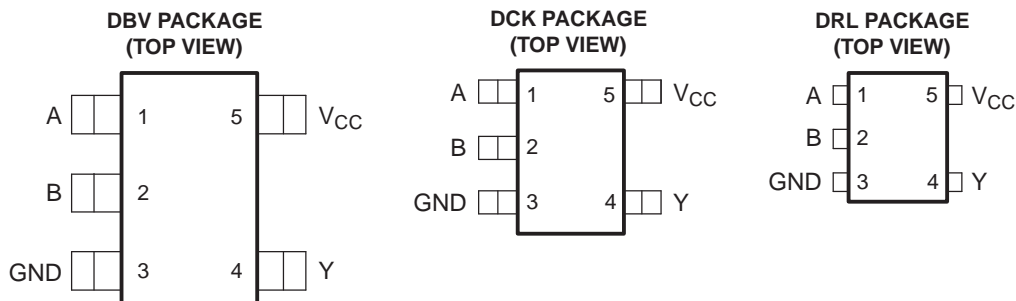


FEATURES

- **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** ⁽¹⁾
 - **Operating Range of 2 V to 5.5 V**
 - **Max t_{pd} of 8.5 ns at 5 V**
 - **Low Power Consumption, 10 μ 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**
 - **ESD Protection Exceeds JESD 22**
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)
- (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.



See mechanical drawings for dimensions.

DESCRIPTION/ORDERING INFORMATION

This device contains a single 2-input NOR gate that performs the Boolean function $Y = \overline{A} \cdot \overline{B}$ or $Y = \overline{A + B}$ in positive logic.

ORDERING INFORMATION⁽¹⁾

| T _A | PACKAGE ⁽²⁾ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|------------------------|--------------|-----------------------|------------------|
| –55°C to 125°C | SOT (SC-70) - DCK | Reel of 3000 | SN74AHC1G02MDCKREP | CGC |

- (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.
 (2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.



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.

SN74AHC1G02-EP SINGLE 2-INPUT POSITIVE-NOR GATE

SCLS708—FEBRUARY 2008

FUNCTION TABLE

| INPUTS | | OUTPUT Y |
|--------|---|-------------|
| A | B | |
| H | X | L |
| X | H | L |
| L | L | H |

LOGIC DIAGRAM (POSITIVE LOGIC)



Absolute Maximum Ratings⁽¹⁾

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 ⁽²⁾ | -0.5 | 7 | V | |
| V_O | Output voltage range ⁽²⁾ | -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} | | ± 20 | mA |
| I_O | Continuous output current | $V_O = 0$ to V_{CC} | | ± 25 | mA |
| | Continuous current through V_{CC} or GND | V_{CC} or GND | | ± 50 | mA |
| θ_{JA} | Package thermal impedance ⁽³⁾ | DCK package | | 252 | °C/W |
| T_{stg} | Storage temperature range | -65 | 150 | °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⁽¹⁾

| | | 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 | μA |
| | | $V_{CC} = 3.3\text{ V} \pm 0.3$ | -4 | mA |
| | | $V_{CC} = 5\text{ V} \pm 0.5$ | -8 | |
| I_{OL} | Low-Level output current | $V_{CC} = 2\text{ V}$ | 50 | μA |
| | | $V_{CC} = 3.3\text{ V} \pm 0.3$ | 4 | mA |
| | | $V_{CC} = 5\text{ V} \pm 0.5$ | 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.

SN74AHC1G02-EP SINGLE 2-INPUT POSITIVE-NOR GATE

SCLS708—FEBRUARY 2008

Electrical Characteristics

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

| PARAMETER | TEST CONDITIONS | V _{CC} | T _A = 25°C | | | T _A = -55°C TO 125°C | | UNIT |
|-----------------|--|-----------------|-----------------------|-----|------|---------------------------------|-----|------|
| | | | MIN | TYP | MAX | MIN | MAX | |
| V _{OH} | I _{OH} = -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 _{OH} = -4 mA | 3 V | 2.58 | | | 2.48 | | |
| | I _{OH} = -8 mA | 4.5 V | 3.94 | | | 3.8 | | |
| V _{OL} | I _{OL} = 50 μA | 2 V | | | | 0.1 | V | |
| | | 3 V | | | | 0.1 | | |
| | | 4.5 V | | | | 0.1 | | |
| | I _{OL} = 4 mA | 3 V | | | 0.36 | 0.44 | | |
| | I _{OL} = 8 mA | 4.5 V | | | 0.36 | 0.44 | | |
| I _I | V _I = 5.5 V or GND | 0 V to 5.5 V | | | ±0.1 | ±1 | μA | |
| I _{CC} | V _I = V _{CC} or GND, O = 0 | 5.5 V | | | 1 | 10 | μA | |
| C _i | V _I = V _{CC} or GND | 5 V | | 4 | 10 | 10 | pF | |

Switching Characteristics

over operating free-air temperature range, V_{CC} = 3.3 ± 0.3 V (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE | T _A = 25°C | | | T _A = -55°C TO 125°C | | UNIT |
|------------------|--------------|-------------|------------------------|-----------------------|-----|------|---------------------------------|-----|------|
| | | | | MIN | TYP | MAX | MIN | MAX | |
| t _{PLH} | A or B | Y | C _L = 50 pF | | 8.1 | 11.4 | 1 | 13 | ns |
| t _{PHL} | | | | | 8.1 | 11.4 | 1 | 13 | |

Switching Characteristics

over operating free-air temperature range, V_{CC} = 5 ± 0.5 V (unless otherwise noted) (see Figure 1)

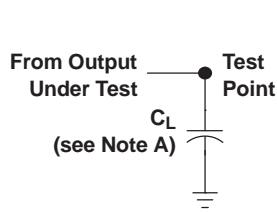
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE | T _A = 25°C | | | T _A = -55°C TO 125°C | | UNIT |
|------------------|--------------|-------------|------------------------|-----------------------|-----|-----|---------------------------------|-----|------|
| | | | | MIN | TYP | MAX | MIN | MAX | |
| t _{PLH} | A or B | Y | C _L = 50 pF | | 5.1 | 7.5 | 1 | 8.5 | ns |
| t _{PHL} | | | | | 5.1 | 7.5 | 1 | 8.5 | |

Operating Characteristics

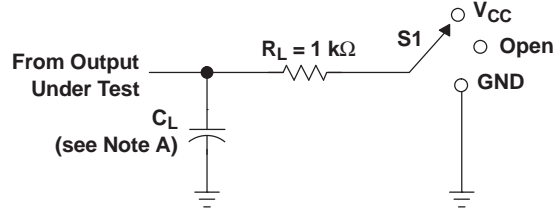
V_{CC} = 5 V, T_A = 25°C

| PARAMETER | TEST CONDITIONS | TYP | UNIT |
|---|--------------------|-----|------|
| C _{pd} Power dissipation capacitance | No load, f = 1 MHz | 15 | pF |

PARAMETER MEASUREMENT INFORMATION

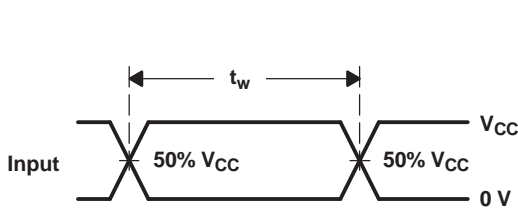


LOAD CIRCUIT FOR TOTEM-POLE OUTPUTS

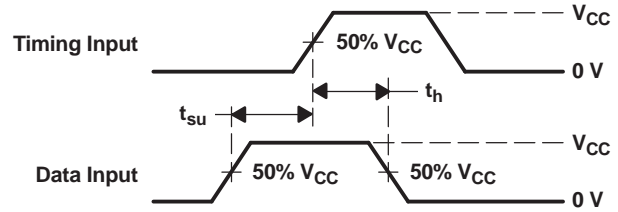


LOAD CIRCUIT FOR 3-STATE AND OPEN-DRAIN OUTPUTS

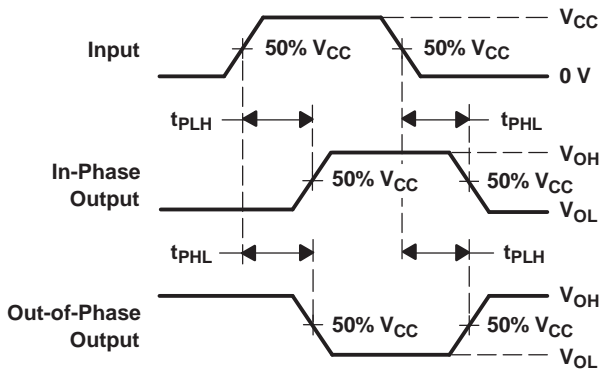
| TEST | S1 |
|------------------------------------|-----------------|
| t _{PLH} /t _{PHL} | Open |
| t _{PLZ} /t _{PZH} | V _{CC} |
| t _{PHZ} /t _{PZH} | GND |
| Open Drain | V _{CC} |



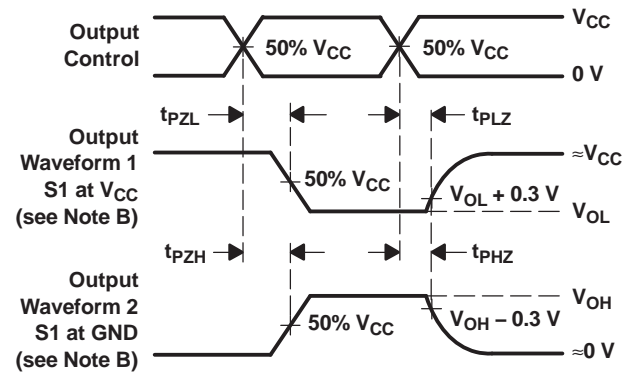
VOLTAGE WAVEFORMS PULSE DURATION



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_L 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_O = 50 Ω, t_r ≤ 3 ns, t_f ≤ 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

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74AHC1G02MDCKREP | SC70 | DCK | 5 | 3000 | 180.0 | 8.4 | 2.4 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|--------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74AHC1G02MDCKREP | SC70 | DCK | 5 | 3000 | 202.0 | 201.0 | 28.0 |

DCK (R-PDSO-G5)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
 - D. Publication IPC-7351 is recommended for alternate designs.
 - E. 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 (TI) reserves the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

TI's published terms of sale for semiconductor products (<http://www.ti.com/sc/docs/stdterms.htm>) apply to the sale of packaged integrated circuit products that TI has qualified and released to market. Additional terms may apply to the use or sale of other types of TI products and services.

Reproduction of significant portions of TI information in TI data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such reproduced 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.

Buyers and others who are developing systems that incorporate TI products (collectively, "Designers") understand and agree that Designers remain responsible for using their independent analysis, evaluation and judgment in designing their applications and that Designers have full and exclusive responsibility to assure the safety of Designers' applications and compliance of their applications (and of all TI products used in or for Designers' applications) with all applicable regulations, laws and other applicable requirements. Designer represents that, with respect to their applications, Designer has all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. Designer agrees that prior to using or distributing any applications that include TI products, Designer will thoroughly test such applications and the functionality of such TI products as used in such applications.

TI's provision of technical, application or other design advice, quality characterization, reliability data or other services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using TI Resources in any way, Designer (individually or, if Designer is acting on behalf of a company, Designer's company) agrees to use any particular TI Resource solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

Designer is authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources 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.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS. TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY DESIGNER AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Unless TI has explicitly designated an individual product as meeting the requirements of a particular industry standard (e.g., ISO/TS 16949 and ISO 26262), TI is not responsible for any failure to meet such industry standard requirements.

Where TI specifically promotes products as facilitating functional safety or as compliant with industry functional safety standards, such products are intended to help enable customers to design and create their own applications that meet applicable functional safety standards and requirements. Using products in an application does not by itself establish any safety features in the application. Designers must ensure compliance with safety-related requirements and standards applicable to their applications. Designer may not use any TI products in life-critical medical equipment unless authorized officers of the parties have executed a special contract specifically governing such use. Life-critical medical equipment is medical equipment where failure of such equipment would cause serious bodily injury or death (e.g., life support, pacemakers, defibrillators, heart pumps, neurostimulators, and implantables). Such equipment includes, without limitation, all medical devices identified by the U.S. Food and Drug Administration as Class III devices and equivalent classifications outside the U.S.

TI may expressly designate certain products as completing a particular qualification (e.g., Q100, Military Grade, or Enhanced Product). Designers agree that it has the necessary expertise to select the product with the appropriate qualification designation for their applications and that proper product selection is at Designers' own risk. Designers are solely responsible for compliance with all legal and regulatory requirements in connection with such selection.

Designer will fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of Designer's non-compliance with the terms and provisions of this Notice.