

SN5406, SN5416, SN7406, SN7416 HEX INVERTER BUFFERS/DRIVERS WITH OPEN-COLLECTOR HIGH-VOLTAGE OUTPUTS

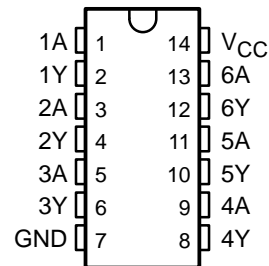
SDLS031A – DECEMBER 1983 – REVISED DECEMBER 2001

- Convert TTL Voltage Levels to MOS Levels
- High Sink-Current Capability
- Input Clamping Diodes Simplify System Design
- Open-Collector Drivers for Indicator Lamps and Relays
- Inputs Fully Compatible With Most TTL Circuits

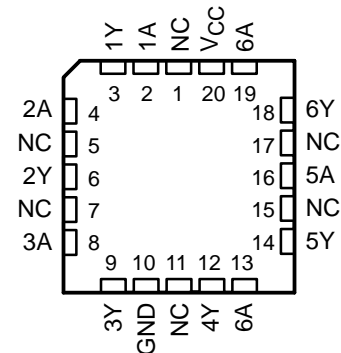
description

These TTL hex inverter buffers/drivers feature high-voltage open-collector outputs for interfacing with high-level circuits (such as MOS) or for driving high-current loads (such as lamps or relays), and also are characterized for use as inverter buffers for driving TTL inputs. The SN5406 and SN7406 have minimum breakdown voltages of 30 V. The SN5416 and SN7416 have minimum breakdown voltages of 15 V. The maximum sink current is 30 mA for the SN5406 and SN5416, and 40 mA for the SN7406 and SN7416.

SN5406, SN5416 . . . J OR W PACKAGE
SN7406 . . . D, N, OR NS PACKAGE
SN7416 . . . D OR N PACKAGE
(TOP VIEW)



SN5406 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

ORDERING INFORMATION

| T _A | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|-----------|---------------|-----------------------|------------------|
| 0°C to 70°C | SOIC – D | Tube | SN7406D | 7406 |
| | | Tape and reel | SN7406DR | |
| | | Tube | SN7416D | 7416 |
| | | Tape and reel | SN7416DR | |
| | PDIP – N | Tube | SN7406N | SN7406N |
| | SOP – NS | Tape and reel | SN7406NSR | SN7406 |
| –55°C to 125°C | CDIP – J | Tube | SNJ5406J | SNJ5406J |
| | | Tube | SNJ5416J | SNJ5416J |
| | CDIP – W | Tube | SNJ5406W | SNJ5406W |
| | | Tube | SNJ5416W | SNJ5416W |
| | LCCC – FK | Tube | SNJ5406FK | SNJ5406FK |

† 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**

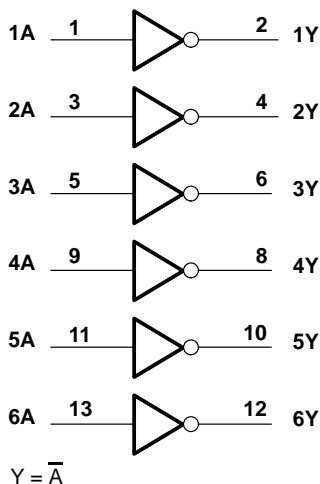
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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

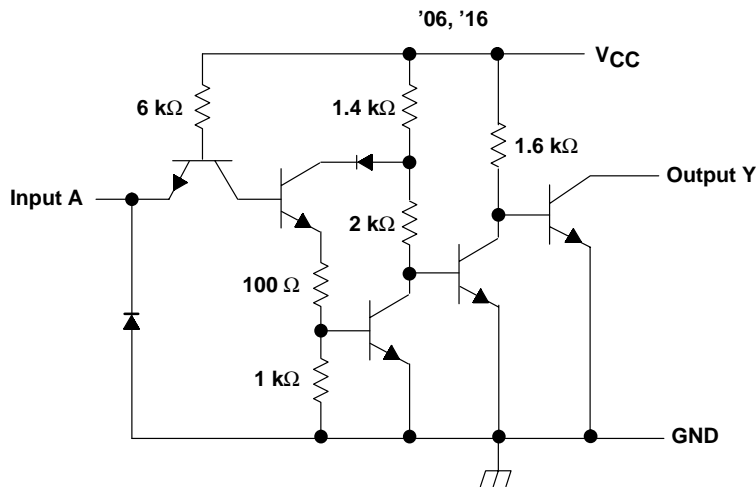
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logic diagram (positive logic)



schematic (each buffer/driver)



Resistor values shown are nominal.

absolute maximum ratings over operating free-air temperature (unless otherwise noted)†

| | |
|--|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage, V_I (see Note 1) | 5.5 V |
| Output voltage, V_O (see Notes 1 and 2): SN5406, SN7406 | 30 V |
| SN5416, SN7416 | 15 V |
| Package thermal impedance, θ_{JA} (see Note 3): D package | 86°C/W |
| N package | 80°C/W |
| NS package | 76°C/W |
| Storage temperature range, T_{stg} | -65°C to 150°C |

† 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.

- NOTES: 1. Voltage values are with respect to network ground terminal.
 2. This is the maximum voltage which should be applied to any output when it is in the off state.
 3. The package thermal impedance is calculated in accordance with JESD 51-7.



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recommended operating conditions

| | | SN5406 SN5416 | | | SN7406 SN7416 | | | 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 | | | '06 | | | 30 | V | |
| | | | | '16 | | | 15 | | |
| I _{OL} | Low-level output current | | | | 30 | | | 40 | 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† | SN5406 SN5416 | | | SN7406 SN7416 | | | UNIT |
|------------------|---|------------------|------|-------------------------|------------------|------|-----|------|
| | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| V _{IK} | V _{CC} = MIN, I _I = -12 mA | | | | -1.5 | | | V |
| I _{OH} | V _{CC} = MIN, V _{IL} = 0.8 V, V _{OH} = § | | | | 0.25 | | | mA |
| V _{OL} | V _{CC} = MIN, V _{IH} = 2 V | | | I _{OL} = 16 mA | | | 0.4 | V |
| | | | | I _{OL} = ¶ | | | 0.7 | |
| I _I | V _{CC} = MAX, V _I = 5.5 V | | | | 1 | | | mA |
| I _{IH} | V _{CC} = MAX, V _{IH} = 2.4 V | | | | 40 | | | µA |
| I _{IL} | V _{CC} = MAX, V _{IL} = 0.4 V | | | | -1.6 | | | mA |
| I _{CCH} | V _{CC} = MAX | 30 | | 48 | 30 | | 48 | mA |
| I _{CCL} | V _{CC} = MAX | 32 | | 51 | 32 | | 51 | 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.

§ V_{OH} = 30 V for '06 and 15 V for '16.

¶ I_{OL} = 30 mA for SN54' and 40 mA for SN74'.

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

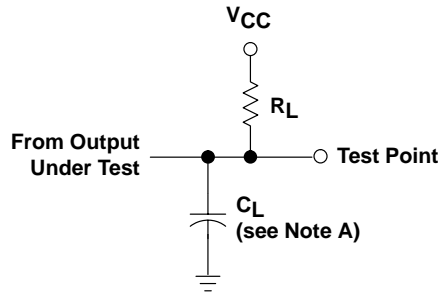
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------|-----------------|----------------|--|-----|-----|-----|------|
| t _{PLH} | A | Y | R _L = 110 Ω, C _L = 15 pF | 10 | | 15 | ns |
| t _{PHL} | | | | 15 | | 23 | |



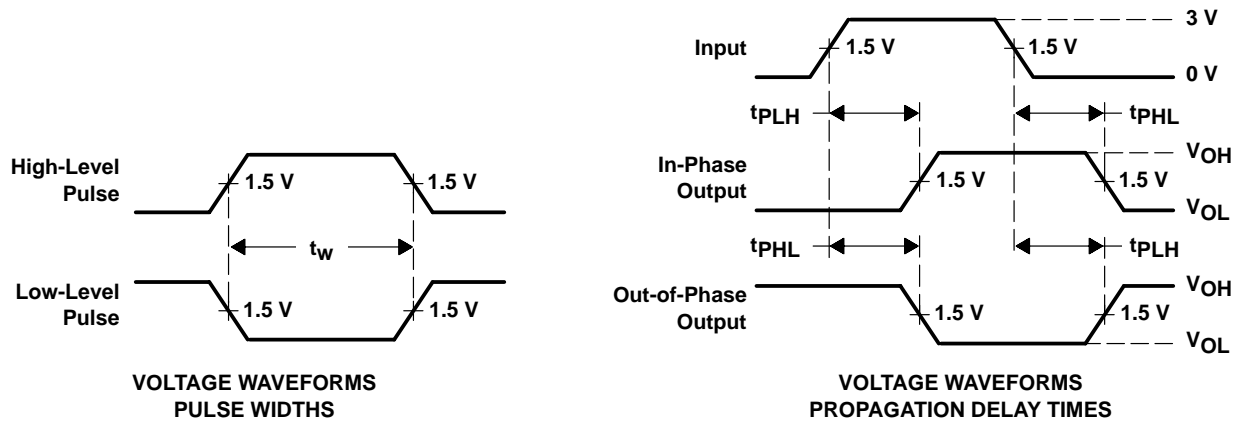
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PARAMETER MEASUREMENT INFORMATION



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, $Z_O = 50 \Omega$, $t_r \leq 7$ ns, $t_f \leq 7$ ns.
 D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|--|
| JM38510/00801BCA | ACTIVE | CDIP | J | 14 | 1 | None | Call TI | Level-NC-NC-NC |
| JM38510/00801BDA | ACTIVE | CFP | W | 14 | 1 | None | Call TI | Level-NC-NC-NC |
| SN5406J | ACTIVE | CDIP | J | 14 | 1 | None | Call TI | Level-NC-NC-NC |
| SN5416J | ACTIVE | CDIP | J | 14 | 1 | None | Call TI | Level-NC-NC-NC |
| SN7406D | ACTIVE | SOIC | D | 14 | 50 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| SN7406DR | ACTIVE | SOIC | D | 14 | 2500 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| SN7406J | OBSOLETE | CDIP | J | 14 | | None | Call TI | Call TI |
| SN7406N | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | Level-NC-NC-NC |
| SN7406N3 | OBSOLETE | PDIP | N | 14 | | None | Call TI | Call TI |
| SN7406NSR | ACTIVE | SO | NS | 14 | 2000 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| SN7416D | ACTIVE | SOIC | D | 14 | 50 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| SN7416DR | ACTIVE | SOIC | D | 14 | 2500 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| SN7416N | ACTIVE | PDIP | N | 14 | 25 | Pb-Free (RoHS) | CU NIPDAU | Level-NC-NC-NC |
| SN7416N3 | OBSOLETE | PDIP | N | 14 | | None | Call TI | Call TI |
| SN7416NSR | ACTIVE | SO | NS | 14 | 2000 | Pb-Free (RoHS) | CU NIPDAU | Level-2-260C-1 YEAR/ Level-1-235C-UNLIM |
| SNJ5406FK | ACTIVE | LCCC | FK | 20 | 1 | None | Call TI | Level-NC-NC-NC |
| SNJ5406J | ACTIVE | CDIP | J | 14 | 1 | None | Call TI | Level-NC-NC-NC |
| SNJ5406W | ACTIVE | CFP | W | 14 | 1 | None | Call TI | Level-NC-NC-NC |
| SNJ5416J | ACTIVE | CDIP | J | 14 | 1 | None | Call TI | Level-NC-NC-NC |
| SNJ5416W | ACTIVE | CFP | W | 14 | 1 | None | Call TI | Level-NC-NC-NC |

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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