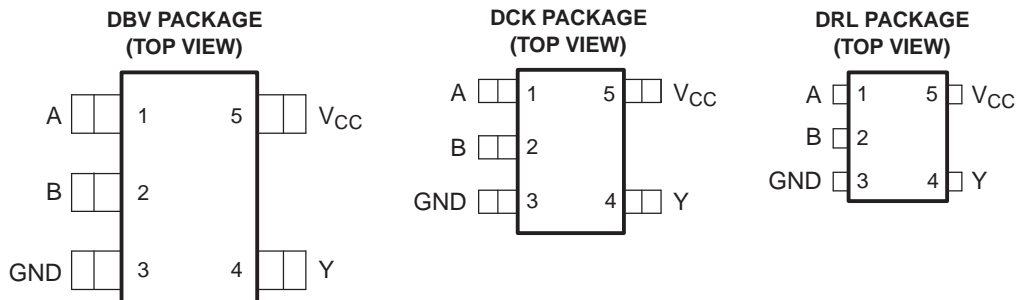


## FEATURES

- **Controlled Baseline**
  - One Assembly Site
  - One Test Site
  - One Fabrication Site
- **Extended Temperature Performance of –55°C to 125°C**
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product-Change Notification**
- **Qualification Pedigree** <sup>(1)</sup>
- **Operating Range of 2 V to 5.5 V**

(1) Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.

- **Max  $t_{pd}$  of 10 ns at 5 V**
- **Low Power Consumption, 10  $\mu$ A Max  $I_{CC}$**
- **$\pm 8$  mA Output Drive at 5 V**
- **Schmitt Trigger Action at All Inputs Makes the Circuit Tolerant for Slower Input Rise and Fall Time**
- **Latch-Up Performance Exceeds 250 mA Per JESD 17**
- 
- **ESD Protection Exceeds JESD 22**
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)



See mechanical drawings for dimensions.

## DESCRIPTION/ORDERING INFORMATION

The SN74AHC1G86 is a single 2-input exclusive-OR gate. The device performs the Boolean function  $Y = A \oplus B$  or  $Y = \bar{A}B + A\bar{B}$  in positive logic.

A common application is as a true/complement element. If one of the inputs is low, the other input is reproduced in true form at the output. If one of the inputs is high, the signal on the other input is reproduced inverted at the output.

### ORDERING INFORMATION<sup>(1)</sup>

$T_A$	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(3)</sup>
–55°C to 125°C	SOT (SC-70) - DCK	Reel of 3000	SN74AHC1G86MDCKREP	CGB

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at [www.ti.com](http://www.ti.com).  
 (2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).  
 (3) The actual top-side marking has one additional character that designates the assembly/test site.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

**FUNCTION TABLE**

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

**EXCLUSIVE-OR LOGIC**

An exclusive-OR gate has many applications, some of which can be represented better by alternative logic symbols.



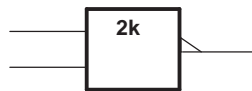
These are five equivalent exclusive-OR symbols valid for an SN74AHC1G86 gate in positive logic; negation may be shown at any two ports.

**LOGIC-IDENTITY ELEMENT**



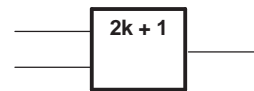
The output is active (low) if all inputs stand at the same logic level (i.e.,  $A = B$ ).

**EVEN-PARITY ELEMENT**



The output is active (low) if an even number of inputs (i.e., 0 or 2) are active.

**ODD-PARITY ELEMENT**



The output is active (high) if an odd number of inputs (i.e., only 1 of the 2) are active.

**Absolute Maximum Ratings<sup>(1)</sup>**

over operating free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage range	-0.5	7	V
$V_I$	Input voltage range <sup>(2)</sup>	-0.5	7	V
$V_O$	Output voltage range <sup>(2)</sup>	-0.5	$V_{CC} + 0.5$	V
$I_{IK}$	Input clamp current	$V_I < 0$	-20	mA
$I_{OK}$	Output clamp current	$V_O < 0$ or $V_O = 0$ to $V_{CC}$	$\pm 20$	mA
$I_O$	Continuous output current	$V_O = 0$ to $V_{CC}$	$\pm 25$	mA
	Continuous current through $V_{CC}$ or GND	$V_{CC}$ or GND	$\pm 50$	mA
$\theta_{JA}$	Package thermal impedance <sup>(3)</sup>	DCK package	252	$^{\circ}\text{C}/\text{W}$
$T_{stg}$	Storage temperature range	-65	150	$^{\circ}\text{C}$

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (3) The package thermal impedance is calculated in accordance with JESD 51-7.

**Recommended Operating Conditions<sup>(1)</sup>**

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage	2	5.5	V
$V_{IH}$	High-level input voltage	$V_{CC} = 2\text{ V}$	1.5	V
		$V_{CC} = 3\text{ V}$	2.1	
		$V_{CC} = 5.5\text{ V}$	3.85	
$V_{IL}$	Low-level input voltage	$V_{CC} = 2\text{ V}$	0.5	V
		$V_{CC} = 3\text{ V}$	0.9	
		$V_{CC} = 5.5\text{ V}$	1.65	
$V_I$	Input voltage	0	5.5	V
$V_O$	Output voltage	0	$V_{CC}$	V
$I_{OH}$	High-Level output current	$V_{CC} = 2\text{ V}$	–50	$\mu\text{A}$
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	–4	mA
		$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	–8	
$I_{OL}$	Low-Level output current	$V_{CC} = 2\text{ V}$	50	$\mu\text{A}$
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	4	mA
		$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	8	
$\Delta t/\Delta v$	Input transition rise or fall rate	$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	100	ns/V
		$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	20	
$T_A$	Operating free-air temperature	–55	125	$^{\circ}\text{C}$

(1) All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

# SN74AHC1G86-EP SINGLE 2-INPUT EXCLUSIVE-OR GATE

SCLS709–FEBRUARY 2008

## Electrical Characteristics

over operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C			T <sub>A</sub> = -55°C TO 125°C		UNIT
			MIN	TYP	MAX	MIN	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = -50 μA	2 V	1.9	2		1.9	V	
		3 V	2.9	3		2.9		
		4.5 V	4.4	4.5		4.4		
	I <sub>OH</sub> = -4 mA	3 V	2.58			2.48		
	I <sub>OH</sub> = -8 mA	4.5 V	3.94			3.8		
V <sub>OL</sub>	I <sub>OL</sub> = 50 μA	2 V			0.1		0.1	V
		3 V			0.1		0.1	
		4.5 V			0.1		0.1	
	I <sub>OL</sub> = 4 mA	3 V			0.36		0.44	
	I <sub>OL</sub> = 8 mA	4.5 V			0.36		0.44	
I <sub>I</sub>	V <sub>I</sub> = 5.5 V or GND	0 V to 5.5 V			±0.1		±1	μA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V			1		10	μA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V		4	10		10	pF

## Switching Characteristics

over operating free-air temperature range, V<sub>CC</sub> = 3.3 ± 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T <sub>A</sub> = 25°C			T <sub>A</sub> = -55°C TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	Y	C <sub>L</sub> = 50 pF		9.5	14.5	1	16.5	ns
t <sub>PHL</sub>					9.5	14.5	1	16.5	ns

## Switching Characteristics

over operating free-air temperature range, V<sub>CC</sub> = 5 ± 0.5 V (unless otherwise noted) (see Figure 1)

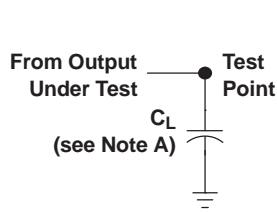
PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T <sub>A</sub> = 25°C			T <sub>A</sub> = -55°C TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	Y	C <sub>L</sub> = 50 pF		6.3	8.8	1	10	ns
t <sub>PHL</sub>					6.3	8.8	1	10	

## Operating Characteristics

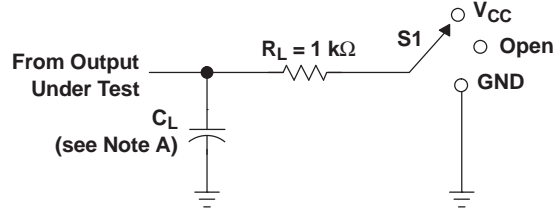
V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C

PARAMETER	TEST CONDITIONS	TYP	UNIT
C <sub>pd</sub>	No load, f = 1 MHz	18	pF

PARAMETER MEASUREMENT INFORMATION

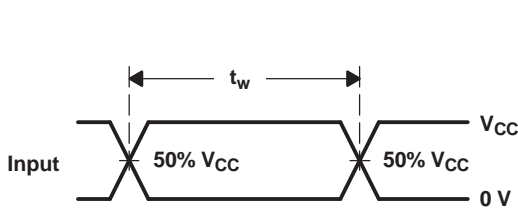


LOAD CIRCUIT FOR TOTEM-POLE OUTPUTS

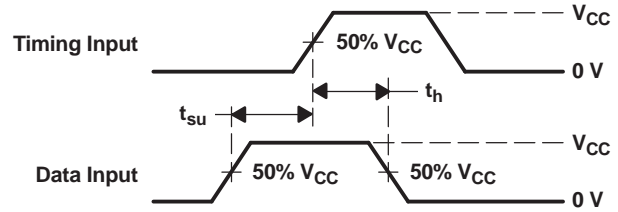


LOAD CIRCUIT FOR 3-STATE AND OPEN-DRAIN OUTPUTS

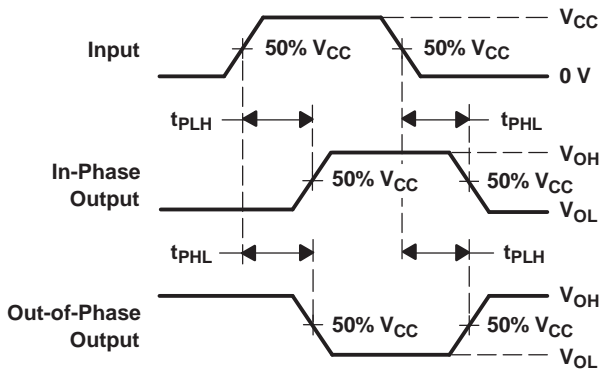
TEST	S1
t <sub>PLH</sub> /t <sub>PHL</sub>	Open
t <sub>PZL</sub> /t <sub>PZH</sub>	V <sub>CC</sub>
t <sub>PHZ</sub> /t <sub>PZH</sub>	GND
Open Drain	V <sub>CC</sub>



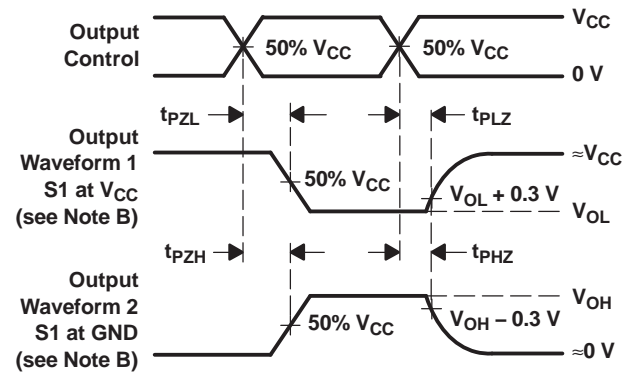
VOLTAGE WAVEFORMS PULSE DURATION



VOLTAGE WAVEFORMS SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES LOW- AND HIGH-LEVEL ENABLING

- NOTES: A. C<sub>L</sub> includes probe and jig capacitance.  
B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.  
C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z<sub>O</sub> = 50 Ω, t<sub>r</sub> ≤ 3 ns, t<sub>f</sub> ≤ 3 ns.  
D. The outputs are measured one at a time, with one input transition per measurement.  
E. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

DCK (R-PDSO-G5)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - D. Falls within JEDEC MO-203 variation AA.

DCK (R-PDSO-G5)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Mobile Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

TI E2E Community Home Page

[e2e.ti.com](http://e2e.ti.com)

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2012, Texas Instruments Incorporated