National Semiconductor

MM54C14/MM74C14 Hex Schmitt Trigger

General Description

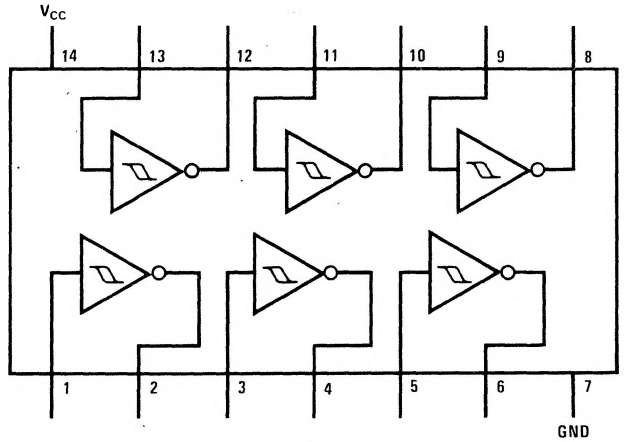
The MM54C14/MM74C14 Hex Schmitt Trigger is a monolithic complementary MOS (CMOS) integrated circuit constructed with N and P-channel enhancement transistors. The positive and negative going threshold voltages, V_{T+} and V_{T-}, show low variation with respect to temperature (typ. 0.0005 V/°C at $V_{CC} = 10V$), and hysteresis, $V_{T+} - V_{T-} \geq 0.2V_{CC}$ 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	3.0V to 15V
■ High noise immunity	0.70 V_{CC} (typ.)
■ Low power TTL compatibility	0.4 V_{CC} (typ.) 0.2 V_{CC} guaranteed
■ Hysteresis	0.4 V_{CC} typ. 0.2 V_{CC} guaranteed

Connection Diagram



TOP VIEW

Absolute Maximum Ratings

Voltage at Any Pin	$-0.3V$ to $V_{CC}+0.3V$
Operating Temperature Range	
MM54C14	$-55°C$ to $+125°C$
MM74C14	$-40°C$ to $+85°C$
Storage Temperature Range	$-65°C$ to $+150°C$
Package Dissipation	500 mW
Operating V_{CC} Range	3.0V to 15V
Absolute Maximum V_{CC}	18V
Lead Temperature (Soldering, 10 seconds)	300°C

DC Electrical Characteristics

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

	Parameter	Conditions	Min.	Typ.	Max.	Units
	CMOS to CMOS					
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	μA
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC}=15V$, $V_{IN}=0V$	-1.0	-0.005		μA
I_{CC}	Supply Current	$V_{CC}=15V$, $V_{IN}=0V/15V$		0.05	15	μA
		$V_{CC}=5V$, $V_{IN}=2.5V$ (Note 4)		20		μA
		$V_{CC}=10V$, $V_{IN}=5V$ (Note 4)		200		μA
		$V_{CC}=15V$, $V_{IN}=7.5V$ (Note 4)		600		μA
	CMOS/LPTTL Interface					
$V_{IN(1)}$	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
	Output Drive (See 54C/74C Family Characteristics Data Sheet) (short circuit current)					
I_{SOURCE}	Output Source Current (P-Channel)	$V_{CC}=5V$, $V_{OUT}=0V$, $T_A=25°C$	-1.75	-3.3		mA
I_{SOURCE}	Output Source Current (P-Channel)	$V_{CC}=10V$, $V_{OUT}=0V$, $T_A=25°C$	-8.0	-15		mA
I_{SINK}	Output Sink Current (N-Channel)	$V_{CC}=5V$, $V_{OUT}=V_{CC}$, $T_A=25°C$	1.75	3.6		mA
I_{SINK}	Output Sink Current (N-Channel)	$V_{CC}=10V$, $V_{OUT}=V_{CC}$, $T_A=25°C$	8.0	16		mA

AC Electrical Characteristics

$T_A = 25°C$, $C_L = 50\,pF$, unless otherwise specified.

Parameter		Conditions	Min.	Typ.	Max.	Units
t_{pd0}, t_{pd1}	Propagation Delay from Input to Output	$V_{CC} = 5V$		220	400	ns
		$V_{CC} = 10V$		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

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.

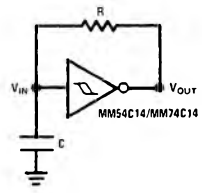
Note 2: Capacitance is guaranteed by periodic testing.

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 1/2 V_{CC}, the others are either at V_{CC} or GND.

Typical Applications

Low Power Oscillator

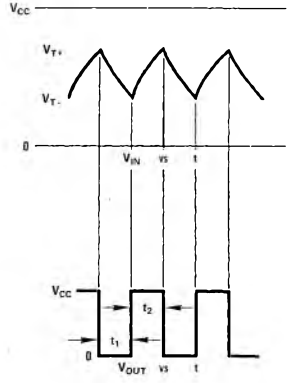


$$t_1 = RC \ln \frac{V_{T+}}{V_{T-}}$$

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

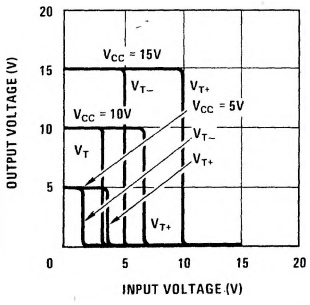
$$f = \frac{1}{RC \ln \frac{V_{T+}(V_{CC} - V_{T-})}{V_{T-}(V_{CC} - V_{T+})}} \approx \frac{1}{1.7\,RC}$$

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

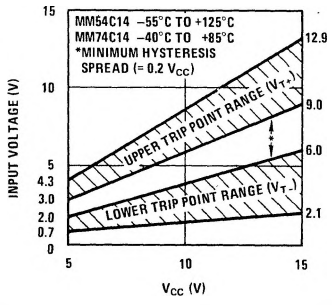


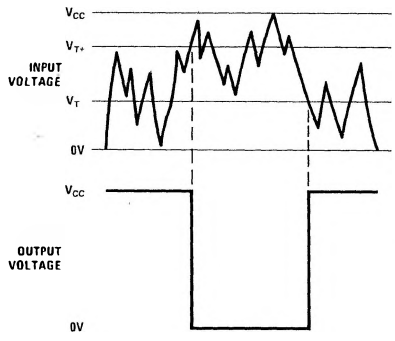
Typical Performance Characteristics

Typical Transfer Characteristics



Guaranteed Trip Point Range





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