Quad Two-Input Exclusive-OR Gate

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (Total)
7486	14ns	30mA
74LS86	10ns	6.1mA
74S86	7ns	50mA

ORDERING CODE

PACKAGES	COMMERCIAL RANGES V_{CC} = 5V ± 5%; T_A = 0°C to +70°C	MILITARY RANGES V_{CC} = 5V ± 10%; T_A = −55°C to +125°C
Plastic DIP	N7486N • N74LS86N N74S86N	
Plastic SO	N74LS86D • N74S86D	
Ceramic DIP		S5486F • S54LS86F S54S86F
Flatpack		S5486W • S54LS86W S54S86W
LLCC		S54LS86G

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FUNCTION TABLE

INPUTS		OUTPUT
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

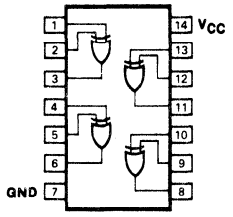
H = HIGH voltage level
L = LOW voltage level

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

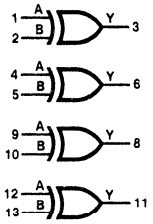
PINS	DESCRIPTION	54/74	54/74S	54/74LS
A, B	Inputs	1ul	1Sul	1LSul
Y	Output	10ul	10Sul	10LSul

NOTE
Where a 54/74 unit load (ul) is understood to be 40μA I_{IH} and −1.6mA I_{IL}, a 54/74S unit load (Sul) is 50μA I_{IH} and −2.0mA I_{IL}, and a 54/74LS unit load (LSul) is 20μA I_{IH} and −0.4mA I_{IL}.

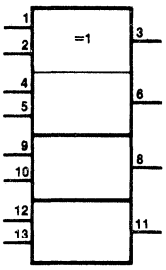
PIN CONFIGURATION



LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



ABSOLUTE MAXIMUM RATINGS (Over operating free-air temperature range unless otherwise noted.)

PARAMETER		54	54LS	54S	74	74LS	74S	UNIT
V_{CC}	Supply voltage	7.0	7.0	7.0	7.0	7.0	7.0	V
V_{IN}	Input voltage	−0.5 to +5.5	−0.5 to +7.0	−0.5 to +5.5	−0.5 to +5.5	−0.5 to +7.0	−0.5 to +5.5	V
I_{IN}	Input current	−30 to +5	−30 to +1	−30 to +5	−30 to +5	−30 to +1	−30 to +5	mA
V_{OUT}	Voltage applied to output in HIGH output state	−0.5 to +V_{CC}	−0.5 to +V_{CC}	−0.5 to +V_{CC}	−0.5 to +V_{CC}	−0.5 to +V_{CC}	−0.5 to +V_{CC}	V
T_A	Operating free-air temperature range	−55 to +125			0 to 70			°C

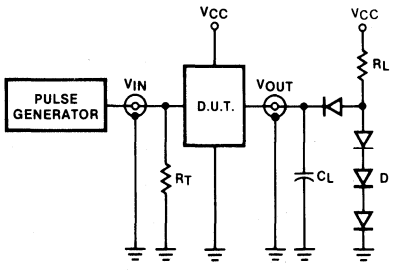
RECOMMENDED OPERATING CONDITIONS

PARAMETER			54/74			54/74LS			54/74S			UNIT
			Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	
V_{CC}	Supply voltage	Mil	4.5	5.0	5.5	4.5	5.0	5.5	4.5	5.0	5.5	V
		Com'l	4.75	5.0	5.25	4.75	5.0	5.25	4.75	5.0	5.25	V
V_{IH}	HIGH-level input voltage		2.0			2.0			2.0			V
V_{IL}	LOW-level input voltage	Mil			+0.8			+0.7			+0.8	V
		Com'l			+0.8			+0.8			+0.8	V
I_{IK}	Input clamp current				−12			−18			−18	mA
I_{OH}	HIGH-level output current				−800			−400			−1000	μA
I_{OL}	LOW-level output current	Mil			16			4			20	mA
		Com'l			16			8			20	mA
T_A	Operating free-air temperature	Mil	−55		+125	−55		+125	−55		+125	°C
		Com'l	0		70	0		70	0		70	°C

NOTE
V_{IL} = +0.7V MAX for 54S at T_A = +125°C only.

TEST CIRCUITS AND WAVEFORMS

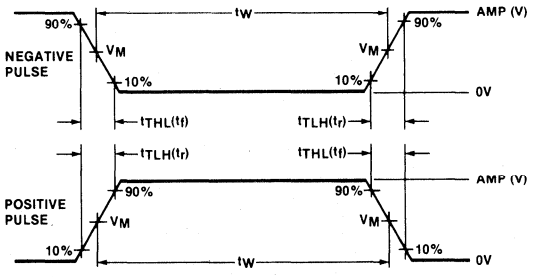
TEST CIRCUIT FOR 54/74 TOTEM-POLE OUTPUTS



DEFINITIONS

R_L = Load resistor to V_{CC}; see AC CHARACTERISTICS for value.
C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.
R_T = Termination resistance should be equal to Z_{OUT} of Pulse Generators.
D = Diodes are 1N916, 1N3064, or equivalent.
t_{TLH}, t_{THL} Values should be less than or equal to the table entries.

INPUT PULSE DEFINITIONS



V_M = 1.3V for 54LS/74LS; V_M = 1.5V for all other TTL families.

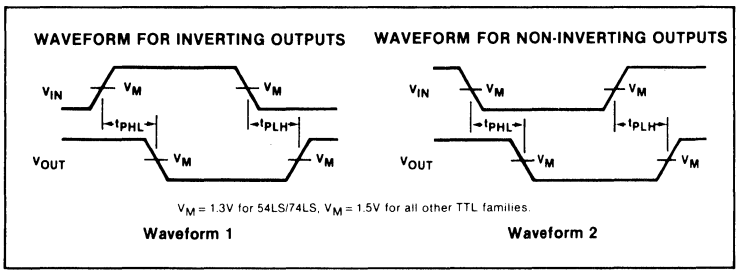
FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	Pulse Width	t_{TLH}	t_{THL}
54/74	3.0V	1MHz	500ns	7ns	7ns
54LS/74LS	3.0V	1MHz	500ns	15ns	6ns
54S/74S	3.0V	1MHz	500ns	2.5ns	2.5ns

DC ELECTRICAL CHARACTERISTICS (Over recommended operating free-air temperature range unless otherwise noted.)

PARAMETER		TEST CONDITIONS[1]			54/7486			54/74LS86			54/74S86			UNIT
					Min	Typ[2]	Max	Min	Typ[2]	Max	Min	Typ[2]	Max	
V_{OH}	HIGH-level output voltage	V_{CC} = MIN, V_{IH} = MIN, V_{IL} = MAX, I_{OH} = MAX		Mil	2.4	3.4		2.5	3.4		2.5	3.4		V
				Com'l	2.4	3.4		2.7	3.4		2.7	3.4		V
V_{OL}	LOW-level output voltage	V_{CC} = MIN, V_{IH} = MIN, V_{IL} = MAX	I_{OL} = MAX	Mil		0.2	0.4		0.25	0.4			0.5[5]	V
				Com'l		0.2	0.4		0.35	0.5			0.5	V
			I_{OL} = 4mA	74LS					0.25	0.4				V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = I_{IK}					– 1.5			– 1.5			– 1.2	V
I_I	Input current at maximum input voltage	V_{CC} = MAX	V_I = 5.5V				1.0						1.0	mA
			V_I = 7.0V							0.2				mA
I_{IH}	HIGH-level input current	V_{CC} = MAX	V_I = 2.4V				40							μA
			V_I = 2.7V							40			50	μA
I_{IL}	LOW-level input current	V_{CC} = MAX	V_I = 0.4V				– 1.6			– 0.8				mA
			V_I = 0.5V										– 2.0	mA
I_{OS}	Short-circuit output current[3]	V_{CC} = MAX		Mil	– 20		– 55	– 15		– 100	– 40		– 100	mA
				Com'l	– 18		– 55	– 15		– 100	– 40		– 100	mA
I_{CC}	Supply current[4] (total)	V_{CC} = MAX		Mil		30	43		6.1	10		50	75	mA
				Com'l		30	50		6.1	10		50	75	mA

NOTES
1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at V_{CC} = 5V, T_A = 25°C.
3. I_{OS} is tested with V_{OUT} = + 0.5V and V_{CC} = V_{CC} MAX + 0.5V. Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.
4. I_{CC} is measured with inputs grounded and outputs open.
5. V_{OL} = + 0.45V MAX for 54S at T_A = + 125°C only.

AC WAVEFORMS



AC CHARACTERISTICS T_A = 25°C, V_{CC} = 5.0V

PARAMETER		TEST CONDITIONS	54/74		54/74LS		54/74S		UNIT
			C_L = 15pF, R_L = 400Ω		C_L = 15pF, R_L = 2kΩ		C_L = 15pF, R_L = 280Ω		
			Min	Max	Min	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation delay A or B to output	Other input LOW Waveform 2		23 17		23 17		10.5 10	ns
t_{PLH} t_{PHL}	Propagation delay A or B to output	Other input HIGH Waveform 1		30 22		30 22		10.5 10	ns