

**SN5404, SN54LS04, SN54S04,
SN7404, SN74LS04, SN74S04
HEX INVERTERS**

DECEMBER 1983—REVISED MARCH 1988

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages, and Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

description

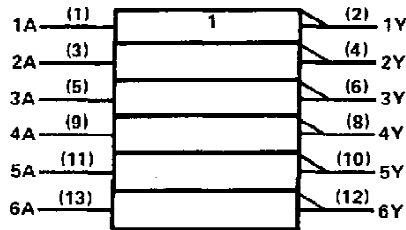
These devices contain six independent inverters.

The SN5404, SN54LS04, and SN54S04 are characterized for operation over the full military temperature range of -55°C to 125°C. The SN7404, SN74LS04, and SN74S04 are characterized for operation from 0°C to 70°C.

FUNCTION TABLE (each inverter)

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

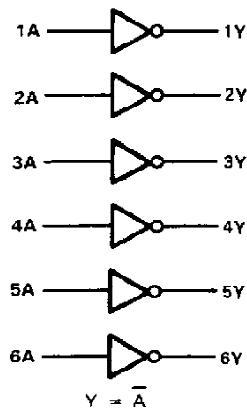
logic symbol †



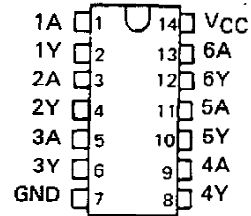
† This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

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

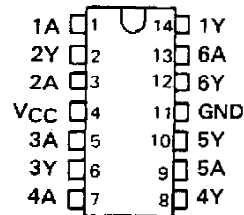
logic diagram (positive logic)



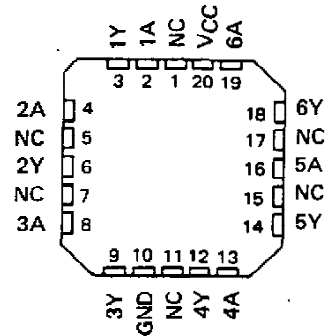
SN5404 . . . J PACKAGE
SN54LS04, SN54S04 . . . J OR W PACKAGE
SN7404 . . . N PACKAGE
SN74LS04, SN74S04 . . . D OR N PACKAGE
(TOP VIEW)



SN5404 . . . W PACKAGE
(TOP VIEW)



SN54LS04, SN54S04 . . . FK PACKAGE
(TOP VIEW)



NC - No internal connection

PRODUCTION DATA documents contain information 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.



SN5404, SN7404 HEX INVERTERS

recommended operating conditions

| | SN5404 | | | SN7404 | | | 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 |
| I _{OH} High-level output current | - 0.4 | | | - 0.4 | | | mA |
| I _{OL} Low-level output current | 16 | | | 16 | | | mA |
| T _A Operating free-air temperature | - 55 | | | 0 | | | 70 °C |

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

| PARAMETER | TEST CONDITIONS † | SN5404 | | | SN7404 | | | UNIT |
|-------------------|--|--------|-------|------|--------|-------|------|------|
| | | MIN | TYP ‡ | MAX | MIN | TYP ‡ | MAX | |
| V _{IK} | V _{CC} = MIN, I _I = - 12 mA | - 1.5 | | | - 1.5 | | | V |
| V _{OH} | V _{CC} = MIN, V _{IL} = 0.8 V, I _{OH} = - 0.4 mA | 2.4 | 3.4 | | 2.4 | 3.4 | V | |
| 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 _{OS} § | V _{CC} = MAX | - 20 | | - 55 | - 18 | | - 55 | 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.

§ Not more than one output should be shorted at a time.

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

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|------------------|--------------|-------------|-------------------------|------------------------|-----|-----|-----|------|
| t _{PLH} | A | Y | R _L = 400 Ω, | C _L = 15 pF | | 12 | 22 | ns |
| t _{PHL} | | | | | | 8 | 15 | ns |

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.



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SN54LS04, SN74LS04 HEX INVERTERS

recommended operating conditions

| | SN54LS04 | | | SN74LS04 | | | 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 | | | 0.8 | V |
| I_{OH} High-level output current | | | -0.4 | | | -0.4 | mA |
| I_{OL} Low-level output current | | | 4 | | | 8 | 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 † | SN54LS04 | | SN74LS04 | | UNIT | | |
|------------|--|----------|-------|----------|------|------|-------|-----|
| | | MIN | TYP ‡ | MAX | MIN | | TYP ‡ | MAX |
| V_{IK} | $V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$ | | | -1.5 | | -1.5 | V | |
| V_{OH} | $V_{CC} = \text{MIN}, V_{IL} = \text{MAX}, I_{OH} = -0.4 \text{ mA}$ | 2.5 | 3.4 | | 2.7 | 3.4 | V | |
| V_{OL} | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 4 \text{ mA}$ | | 0.25 | 0.4 | | 0.4 | V | |
| | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 8 \text{ mA}$ | | | | 0.25 | 0.5 | | |
| I_I | $V_{CC} = \text{MAX}, V_I = 7 \text{ V}$ | | | 0.1 | | 0.1 | mA | |
| I_{IH} | $V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$ | | | 20 | | 20 | µA | |
| I_{IL} | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ | | | -0.4 | | -0.4 | mA | |
| $I_{OS} §$ | $V_{CC} = \text{MAX}$ | -20 | | -100 | -20 | -100 | mA | |
| I_{CCH} | $V_{CC} = \text{MAX}, V_I = 0 \text{ V}$ | | 1.2 | 2.4 | | 1.2 | 2.4 | mA |
| I_{CCL} | $V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$ | | 3.6 | 6.6 | | 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 $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$.

§ Not more than one output should be shorted at a time, and the duration of the short-circuit should not exceed one second.

switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ (see note 2)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|-----------|--------------|-------------|----------------------------|-----------------------|-----|-----|-----|------|
| t_{PLH} | A | Y | $R_L = 2 \text{ k}\Omega,$ | $C_L = 15 \text{ pF}$ | | 9 | 15 | ns |
| t_{PHL} | | | | | | 10 | 15 | ns |

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.



SN54S04, SN74S04 HEX INVERTERS

recommended operating conditions

| | SN54S04 | | | SN74S04 | | | 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 |
| I _{OH} High-level output current | | | -1 | | | -1 | mA |
| 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 † | SN54S04 | | | SN74S04 | | | UNIT |
|-------------------|---|---------|-------|------|---------|-------|------|------|
| | | MIN | TYP ‡ | MAX | MIN | TYP ‡ | MAX | |
| V _{IK} | V _{CC} = MIN, I _I = -18 mA | | | -1.2 | | | -1.2 | V |
| V _{OH} | V _{CC} = MIN, V _{IL} = 0.8 V, I _{OH} = -1 mA | 2.5 | 3.4 | | 2.7 | 3.4 | | V |
| 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 _{OS} § | V _{CC} = MAX | -40 | | -100 | -40 | | -100 | mA |
| I _{CCH} | V _{CC} = MAX, V _I = 0 V | | 15 | 24 | | 15 | 24 | 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.

§ Not more than one output should be shorted at a time, and the duration of the short-circuit should not exceed one second.

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

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|------------------|--------------|-------------|-------------------------|------------------------|-----|-----|-----|------|
| t _{PLH} | A | Y | R _L = 280 Ω, | C _L = 15 pF | | 3 | 4.5 | ns |
| t _{PHL} | | | | | | 3 | 5 | ns |
| t _{PLH} | | | R _L = 280 Ω, | C _L = 50 pF | | 4.5 | | ns |
| t _{PHL} | | | | | | 5 | | ns |

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

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