

The SN5405 is obsolete and no longer is supplied.

SN54LS05, SN54S05 SN7405, SN74LS05, SN74S05 HEX INVERTERS WITH OPEN-COLLECTOR OUTPUTS

SDLS030A – DECEMBER 1983 – REVISED NOVEMBER 2003

- Package Options Include Plastic Small-Outline (D, NS), Shrink Small-Outline (DB), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) DIPs

- Dependable Texas Instrument Quality and Reliability

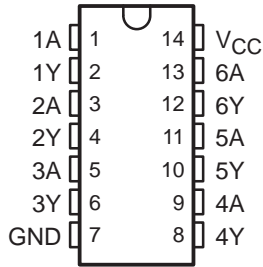
SN5405, SN54LS05, SN54S05 . . . J PACKAGE

SN7405 . . . N PACKAGE

SN74LS05 . . . D, DB, N, OR NS PACKAGE

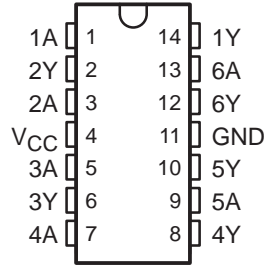
SN74S05 . . . D, N, OR NS PACKAGE

(TOP VIEW)



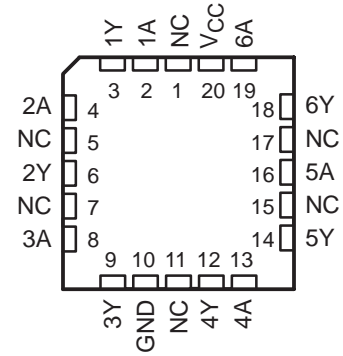
SN54LS05, SN54S05 . . . W PACKAGE

(TOP VIEW)



SN54LS05, SN54S05 . . . FK PACKAGE

(TOP VIEW)



NC – No internal connection

description/ordering information

These devices contain six independent inverters. To perform correctly, the open-collector outputs require pullup resistors. These devices may be connected to other open-collector outputs to implement active-low wired-OR or active-high wire-AND functions. Open-collector devices often are used to generate high V_{OH} levels.

ORDERING INFORMATION

| T_A | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING | |
|----------------|---------------|-------------|-----------------------|------------------|------------|
| 0°C to 70°C | PDIP – N | Tube | SN7405N | SN7405N | |
| | | | SN74LS05N | SN74LS05N | |
| | | | SN74S05N | SN74S05N | |
| | SOIC – D | Tube | SN74LS05D | LS05 | |
| | | | Tape and reel | | SN74LS05DR |
| | | | Tube | SN74S05D | S05 |
| | | | | Tape and reel | |
| SOP – NS | Tape and reel | SN74LS05NSR | 74LS05 | | |
| | | SN74S05NSR | 74S05 | | |
| –55°C to 125°C | CDIP – J | Tube | SNJ54LS05J | SNJ54LS05J | |
| | | | SNJ54S05J | SNJ54S05J | |
| | CDIP – W | Tube | SNJ54LS05W | SNJ54LS05W | |
| | | | SNJ54S05W | SNJ54S05W | |
| | LCCC – FK | Tube | SNJ54LS05FK | SNJ54LS05FK | |
| SNJ54S05FK | | | SNJ54S05FK | | |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

SN54LS05, SN54S05
SN7405, SN74LS05, SN74S05
HEX INVERTERS WITH OPEN-COLLECTOR OUTPUTS

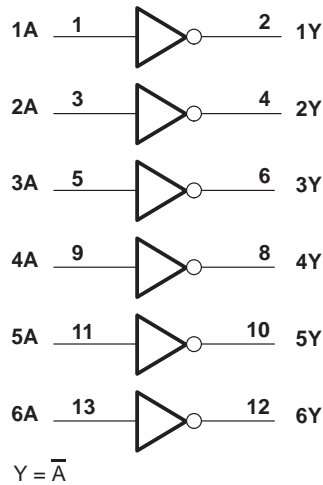
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FUNCTION TABLE
(each inverter)

| INPUT A | OUTPUT Y |
|------------|-------------|
| H | L |
| L | H |

logic diagram (positive logic)



Pin numbers shown are for the D, DB, J, N, and NS packages.

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recommended operating conditions

| | SN5405 | | | SN7405 | | | UNIT |
|---|--------|-----|-----|--------|-----|------|------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| V _{CC} Supply voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| V _{IH} High-level input voltage | 2 | | | 2 | | | V |
| V _{IL} Low-level input voltage | | | 0.8 | | | 0.8 | V |
| V _{OH} High-level output voltage | | | 5.5 | | | 5.5 | V |
| I _{OL} Low-level output current | | | 16 | | | 16 | mA |
| T _A Operating free-air temperature | -55 | | 125 | 0 | | 70 | °C |

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

| PARAMETER | TEST CONDITIONS† | SN5405 | | | SN7405 | | | UNIT |
|------------------|--|--------|------|------|--------|------|------|------|
| | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| V _{IK} | V _{CC} = MIN, I _I = -12 mA | | | -1.5 | | | -1.5 | V |
| I _{OH} | V _{CC} = MIN, V _{OH} = 5.5 V V _{IL} = 0.8 V V _{IL} = 0.7 V | | | | | | 0.25 | mA |
| V _{OL} | V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 16 mA | | 0.2 | 0.4 | | 0.2 | 0.4 | V |
| I _I | V _{CC} = MAX, V _I = 5.5 V | | | 1 | | | 1 | mA |
| I _{IH} | V _{CC} = MAX, V _I = 2.4 V | | | 40 | | | 40 | µA |
| I _{IL} | V _{CC} = MAX, V _I = 0.4 V | | | -1.6 | | | -1.6 | mA |
| I _{CCH} | V _{CC} = MAX, V _I = 0 V | | 6 | 12 | | 6 | 12 | mA |
| I _{CCL} | V _{CC} = MAX, V _I = 4.5 V | | 18 | 33 | | 18 | 33 | mA |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|------------------|--------------|-------------|------------------------|------------------------|-----|-----|-----|------|
| t _{PLH} | A | Y | R _L = 4 kΩ | C _L = 15 pF | | 40 | 55 | ns |
| t _{PHL} | | | R _L = 400 Ω | | | 8 | 15 | |



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recommended operating conditions

| | | SN54LS05 | | | SN74LS05 | | | UNIT |
|-----------------|--------------------------------|----------|-----|-----|----------|-----|------|------|
| | | MIN | NOM | MAX | MIN | NOM | MAX | |
| V _{CC} | Supply voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| V _{IH} | High-level input voltage | 2 | | | 2 | | | V |
| V _{IL} | Low-level input voltage | | | | 0.7 | | | V |
| V _{OH} | High-level output voltage | | | | 5.5 | | | V |
| I _{OL} | Low-level output current | | | | 4 | | | mA |
| T _A | Operating free-air temperature | -55 | | | 125 | | | °C |

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

| PARAMETER | TEST CONDITIONS† | SN54LS05 | | | SN74LS05 | | | UNIT | |
|------------------|---|------------------------|------|------|----------|------|-----|------|----|
| | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | | |
| V _{IK} | V _{CC} = MIN, I _I = -18 mA | | | | -1.5 | | | V | |
| I _{OH} | V _{CC} = MIN, V _{IL} = MAX, V _{OH} = 5.5 V | | | | 0.1 | | | mA | |
| V _{OL} | V _{CC} = MIN, V _{IH} = 2 V | I _{OL} = 4 mA | | 0.25 | | 0.4 | | V | |
| | | I _{OL} = 8 mA | | | | 0.35 | | | |
| I _I | V _{CC} = MAX, V _I = 7 V | | | | 0.1 | | | mA | |
| I _{IH} | V _{CC} = MAX, V _I = 2.7 V | | | | 20 | | | μA | |
| I _{IL} | V _{CC} = MAX, V _I = 0.4 V | | | | -0.4 | | | mA | |
| I _{CCH} | V _{CC} = MAX, V _I = 0 V | | | | 1.2 | | 2.4 | | mA |
| I _{CCL} | V _{CC} = MAX, V _I = 4.5 V | | | | 3.6 | | 6.6 | | mA |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see Figure 2)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------|--------------|-------------|---|-----|-----|-----|------|
| t _{PLH} | A | Y | R _L = 2 kΩ, C _L = 15 pF | 17 | | 32 | ns |
| t _{PHL} | | | | 15 | | 28 | |



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recommended operating conditions

| | SN54S05 | | | SN74S05 | | | UNIT |
|---|---------|-----|-----|---------|-----|------|------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| V _{CC} Supply voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| V _{IH} High-level input voltage | 2 | | | 2 | | | V |
| V _{IL} Low-level input voltage | | | 0.8 | | | 0.8 | V |
| V _{OH} High-level output voltage | | | 5.5 | | | 5.5 | V |
| I _{OL} Low-level output current | | | 20 | | | 20 | mA |
| T _A Operating free-air temperature | -55 | | 125 | 0 | | 70 | °C |

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

| PARAMETER | TEST CONDITIONS† | | SN54S05 | | | SN74S05 | | | UNIT |
|------------------|------------------------|--|---------|------|------|---------|------|------|------|
| | | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| V _{IK} | V _{CC} = MIN, | I _I = -18 mA | | | -1.2 | | | -1.2 | V |
| I _{OH} | V _{CC} = MIN, | V _{OH} = 5.5 V | | | | | 0.25 | | mA |
| | | V _{IL} = 0.8 V | | | | | | | |
| | | V _{IL} = 0.7 V | | | 0.25 | | | | |
| V _{OL} | V _{CC} = MIN, | V _{IH} = 2 V, I _{OL} = 20 mA | | | 0.5 | | | 0.5 | V |
| I _I | V _{CC} = MAX, | V _I = 5.5 V | | | 1 | | | 1 | mA |
| I _{IH} | V _{CC} = MAX, | V _I = 2.7 V | | | 50 | | | 50 | µA |
| I _{IL} | V _{CC} = MAX, | V _I = 0.5 V | | | -2 | | | -2 | mA |
| I _{CCH} | V _{CC} = MAX, | V _I = 0 V | | 9 | 19.8 | | 9 | 19.8 | mA |
| I _{CCL} | V _{CC} = MAX, | V _I = 4.5 V | | 30 | 54 | | 30 | 54 | mA |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

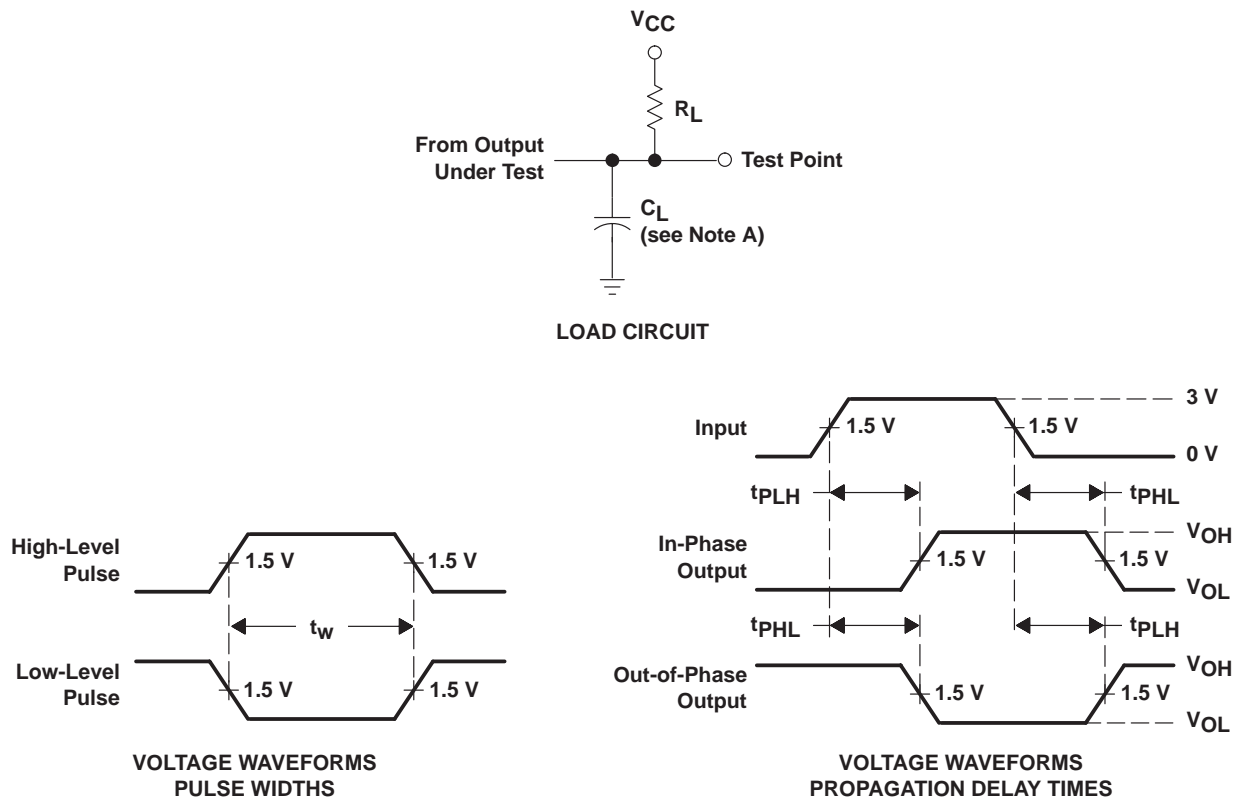
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|------------------|--------------|-------------|------------------------|------------------------|-----|-----|-----|------|
| t _{PLH} | A | Y | R _L = 280 Ω | C _L = 15 pF | 2 | 5 | 7.5 | ns |
| t _{PHL} | | | | | 2 | 4.5 | 7 | |
| t _{PLH} | | | | C _L = 50 pF | 7.5 | ns | | |
| t _{PHL} | | | | | 7 | | | |



PARAMETER MEASUREMENT INFORMATION
SERIES 54/74 AND 54S/74S DEVICES



- NOTES: A. C_L includes probe and jig capacitance.
 B. In the examples above, the phase relationships between inputs and outputs have been chosen arbitrarily.
 C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_O = 50 \Omega$, and:
 For Series 54/74, $t_r \leq 7$ ns, $t_f \leq 7$ ns.
 For Series 54S/74S, $t_r \leq 2.5$ ns, $t_f \leq 2.5$ ns.
 D. The outputs are measured one at a time with one input transition per measurement.

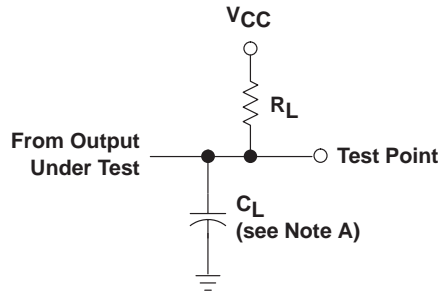
Figure 1. Load Circuit and Voltage Waveforms

**SN54LS05, SN54S05
SN7405, SN74LS05, SN74S05
HEX INVERTERS WITH OPEN-COLLECTOR OUTPUTS**

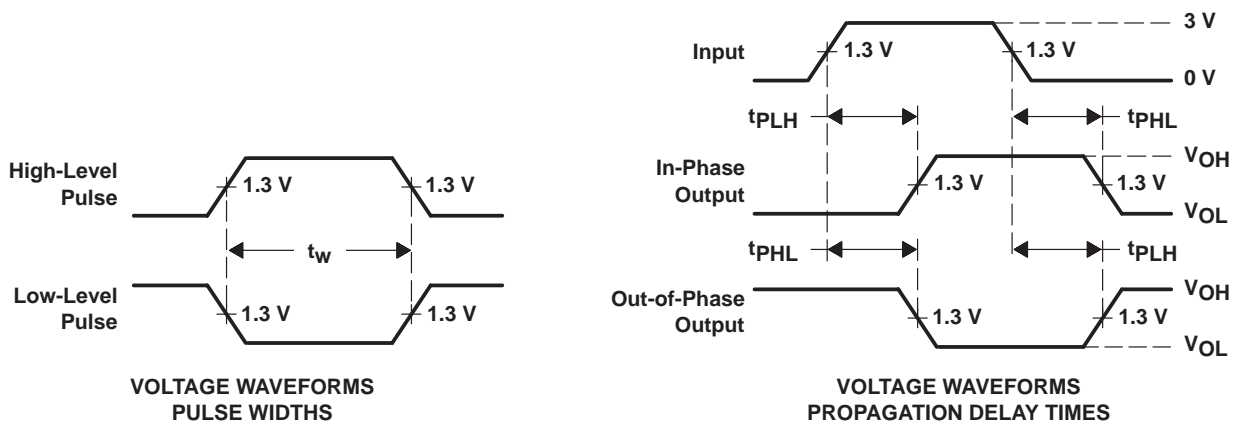
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**PARAMETER MEASUREMENT INFORMATION
SERIES 54LS/74LS DEVICES**



LOAD CIRCUIT



- NOTES: A. C_L includes probe and jig capacitance.
 B. In the examples above, the phase relationships between inputs and outputs have been chosen arbitrarily.
 C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_O = 50 \Omega$, $t_r \leq 1.5$ ns, $t_f \leq 2.6$ ns.
 D. The outputs are measured one at a time with one input transition per measurement.

Figure 2. Load Circuit and Voltage Waveforms