

MM54HC02/MM74HC02



T-43-21

MM54HC02/MM74HC02 Quad 2-Input NOR Gate

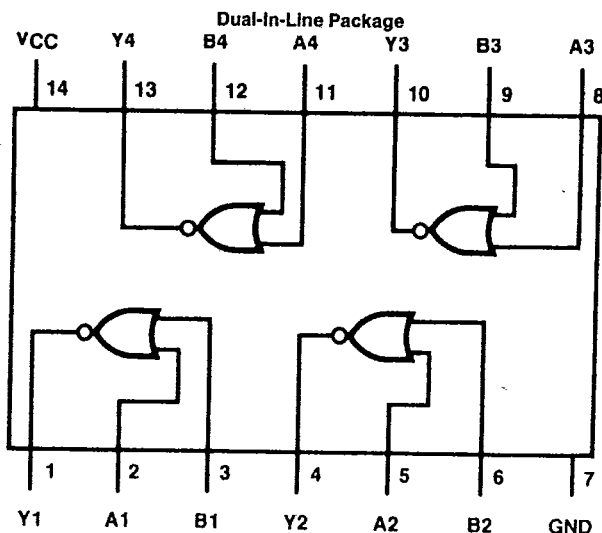
General Description

These NOR gates utilize advanced silicon-gate CMOS technology to achieve operating speeds similar to LS-TTL gates with the low power consumption of standard CMOS integrated circuits. All gates have buffered outputs, providing high noise immunity and the ability to drive 10 LS-TTL loads. The 54HC/74HC logic family is functionally as well as pin-out 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: 8 ns
- Wide power supply range: 2-6V
- Low quiescent supply current: 20 μ A maximum (74HC Series)
- Low input current: 1 μ A maximum
- High output current: 4 mA minimum

Connection and Logic Diagrams



Top View

TL/F/5294-1

Order Number MM54HC02* or MM74HC02*

*Please look into Section 8, Appendix D for availability of various package types.



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Absolute Maximum Ratings (Notes 1 & 2)

If Military/Aerospace specified devices are required, 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
Input Rise or Fall Times (t _r , t _f)			
V _{CC} =2.0V		1000	ns
V _{CC} =4.5V		500	ns
V _{CC} =6.0V		400	ns

DC Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	V _{CC}	T _A =25°C		74HC	54HC	Units	
				Typ	Guaranteed Limits				
				T _A = -40 to 85°C		T _A = -55 to 125°C			
V _{IH}	Minimum High Level Input Voltage		2.0V	1.5	1.5	1.5	V		
			4.5V	3.15	3.15	3.15	V		
			6.0V	4.2	4.2	4.2	V		
V _{IL}	Maximum Low Level Input Voltage**		2.0V	0.5	0.5	0.5	V		
			4.5V	1.35	1.35	1.35	V		
			6.0V	1.8	1.8	1.8	V		
V _{OH}	Minimum High Level Output Voltage	V _{IN} =V _{IL} I _{OUT} ≤ 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} I _{OUT} ≤ 4.0 mA I _{OUT} ≤ 5.2 mA	4.5V	4.2	3.98	3.84	3.7	V	
			6.0V	5.7	5.48	5.34	5.2	V	
V _{OL}	Maximum Low Level Output Voltage	V _{IN} =V _{IH} or V _{IL} I _{OUT} ≤ 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} or V _{IL} I _{OUT} ≤ 4.0 mA I _{OUT} ≤ 5.2 mA	4.5V	0.2	0.26	0.33	0.4	V	
			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.

**V_{IL} limits are currently tested at 20% of V_{CC}. The above V_{IL} specification (30% of V_{CC}) will be implemented no later than Q1, CY'89.

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

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Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
t_{PHL}, t_{PLH}	Maximum Propagation Delay		8	15	ns

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

Symbol	Parameter	Conditions	V_{CC}	$T_A=25^{\circ}C$		74HC	54HC	Units
				Typ		$T_A=-40\text{ to }85^{\circ}C$	$T_A=-55\text{ to }125^{\circ}C$	
t_{PHL}, t_{PLH}	Maximum Propagation Delay		2.0V	45	90	113	134	ns
			4.5V	9	18	23	27	ns
			6.0V	8	15	19	23	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)		20				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, $I_S=C_{PD} V_{CC} f + I_{CC}$.