

2-Input Exclusive OR Gate / CMOS Logic Level Shifter with LSTTL-Compatible Inputs

MC74VHC1GT86

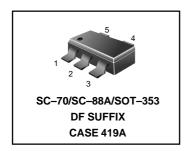
The MC74VHC1GT86 is an advanced high speed CMOS 2–input Exclusive OR gate fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

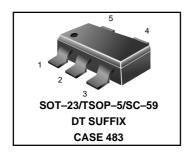
The internal circuit is composed of three stages, including a buffer output which provides high noise immunity and stable output.

The device input is compatible with TTL-type input thresholds and the output has a full 5 V CMOS level output swing. The input protection circuitry on this device allows overvoltage tolerance on the input, allowing the device to be used as a logic-level translator from 3.0 V CMOS logic to 5.0 V CMOS Logic or from 1.8 V CMOS logic to 3.0 V CMOS Logic while operating at the high-voltage power supply.

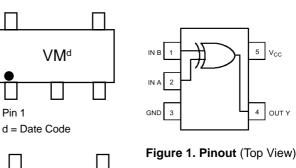
The MC74VHC1GT86 input structure provides protection when voltages up to 7 V are applied, regardless of the supply voltage. This allows the MC74VHC1GT86 to be used to interface 5 V circuits to 3 V circuits. The output structures also provide protection when $V_{CC} = 0 \text{ V}$. These input and output structures help prevent device destruction caused by supply voltage – input/output voltage mismatch, battery backup, hot insertion, etc.

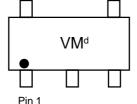
- High Speed: $t_{PD} = 4.8 \text{ ns}$ (Typ) at $V_{CC} = 5 \text{ V}$
- Low Power Dissipation: I $_{CC}$ = 2 mA (Max) at T $_{A}$ = 25°C
- TTL-Compatible Inputs: V _{IL} = 0.8 V; V _{IH} = 2.0 V
- • CMOS–Compatible Outputs: V $_{\text{OH}}$ > 0.8 V $_{\text{CC}}$; V $_{\text{OL}}$ < 0.1 V $_{\text{CC}}$ @Load
- Power Down Protection Provided on Inputs and Outputs
- Balanced Propagation Delays
- Pin and Function Compatible with Other Standard Logic Families
- Chip Complexity: FETs = 83; Equivalent Gates = 16



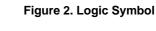


MARKING DIAGRAMS





d = Date Code



FUNCTION TABLE

Inpu	Output	
Α	В	Y
L	L	L
L	Н	Н
Н	L	Н
Н	Н	L

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.



MC74VHC1GT86

MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V _{cc}	DC Supply Voltage		- 0.5 to + 7.0	V
V _{IN}	DC Input Voltage		- 0.5 to +7.0	V
V _{OUT}	DC Output Voltage	V _{CC} =0	- 0.5 to +7.0	V
		High or Low State	-0.5 to V cc + 0.5	
I _{IK}	Input Diode Current		-20	mA
I _{ok}	Output Diode Current	$V_{out} < GND; V_{out} > V_{cc}$	+20	mA
I _{OUT}	DC Output Current, per Pin		+ 25	mA
I _{cc}	DC Supply Current, V cc and GND		+50	mA
P _D	Power dissipation in still air	SC-88A, TSOP-5	200	mW
θ JA	Thermal resistance	SC-88A, TSOP-5	333	°C/W
T∟	Lead Temperature, 1 mm from Case	for 10 s	260	°C
Τ _J	Junction Temperature Under Bias		+ 150	°C
T stg	Storage temperature		-65 to +150	°C
V _{ESD}	ESD Withstand Voltage	Human Body Model (Note 2)	>2000	V
		Machine Model (Note 3)	> 200	
		Charged Device Model (Note 4)	N/A	
I LATCH-UP	Latch-Up Performance Above V co	and Below GND at 125°C (Note 5)	± 500	mA

- 1. Maximum Ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions eyond those indicated may adversely affect device reliability. Functional operation under absolute—maximum—rated conditions is not implied. Functional operation should be restricted to the Recommended Operating Conditions.
- 2. Derating SC-88A Package: -3 mW/°C from 65°C to 125°C
 - $-\,\text{TSOP5}$ Package: $-6\,\,\text{mW/°C}\,$ from 65°C to 125°C
- 3. Tested to EIA/JESD22-A114-A
- 4. Tested to EIA/JESD22-A115-A
- 5. Tested to JESD22-C101-A
- 6. Tested to EIA/JESD78

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit		
V cc	DC Supply Voltage		3.0	5.5	V	
V IN	DC Input Voltage		0.0	5.5	V	
V _{OUT}	DC Output Voltage		0.0	V cc	V	
T _A	Operating Temperature Range		– 55	+ 125	°C	
t r, t f	Input Rise and Fall Time	$V_{CC} = 3.3 \pm 0.3 \text{ V}$	0	100	ns/V	
		$V_{CC} = 5.0 \pm 0.5 V$	0	20		

DEVICE JUNCTION TEMPERATURE VERSUS TIME TO 0.1% BOND FAILURES

11112 10 011 70 20112 17 11201120								
Junction	Time,	Time,						
Temperature °C	Hours	Years						
80	1,032,200	117.8						
90	419,300	47.9						
100	178,700	20.4						
110	79,600	9.4						
120	37,000	4.2						
130	17,800	2.0						
140	8,900	1.0						

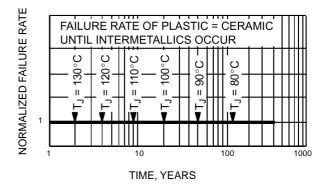


Figure 3. Failure Rate vs. Time Junction Temperature



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DC ELECTRICAL CHARACTERISTICS

			V cc	T _A = 25 °C			$T_A \leq 85^{\circ}C$ $-55^{\circ}C \leq T_A \leq 125^{\circ}C$				
Symbol	Parameter	Test Conditions	(V)	Min	Тур	Max	Min	Max	Min	Max	Unit
V _{IH}	Minimum High-Level										V
	Input Voltage		3.0	1.4			1.4		1.4		
			4.5	2.0			2.0		2.0		
			5.5	2.0			2.0		2.0		
V _{IL}	Maximum Low-Level										V
	Input Voltage		3.0			0.53		0.53		0.53	
			4.5			0.8		0.8		0.8	
			5.5			0.8		0.8		0.8	
V _{OH}	Minimum High-Level	$V_{IN} = V_{IH} \text{ or } V_{IL}$									V
	Output Voltage	$I_{OH} = -50 \mu A$	3.0	2.9	3.0		2.9		2.9		
	$V_{IN} = V_{IH} \text{ or } V_{IL}$		4.5	4.4	4.5		4.4		4.4		
		$V_{IN} = V_{IH} \text{ or } V_{IL}$									
		$I_{OH} = -4 \text{ mA}$	3.0	2.58			2.48		2.34		
		$I_{OH} = -8 \text{ mA}$	4.5	3.94			3.80		3.66		
V _{OL}	Maximum Low-Level	$V_{IN} = V_{IH} \text{ or } V_{IL}$									V
	Output Voltage	$I_{OL} = 50 \mu A$	3.0		0.0	0.1		0.1		0.1	
	$V_{IN} = V_{IH} \text{ or } V_{IL}$		4.5		0.0	0.1		0.1		0.1	
		$V_{IN} = V_{IH} \text{ or } V_{IL}$									1
		$I_{OL} = 4 \text{ mA}$	3.0			0.36		0.44		0.52	
		$I_{OL} = 8 \text{ mA}$	4.5			0.36		0.44		0.52	
I _{IN}	Maximum Input	$V_{IN} = 5.5 V \text{ or GND}$	0 to5.5			±0.1		±1.0		±1.0	μΑ
	Leakage Current										
I _{cc}	Maximum Quiescent	$V_{IN} = V_{CC}$ or GND	5.5			2.0		20		40	μΑ
	Supply Current										
I _{CCT}	Quiescent Supply	Input: V _{IN} = 3.4 V	5.5			1.35		1.50		1.65	mΑ
	Current										
I _{OPD}	Output Leakage	V _{OUT} = 5.5 V	0.0			0.5		5.0		10	μΑ
	Current										

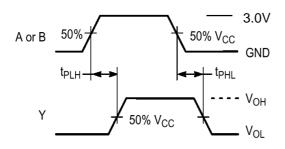
AC ELECTRICAL CHARACTERISTICS C $_{load}$ = 50 pF, Input t $_{r}$ = t $_{f}$ = 3.0 ns

				Т	T _A = 25 °C		T _A ≤ 85°C		-55°C <t<sub>A<125°C</t<sub>		
Symbol	Parameter	Test Conditions		Min	Тур	Max	Min	Max	Min	Max	Unit
t PLH,	Maximum	$V_{CC} = 3.3 \pm 0.3 V$	C _L = 15 pF		5.0	11.0		13.0		15.5	ns
t _{PHL}	Propagation Delay,		C _L = 50 pF		6.2	14.5		16.5		19.5	
	Input A or B to Y										
		$V_{CC} = 5.0 \pm 0.5 V$	C _L = 15 pF		3.1	6.8		8.0		10.0	
			C _L = 50 pF		4.2	8.8		10.0		12.0	
C IN	Maximum Input				5.5	10		10		10	pF
	Capacitance										
				Турі	cal @ 2	5°C, V	cc = 5. 0) V			
C PD	Power Dissipation Capacitance (Note 6)					11					pF

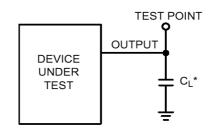
^{7.} C $_{PD}$ is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I $_{CC(OPR)} = C _{PD} \bullet V _{CC} \bullet f _{in} + I _{CC} \cdot C _{PD}$ is used to determine the noload dynamic power consumption; P $_{D} = C _{PD} \bullet V _{CC}^{2} \bullet f _{in} + I _{CC} \bullet V _{CC}$.



MC74VHC1GT86







*Includes all probe and jig capacitance

Figure 5. Test Circuit

DEVICE ORDERING INFORMATION

Device Order Number		Device Nomenclature							
	Circuit Indicator	Temp Range Identifier	Technology	Device Function	Package Suffix	Tape & Reel Suffix	Package Type	Tape and Reel Size	
MC74VHC1GT86DFT1	МС	74	VHC1G	T86	DF	T1	SC-70/SC-88A/	178 mm (7 in)	
							SOT-353	3000 Unit	
MC74VHC1GT86DFT2	MC	74	VHC1G	T86	DF	T2	SC-70/SC-88A/	178 mm (7 in)	
							SOT-353	3000 Unit	
MC74VHC1GT86DFT4	MC	74	VHC1G	T86	DF	T4	SC-70/SC-88A/	330 mm (13 in)	
							SOT-353	10,000 Unit	
MC74VHC1GT86DTT1	MC	74	VHC1G	T86	DT	T1	SOT-23/TSOPS/	178 mm (7 in)	
							SC-59	3000 Unit	
MC74VHC1GT86DTT3	MC	74	VHC1G	T86	DT	Т3	SOT-23/TSOPS/	330 mm (13 in)	
							SC-59	10,000 Unit	