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# MM74HC86

## Quad 2-Input Exclusive OR Gate

### Features

- Typical Propagation Delay: 9ns
- Wide Operating Voltage Range: 2–6V
- Low Input Current: 1mA Maximum
- Low Quiescent Current: 20mA Max. (74 Series)
- Output Drive Capability: 10 LS-TTL Loads

### Description

The MM74HC86 exclusive OR gate utilizes advanced silicon-gate CMOS technology to achieve operating speeds similar to equivalent LS-TTL gates, while maintaining the low power consumption and high noise immunity characteristic of standard CMOS integrated circuits. These gates are fully buffered and have a fanout of 10 LS-TTL loads. The 74HC logic family is functionally as well as pin-out compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to  $V_{CC}$  and ground.

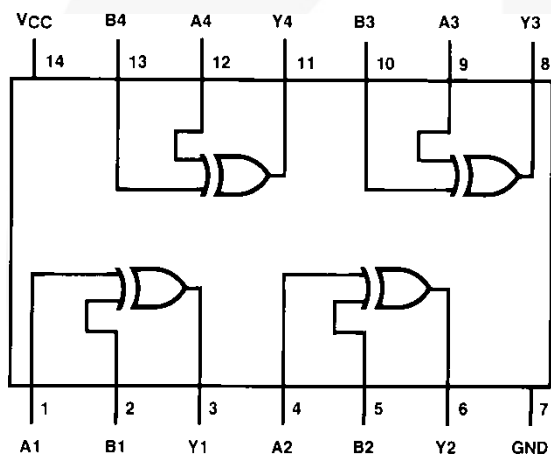


Figure 1. Pin Assignments (Top View)

Table 1. Truth Table

Inputs		Outputs
A	B	$Y^{(1)}$
L	L	L
L	H	H
H	L	H
H	H	L

**Note:**

1.  $Y = A \oplus B = \bar{A}B + A\bar{B}$

### Ordering Information

Part Number	Operating Temperature Range	Package	Packing Method
MM74HC86M	-40 to +85°C	14-Lead, Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow	Tube
MM74HC86MX			Tape & Reel
MM74HC86MTC		14-Lead, Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide	Tube
MM74HC86MTCX			Tape & Reel

**Note:**

2. Pb-Free package per JEDEC J-STD-020B.

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. Absolute maximum ratings are stress ratings only. Unless otherwise specified, all voltages are referenced to ground.

Symbol	Parameter	Min.	Max.	Unit
$V_{CC}$	Supply Voltage	-0.5	7.0	V
$V_{IN}$	DC Input Voltage	-1.5	$V_{CC} + 1.5$	V
$V_{OUT}$	DC Output Voltage	-0.5	$V_{CC} + 0.5$	V
$I_{IK}, I_{OK}$	Clamp Diode Current	±20		mA
$I_{OUT}$	DC Output Current, per Pin	±25		mA
$I_{CC}$	DC VCC or GND Current, per Pin	±50		mA
$T_{STG}$	Storage Temperature Range	-65	+150	°C
$T_L$	Lead Temperature (Soldering, 10 Seconds)		260	°C
$P_D$	Power Dissipation <sup>(3, 4)</sup>		600	mW

### Note:

- Power dissipation temperature derating — plastic “N” package: -12 mW/°C from 65°C to 85°C.
- S.O. package only 500mW.

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Conditions	Min.	Max.	Unit
$V_{CC}$	Supply Voltage		2	6	V
$V_{IN}, V_{OUT}$	DC Input or Output Voltage		0	$V_{CC}$	V
$T_A$	Operating Temperature Range		-40	+85	°C
$t_R, t_F$	Input Rise or Fall Times	$V_{CC} = 2.0V$		1000	ns
		$V_{CC} = 4.5V$		500	
		$V_{CC} = 6.0V$		400	

DC Electrical Characteristics<sup>(5)</sup>

Symbol	Parameter	Condition	V <sub>CC</sub> (V)	T <sub>A</sub> =25°C		T <sub>A</sub> =-40 to +85°C	T <sub>A</sub> =-55 to +125°C	Units
				Typ.	Guaranteed Limit			
V <sub>IH</sub>	Minimum HIGH Level Input Voltage		2.0		1.5	1.5	1.5	V
			4.5		3.15	3.15	3.15	
			6.0		4.2	4.2	4.2	
V <sub>IL</sub>	Maximum LOW Level Input Voltage		2.0		0.5	0.5	0.5	V
			4.5		1.35	1.35	1.35	
			6.0		1.8	1.8	1.8	
V <sub>OH</sub>	Minimum HIGH Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 20μA	2.0	2.0	1.9	1.9	1.9	V
			4.5	4.5	4.4	4.4	4.4	
			6.0	6.0	5.9	5.9	5.9	
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 4.0mA	4.5	4.2	3.98	3.84	3.70	
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 5.2mA	6.0	5.7	5.48	5.34	5.20	
V <sub>OL</sub>	Maximum LOW Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 20μA	2.0	0	0.1	0.1	0.1	V
			4.5	0	0.1	0.1	0.1	
			6.0	0	0.1	0.1	0.1	
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 4.0mA	4.5	0.2	0.26	0.33	0.40	
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 5.2mA	6.0	0.2	0.26	0.33	0.40	
I <sub>IN</sub>	Maximum Input Current	V <sub>IN</sub> = V <sub>CC</sub> or GND	6.0		±0.1	±1.0	±1.0	mA
I <sub>CC</sub>	Maximum Quiescent Supply Current	V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>OUT</sub> = 0mA	6.0		2.0	20	40	mA

**Note:**

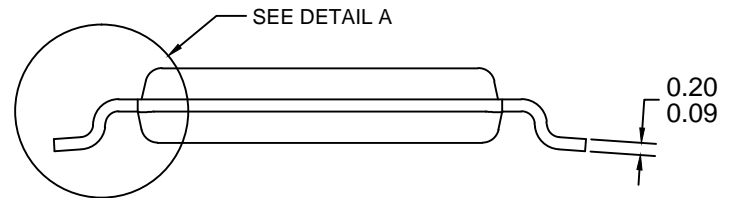
5. For a power supply of 5V ±10%, the worst-case output voltages (V<sub>OH</sub> and V<sub>OL</sub>) occur for HC at 4.5V. Thus, the 4.5V values should be used when designing with this supply. Worst-case V<sub>IH</sub> and V<sub>IL</sub> occur at V<sub>CC</sub> = 5.5V and 4.5V, respectively. (The V<sub>IH</sub> values at 5V and 5.5V are 3.5V and 3.85V, respectively.) The worst-case leakage current (I<sub>IN</sub>, I<sub>CC</sub>, and I<sub>OZ</sub>) occurs for CMOS at the higher voltage, so the 6.0V values should be used.

## AC Electrical Characteristics

Symbol	Parameter	Conditions	V <sub>CC</sub>	T <sub>A</sub> =25°C		T <sub>A</sub> =-40 to +85°C	T <sub>A</sub> =-55 to +125°C	Unit s
				Typ.	Guaranteed Limit			
t <sub>PHL</sub> , t <sub>PLH</sub>	Maximum Propagation Delay	C <sub>L</sub> = 15pF, t <sub>R</sub> = t <sub>F</sub> = 6ns	5.0	12		20		ns
t <sub>PHL</sub> , t <sub>PLH</sub>	Maximum Propagation Delay		2.0	60	120	151	179	ns
			4.5	12	24	30	36	
			6.0	10	20	26	30	
t <sub>TLH</sub> , t <sub>THL</sub>	Maximum Output Rise and Fall Time	C <sub>L</sub> = 50pF, t <sub>R</sub> = t <sub>F</sub> = 6ns	2.0	30	75	95	110	ns
			4.5	8	15	19	22	
			6.0	7	13	16	19	
C <sub>PD</sub>	Power Dissipation Capacitance (per Gate) <sup>(6)</sup>			25				pF
C <sub>IN</sub>	Maximum Input Capacitance			5	10	10	10	pF

**Note:**

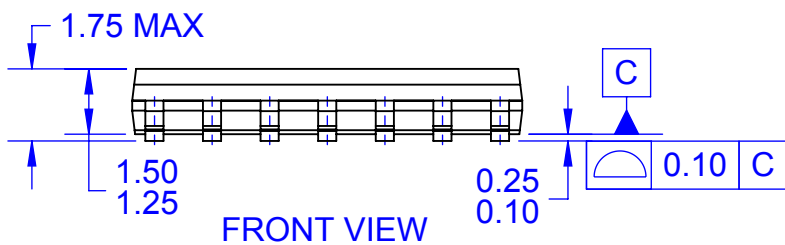
6. C<sub>PD</sub> determines the no-load dynamic power consumption,  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ , and the no load dynamic current consumption,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .



NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 2009.
- E. LANDPATTERN STANDARD: SOP65P640X110-14M.
- F. DRAWING FILE NAME: MKT-MTC14rev7.





NOTES:

- A. CONFORMS TO JEDEC MS-012, VARIATION AB, ISSUE C
- B. ALL DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS
- D. LAND PATTERN STANDARD: SOIC127P600X145-14M
- E. CONFORMS TO ASME Y14.5M, 2009
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