National Semiconductor

MM54C914/MM74C914 Hex Schmitt Trigger with Extended Input Voltage

General Description

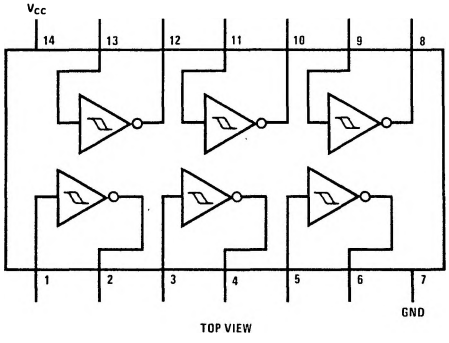
The MM54C914/MM74C914 is a monolithic CMOS Hex Schmitt trigger with special input protection scheme. This scheme allows the input voltage levels to exceed V_{CC} or ground by at least 10V (V_{CC} – 25V to GND + 25V), and is valuable for applications involving voltage level shifting or mismatched power supplies.

The positive and negative-going threshold voltages, V_{T+} and V_{T-}, show low variation with respect to temperature (typ 0.0005V/°C at V_{CC} = 10V). And the hysteresis, $V_{T+} - V_{T-} \geq 0.2\ V_{CC}$ is guaranteed.

Features

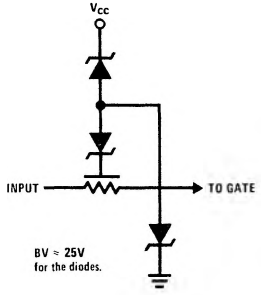
■ Hysteresis	0.45 V_{CC} (typ.) 0.2 V_{CC} guaranteed
■ Special input protection	Extended Input Voltage Range
■ Wide supply voltage range	3.0V to 15V
■ High noise immunity	0.70 V_{CC} (typ.)
■ Low power TTL compatibility	fan out of 2 driving 74L

Connection Diagram



TOP VIEW

Special Input Protection



Absolute Maximum Ratings

Voltage at Any Input Pin	V_{CC} − 25V to GND + 25V
Voltage at Any Other Pin	−0.3V to V_{CC} + 0.3V
Operating Temperature Range	
MM54C914	−55°C to +125°C
MM74C914	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C
Package Dissipation	500mW
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 temperature range unless otherwise noted.

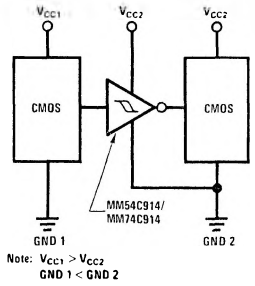
	Parameter	Conditions	Min.	Typ.	Max.	Units
	CMOS to CMOS					
V_{T+}	Positive Going Threshold Voltage	V_{CC} = 5.0V	3.0	3.6	4.3	V
		V_{CC} = 10V	6.0	6.8	8.6	V
		V_{CC} = 15V	9.0	10	12.9	
V_{T-}	Negative Going Threshold Voltage	V_{CC} = 5.0V	0.7	1.4	2.0	V
		V_{CC} = 10V	1.4	3.2	4.0	V
		V_{CC} = 15V	2.1	5.0	6.0	
$V_{T+} - V_{T-}$	Hysteresis	V_{CC} = 5.0V	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} = 5.0V, I_O = −10μA	4.5			V
		V_{CC} = 10V, I_O = −10μA	9.0			V
$V_{OUT(0)}$	Logical "0" Output Voltage	V_{CC} = 5.0V, I_O = +10μA			0.5	V
		V_{CC} = 10V, I_O = +10μA			1.0	V
$I_{IN(1)}$	Logical "1" Input Current	V_{CC} = 15V, V_{IN} = 25V		0.005	5.0	μA
$I_{IN(0)}$	Logical "0" Input Current	V_{CC} = 15V, V_{IN} = −10V	−100	−0.005		μA
I_{CC}	Supply Current	V_{CC} = 15V, V_{IN} = −10V/25V		0.05	300	μA
		V_{CC} = 5.0V, V_{IN} = −2.5V (Note 4)		20		μA
		V_{CC} = 10V, V_{IN} = 5.0V (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} = 5.0V	4.3			V
$V_{IN(0)}$	Logical "0" Input Voltage	V_{CC} = 5.0V			0.7	V
$V_{OUT(1)}$	Logical "1" Output Voltage	54C, V_{CC} = 4.5V, I_O = −360μA	2.4			V
		74C, V_{CC} = 4.75V, I_O = −360μA	2.4			V
$V_{OUT(0)}$	Logical "0" Output Voltage	54C, V_{CC} = 4.5V, I_O = 360μA			0.4	V
		74C, V_{CC} = 4.75V, I_O = 360μA			0.4	V
	Output Drive (See 54C/74C Family Characteristics Data Sheet) (short circuit current)					
I_{SOURCE}	Output Source Current (P-Channel)	V_{CC} = 5.0V, 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} = 5.0V, 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 $T_A = 25°C$, $C_L = 50pF$, unless otherwise specified.

Parameter		Conditions	Min.	Typ.	Max.	Units
C_{pd}	Propagation Delay from Input to Output	$V_{CC} = 5.0V$		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 input is at 1/2 V_{CC}, the others are either at V_{CC} or GND.

Typical Application



Typical Performance Characteristics