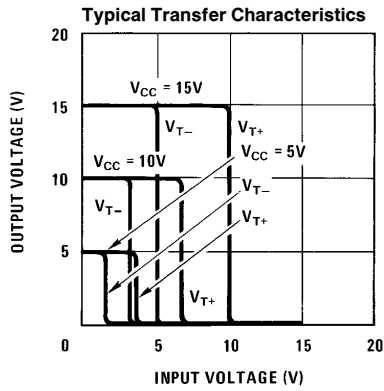
$$f \approx \frac{1}{RC \ln \frac{V_{T+}(V_{CC} - V_{T-})}{V_{T-}(V_{CC} - V_{T+})}} \approx \frac{1}{1.7 RC}$$

**Note:** The equations assume  $t_1 + t_2 \gg t_{pd0} + t_{pd1}$

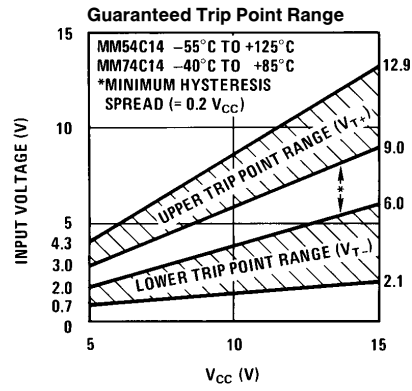


TL/F/5879-3

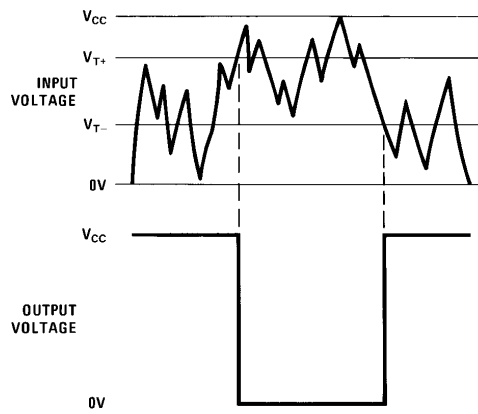
# Typical Performance Characteristics



TL/F/5879-4



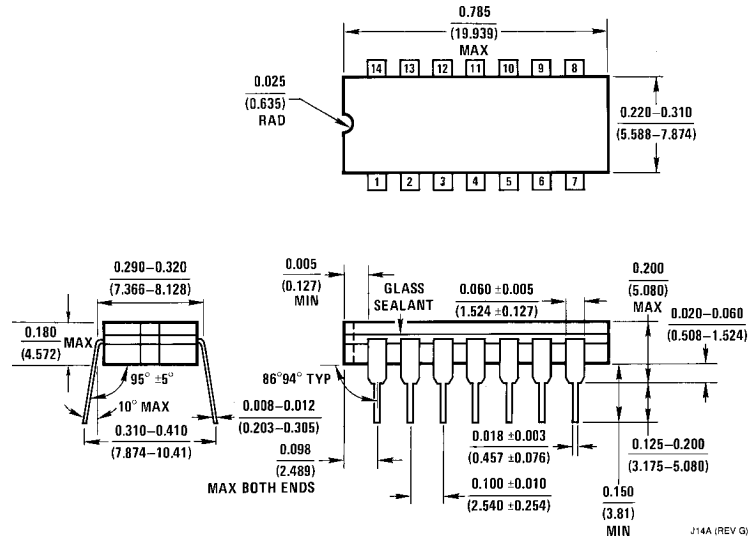
TL/F/5879-5



TL/F/5879-6

**Note:** For more information on output drive characteristics, power dissipation, and propagation delays, see AN-90.

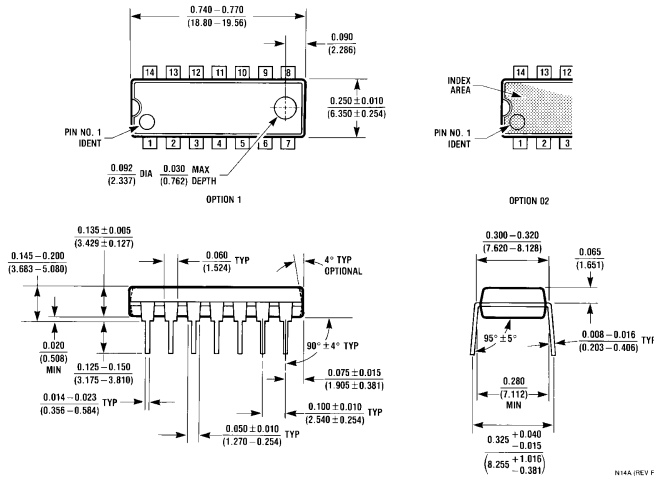
**Physical Dimensions** inches (millimeters)



**Ceramic Dual-In-Line Package (J)**  
**Order Number MM54C14J or MM74C14J**  
**NS Package Number J14A**

J14A (REV G)

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



**Molded Dual-In-Line Package (N)**  
**Order Number MM54C14N or MM74C14N**  
**NS Package Number N14A**

**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.**  
 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.