Rochester Electronics

Datasheet

Rochester Electronics Manufactured Components

Rochester branded components are manufactured using either die/wafers purchased from the original suppliers or Rochester wafers recreated from the original IP. All recreations are done with the approval of the OCM.

Parts are tested using original factory test programs or Rochester developed test solutions to guarantee product meets or exceed the OCM data sheet.

Quality Overview

- ISO-9001
- AS9120 certification
- Qualified Manufacturers List (QML) MIL-PRF-35835
    - Class Q Military
    - Class V Space Level
- Qualified Suppliers List of Distributors (QSLD)

    - Rochester is a critical supplier to DLA and meets all industry and DLA standards.

Rochester Electronics, LLC is committed to supplying products that satisfy customer expectations for quality and are equal to those originally supplied by industry manufacturers.

The original manufacturer's datasheet accompanying this document reflects the performance and specifications of the Rochester manufactured version of this device. Rochester Electronics guarantees the performance of its semiconductor products to the original OEM specifications. 'Typical' values are for reference purposes only. Certain minimum or maximum ratings may be based on product characterization, design, simulation, or sample testing.

National Semiconductor

November 1995

MM54HC14/MM74HC14
Hex Inverting Schmitt Trigger

General Description

The MM54HC14/MM74HC14 utilizes advanced silicon-gate CMOS technology to achieve the low power dissipation and high noise immunity of standard CMOS, as well as the capability to drive 10 LS-TTL loads.

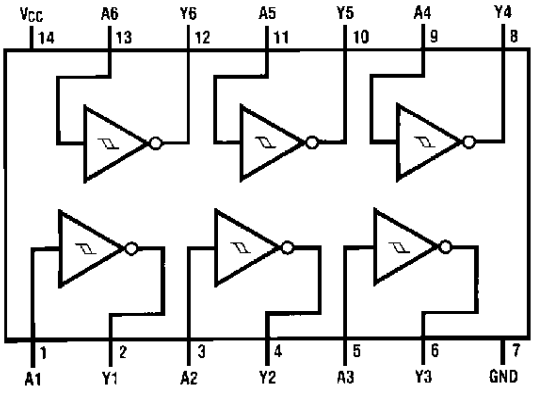
The 54HC/74HC logic family is functionally and pinout compatible with the standard 54LS/74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

Features

- Typical propagation delay: 13 ns
- Wide power supply range: 2–6V
- Low quiescent current: 20 μA maximum (74HC Series)
- Low input current: 1 μA maximum
- Fanout of 10 LS-TTL loads
- Typical hysteresis voltage: 0.9V at V_{CC}=4.5V

Connection and Schematic Diagrams

Dual-In-Line Package



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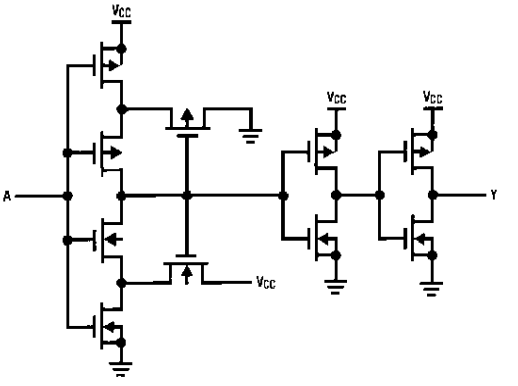
Top View

Order Number MM54HC14 or MM74HC14



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RRD-B30M115/Printed in U. S. A.

Absolute Maximum Ratings (Notes 1 & 2)

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

Supply Voltage (V_{CC})	−0.5 to +7.0V
DC Input Voltage (V_{IN})	−1.5 to V_{CC} +1.5V
DC Output Voltage (V_{OUT})	−0.5 to V_{CC} +0.5V
Clamp Diode Current (I_{IK}, I_{OK})	±20 mA
DC Output Current, per pin (I_{OUT})	±25 mA
DC V_{CC} or GND Current, per pin (I_{CC})	±50 mA
Storage Temperature Range (T_{STG})	−65°C to +150°C
Power Dissipation (P_D) (Note 3)	600 mW
S.O. Package only	500 mW
Lead Temp. (T_L) (Soldering 10 seconds)	260°C

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})	2	6	V
DC Input or Output Voltage (V_{IN}, V_{OUT})	0	V_{CC}	V
Operating Temp. Range (T_A)			
MM74HC	−40	+85	°C
MM54HC	−55	+125	°C

DC Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	V_{CC}	T_A = 25°C	74HC T_A = −40 to 85°C	54HC T_A = −55 to 125°C	Units
				Typ	Guaranteed Limits		
V_{T+}	Positive Going Threshold Voltage	Minimum	2.0V	1.2	1.0	1.0	V
			4.5V	2.7	2.0	2.0	V
			6.0V	3.2	3.0	3.0	V
		Maximum	2.0V	1.2	1.5	1.5	V
			4.5V	2.7	3.15	3.15	V
			6.0V	3.2	4.2	4.2	V
V_{T-}	Negative Going Threshold Voltage	Minimum	2.0V	0.7	0.3	0.3	V
			4.5V	1.8	0.9	0.9	V
			6.0V	2.2	1.2	1.2	V
		Maximum	2.0V	0.7	1.0	1.0	V
			4.5V	1.8	2.2	2.2	V
			6.0V	2.2	3.0	3.0	V
V_H	Hysteresis Voltage	Minimum	2.0V	0.5	0.2	0.2	V
			4.5V	0.9	0.4	0.4	V
			6.0V	1.0	0.5	0.5	V
		Maximum	2.0V	0.5	1.0	1.0	V
			4.5V	0.9	1.4	1.4	V
			6.0V	1.0	1.5	1.5	V
V_{OH}	Minimum High Level Output Voltage	V_{IN} = V_{IL} $\lvert I_{OUT}\rvert$ = 20 μA	2.0V	2.0	1.9	1.9	V
			4.5V	4.5	4.4	4.4	V
			6.0V	6.0	5.9	5.9	V
		V_{IN} = V_{IL} $\lvert I_{OUT}\rvert$ = 4.0 mA	4.5V	4.2	3.98	3.84	V
		$\lvert I_{OUT}\rvert$ = 5.2 mA	6.0V	5.7	5.48	5.34	V
V_{OL}	Maximum Low Level Output Voltage	V_{IN} = V_{IH} $\lvert I_{OUT}\rvert$ = 20 μA	2.0V	0	0.1	0.1	V
			4.5V	0	0.1	0.1	V
			6.0V	0	0.1	0.1	V
		V_{IN} = V_{IH} $\lvert I_{OUT}\rvert$ = 4.0 mA	4.5V	0.2	0.26	0.33	0.4	V
		$\lvert I_{OUT}\rvert$ = 5.2 mA	6.0V	0.2	0.26	0.33	0.4	V
I_{IN}	Maximum Input Current	V_{IN} = V_{CC} or GND	6.0V		±0.1	±1.0	±1.0	μA
I_{CC}	Maximum Quiescent Supply Current	V_{IN} = V_{CC} or GND I_{OUT} = 0 μA	6.0V		2.0	20	40	μA

Note 1: Absolute Maximum Ratings are those values beyond which damage to the device may occur.

Note 2: Unless otherwise specified all voltages are referenced to ground.

Note 3: Power Dissipation temperature derating — plastic "N" package: −12 mW/°C from 65°C to 85°C; ceramic "J" package: −12 mW/°C from 100°C to 125°C.

Note 4: For a power supply of 5V ±10% the worst case output voltages (V_{OH}, and V_{OL}) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case V_{IH} and V_{IL} occur at V_{CC} = 5.5V and 4.5V respectively. (The V_{IH} value at 5.5V is 3.85V.) The worst case leakage current (I_{IN}, I_{CC}, and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0V values should be used.

AC Electrical Characteristics $V_{CC}=5V$, $T_A=25°C$, $C_L=15$ pF, $t_r=t_f=6$ ns

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
t_{PHL}, t_{PLH}	Maximum Propagation Delay		12	22	ns

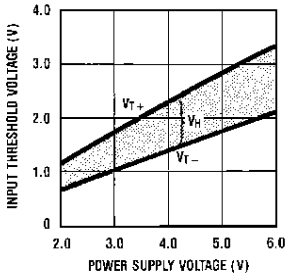
AC Electrical Characteristics $V_{CC}=2.0V$ to $6.0V$, $C_L=50$ pF, $t_r=t_f=6$ ns (unless otherwise specified)

Symbol	Parameter	Conditions	V_{CC}	$T_A=25°C$		74HC $T_A=-40$ to $85°C$	54HC $T_A=-55$ to $125°C$	Units
				Typ	Guaranteed Limits			
t_{PHL}, t_{PLH}	Maximum Propagation Delay		2.0V	60	125	156	188	ns
			4.5V	13	25	31	38	ns
			6.0V	11	21	26	32	ns
t_{TLH}, t_{THL}	Maximum Output Rise and Fall Time		2.0V	30	75	95	110	ns
			4.5V	8	15	19	22	ns
			6.0V	7	13	16	19	ns
C_{PD}	Power Dissipation Capacitance (Note 5)	(per gate)		27				pF
C_{IN}	Maximum Input Capacitance			5	10	10	10	pF

Note 5: C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Typical Performance Characteristics

Input Threshold, V_{T+}, V_{T-}, vs Power Supply Voltage



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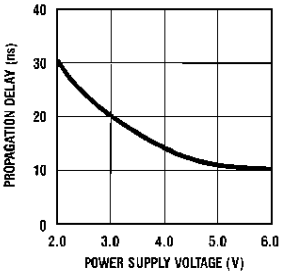
Propagation Delay vs Power Supply



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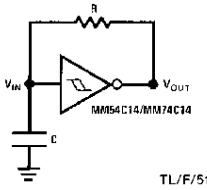
Typical Applications

Low Power Oscillator



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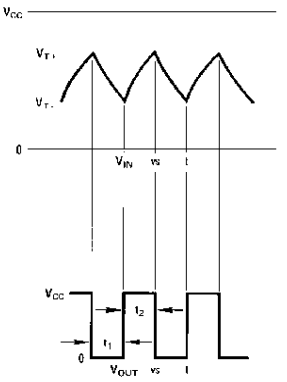
$$t_1 \approx RC \ln \frac{V_{T+}}{V_{T-}}$$

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

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

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



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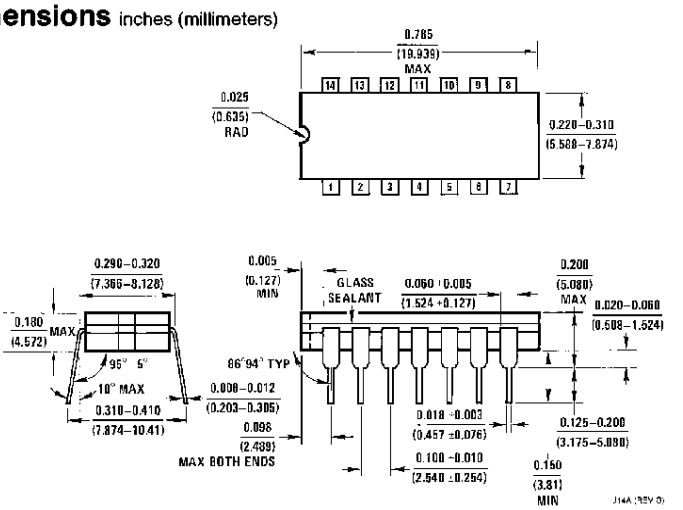
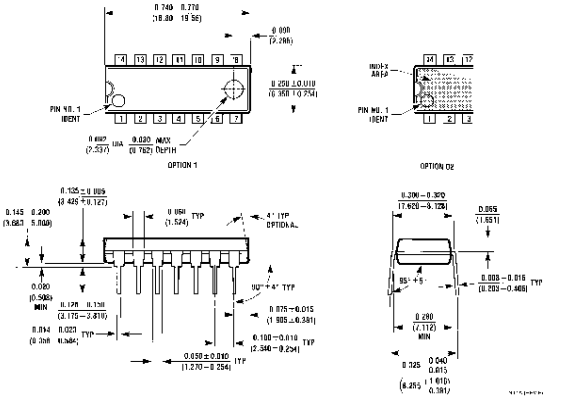
Physical Dimensions inches (millimeters)



Dual-In-Line Package (J)
Order Number MM54HC14J or MM74HC14J
NS Package J14A



Dual-In-Line Package (N)
Order Number MM74HC14N
NS Package N14A

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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.

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