

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.

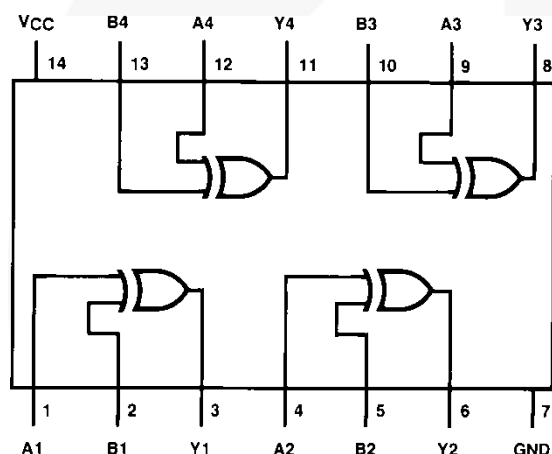


Figure 1. Pin Assignments (Top View)

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 ^(3, 4)		600	mW

Note:

3. Power dissipation temperature derating — plastic “N” package: -12 mW/°C from 65°C to 85°C.
4. 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⁽⁵⁾

Symbol	Parameter	Condition	V _{CC} (V)	T _A =25°C		T _A =-40 to +85°C	T _A =-55 to +125°C	Units
				Typ.	Guaranteed Limit			
V _{IH}	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 _{IL}	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 _{OH}	Minimum HIGH Level Output Voltage	V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 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 _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 4.0mA	4.5	4.2	3.98	3.84	3.70	
		V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 5.2mA	6.0	5.7	5.48	5.34	5.20	
V _{OL}	Maximum LOW Level Output Voltage	V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 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 _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 4.0mA	4.5	0.2	0.26	0.33	0.40	
		V _{IN} = V _{IH} or V _{IL} , I _{OUT} ≤ 5.2mA	6.0	0.2	0.26	0.33	0.40	
I _{IN}	Maximum Input Current	V _{IN} = V _{CC} or GND	6.0		±0.1	±1.0	±1.0	mA
I _{CC}	Maximum Quiescent Supply Current	V _{IN} = V _{CC} or GND, I _{OUT} = 0mA	6.0		2.0	20	40	mA

Note:

5. For a power supply of $5\text{V} \pm 10\%$, 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 $V_{CC} = 5.5\text{V}$ and 4.5V, respectively. (The V_{IH} values at 5V and 5.5V are 3.5V and 3.85V, respectively.) The worst-case leakage current (I_{IN} , I_{CC} , and I_{OZ}) occurs for CMOS at the higher voltage, so the 6.0V values should be used.

AC Electrical Characteristics

Symbol	Parameter	Conditions	V _{CC}	T _A =25°C		T _A =-40 to +85°C	T _A =-55 to +125°C	Units	
				Typ.	Guaranteed Limit				
t _{PHL} , t _{PLH}	Maximum Propagation Delay	C _L = 15pF, t _R = t _F = 6ns	5.0	12		20		ns	
t _{PHL} , t _{PLH}	Maximum Propagation Delay	C _L = 50pF, t _R = t _F = 6ns	2.0	60	120	151	179	ns	
			4.5	12	24	30	36		
			6.0	10	20	26	30		
t _{TLH} , t _{THL}	Maximum Output Rise and Fall Time		2.0	30	75	95	110	ns	
			4.5	8	15	19	22		
			6.0	7	13	16	19		
C _{PD}	Power Dissipation Capacitance (per Gate) ⁽⁶⁾				25				pF
C _{IN}	Maximum Input Capacitance				5	10	10	10	pF

Note:

6. 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, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Physical Dimensions

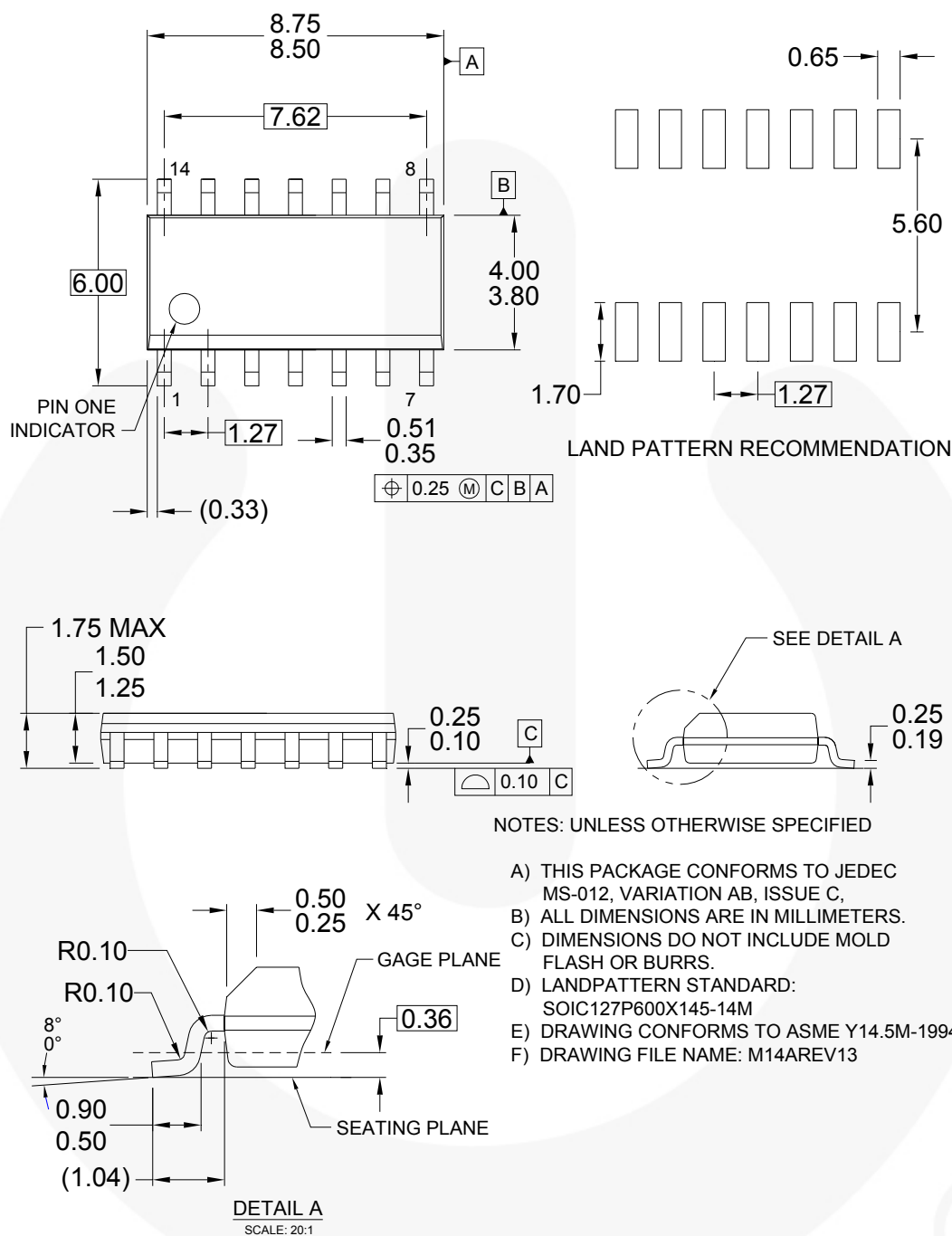
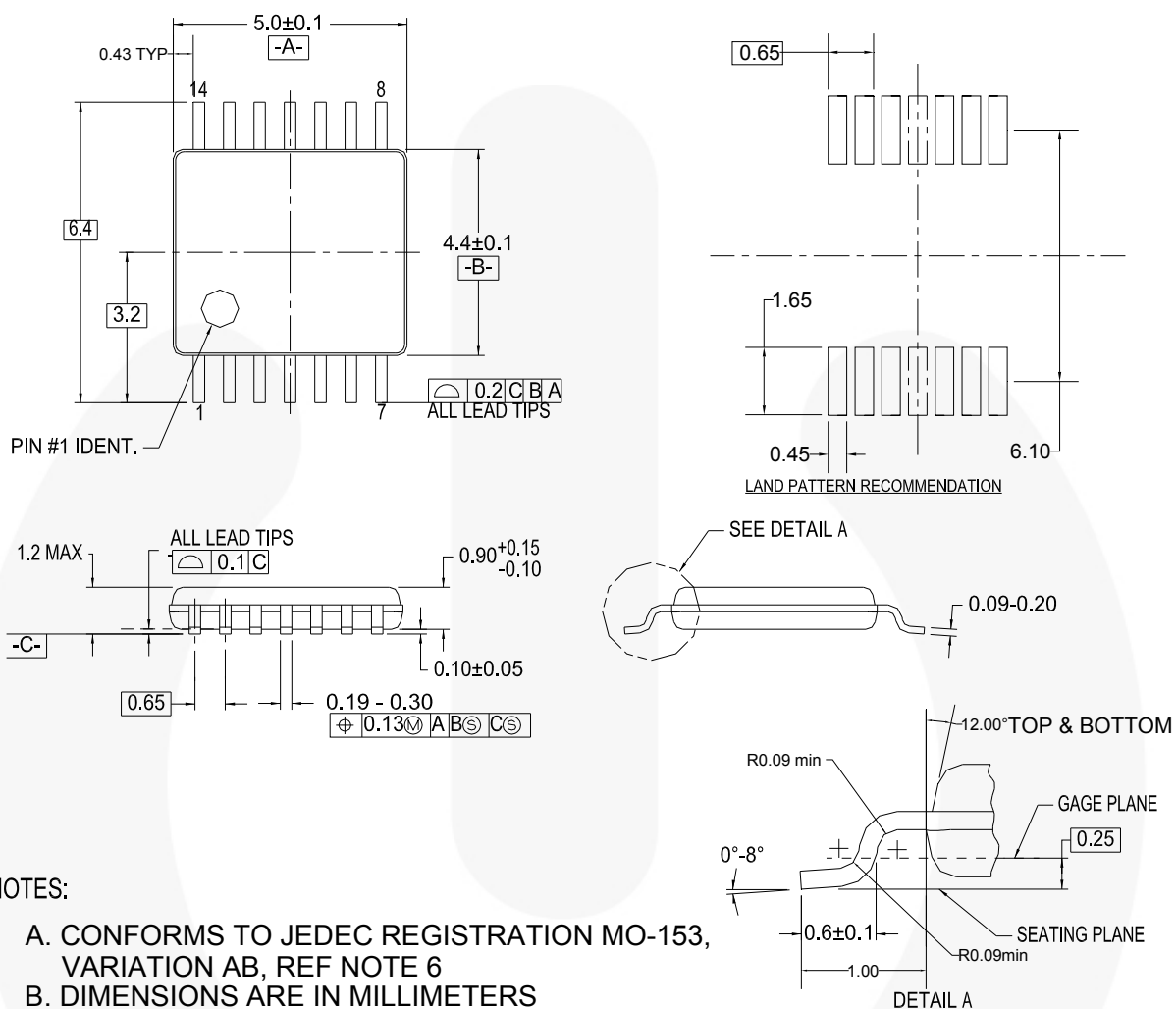


Figure 2. 14-Lead, Small-Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:
<http://www.fairchildsemi.com/packaging/>.

Physical Dimensions



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, 1982
- E. LANDPATTERN STANDARD: SOP65P640X110-14M
- F. DRAWING FILE NAME: MTC14REV6

Figure 3. 14-Lead, Thin-Shrink Small-Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:
<http://www.fairchildsemi.com/packaging/>



TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

2Cool™	F-PFS™	PowerTrench®	The Power Franchise®
AccuPower™	FRFET®	PowerXS™	the power franchise
AX-CAP™*	Global Power Resource™	Programmable Active Droop™	TinyBoost™
BitSiC™	GreenBridge™	QFET®	TinyBuck™
Build it Now™	Green FPS™	QS™	TinyCalc™
CorePLUS™	Green FPS™ e-Series™	Quiet Series™	TinyLogic®
CorePOWER™	Gmax™	RapidConfigure™	TINYOPTO™
CROSSVOLT™	GTO™		TinyPower™
CTL™	IntelliMAX™	Saving our world, 1mW/W at a time™	TinyPWM™
Current Transfer Logic™	ISOPLANAR™	SignalWise™	TinyWire™
DEUXPEED®	Making Small Speakers Sound Louder and Better™	SmartMax™	TranSiC™
Dual Cool™	MegaBuck™	SMART START™	TriFault Detect™
EcoSPARK®	MICROCOUPLER™	Solutions for Your Success™	TRUECURRENT®*
EfficientMax™	MicroFET™	SPM®	µSerDes™
ESBC™	MicroPak™	STEALTH™	
	MicroPak2™	SuperFET®	UHC®
Fairchild®	MillerDrive™	SuperSOT™-3	Ultra FRFET™
Fairchild Semiconductor®	MotionMax™	SuperSOT™-6	UniFET™
FACT Quiet Series™	Motion-SPM™	SuperSOT™-8	VCX™
FACT®	mWSaver™	SupreMOS®	VisualMax™
FAST®	OptoHiT™	SyncFET™	VoltagePlus™
FastvCore™	OPTOLOGIC®	Sync-Lock™	XS™
FETBench™	OPTOPLANAR®		
FlashWriter®*			
FPS™			

* Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in 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.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

Rev. I61