

TYPES SN5442A THRU SN5444A, SN54L42 THRU SN54L44,
SN54LS42, SN7442A THRU SN7444A, SN74LS42
4-LINE TO 10-LINE DECODERS (1-OF-10)

MARCH 1974 - REVISED APRIL 1985

'42A, 'L42, 'LS42 . . . BCD-TO-DECIMAL
'43A, 'L43 . . . EXCESS-3-TO-DECIMAL
'44A, 'L44 . . . GRAY-TO-DECIMAL

- All Outputs Are High for Invalid Input Conditions
- Also for Application as
4-Line-to-16-Line Decoders
3-Line-to-8-Line Decoders
- Diode-Clamped Inputs

| TYPES | TYPICAL POWER DISSIPATION | TYPICAL PROPAGATION DELAYS |
|------------------|------------------------------|-------------------------------|
| '42A, '43A, '44A | 140 mW | 17 ns |
| 'L42, 'L43, 'L44 | 70 mW | 49 ns |
| 'LS42 | 35 mW | 17 ns |

description

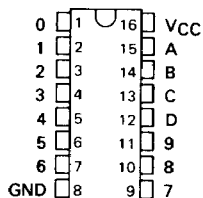
These monolithic decimal decoders consist of eight inverters and ten four-input NAND gates. The inverters are connected in pairs to make BCD input data available for decoding by the NAND gates. Full decoding of valid input logic ensures that all outputs remain off for all invalid input conditions.

The '42A, 'L42, and 'LS42 BCD-to-decimal decoders, the '43A and 'L43 excess-3-to-decimal decoders, and the '44A and 'L44 gray-to-decimal decoders feature inputs and outputs that are compatible for use with most TTL and other saturated low-level logic circuits. DC noise margins are typically one volt.

Series 54, 54L, and 54LS circuits are characterized for operation over the full military temperature range of -55°C to 125°C; Series 74, and 74LS circuits are characterized for operation from 0°C to 70°C.

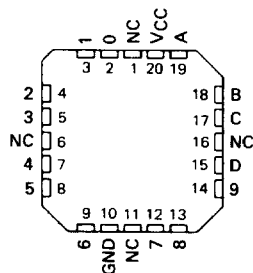
SN5442A THRU SN5444A, SN54LS42 . . . J OR W PACKAGE
SN54L42 THRU SN54L44 . . . J PACKAGE
SN7442A THRU SN7444A . . . J OR N PACKAGE
SN74LS42 . . . D, J OR N PACKAGE

(TOP VIEW)



SN54LS42 . . . FK PACKAGE
SN74LS42 . . . FN PACKAGE

(TOP VIEW)



NC - No internal connection

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TTL DEVICES

PRODUCTION DATA

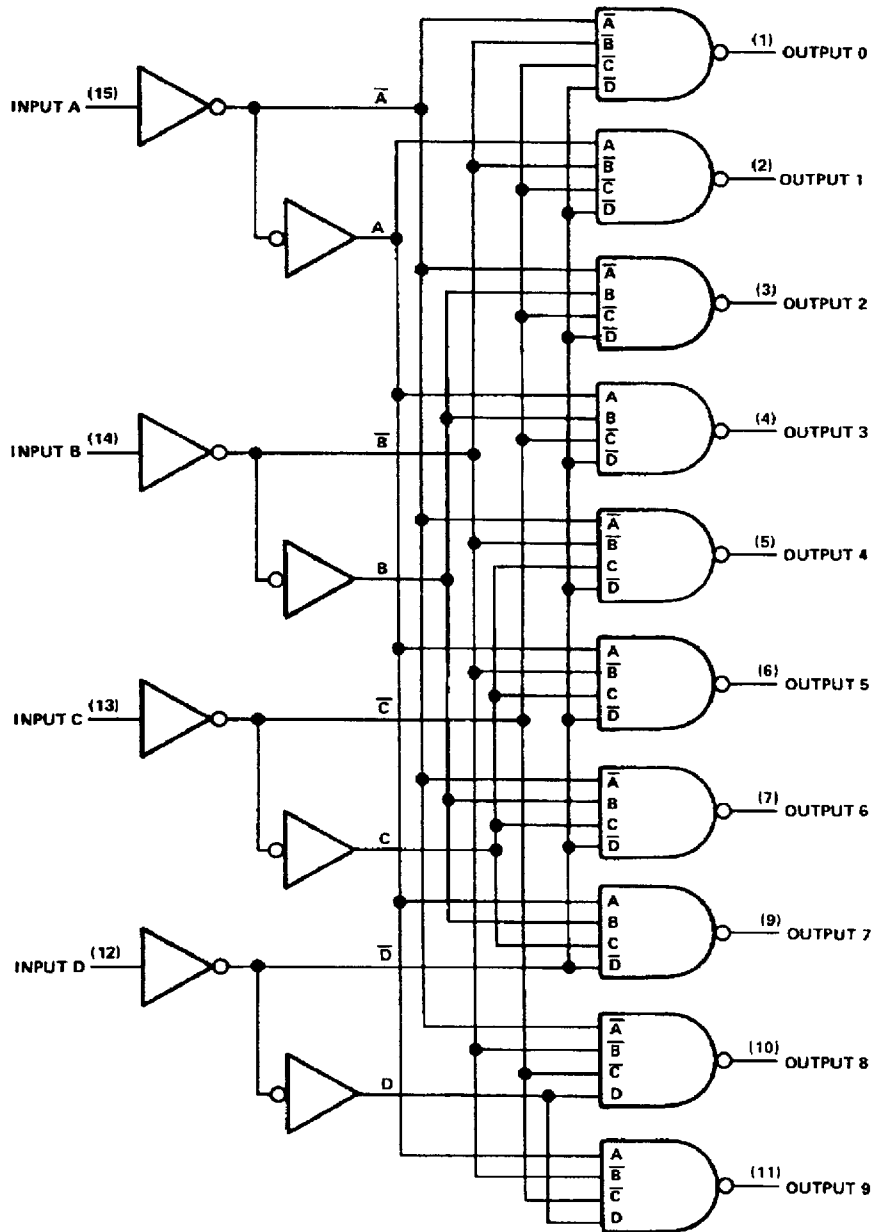
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TYPES SN5442A, SN54L42, SN54LS42, SN7442A, SN74LS42
 4-LINE TO 10-LINE DECODERS (1-OF-10)

logic diagrams



Pin numbers shown on logic notation are for D, J or N packages

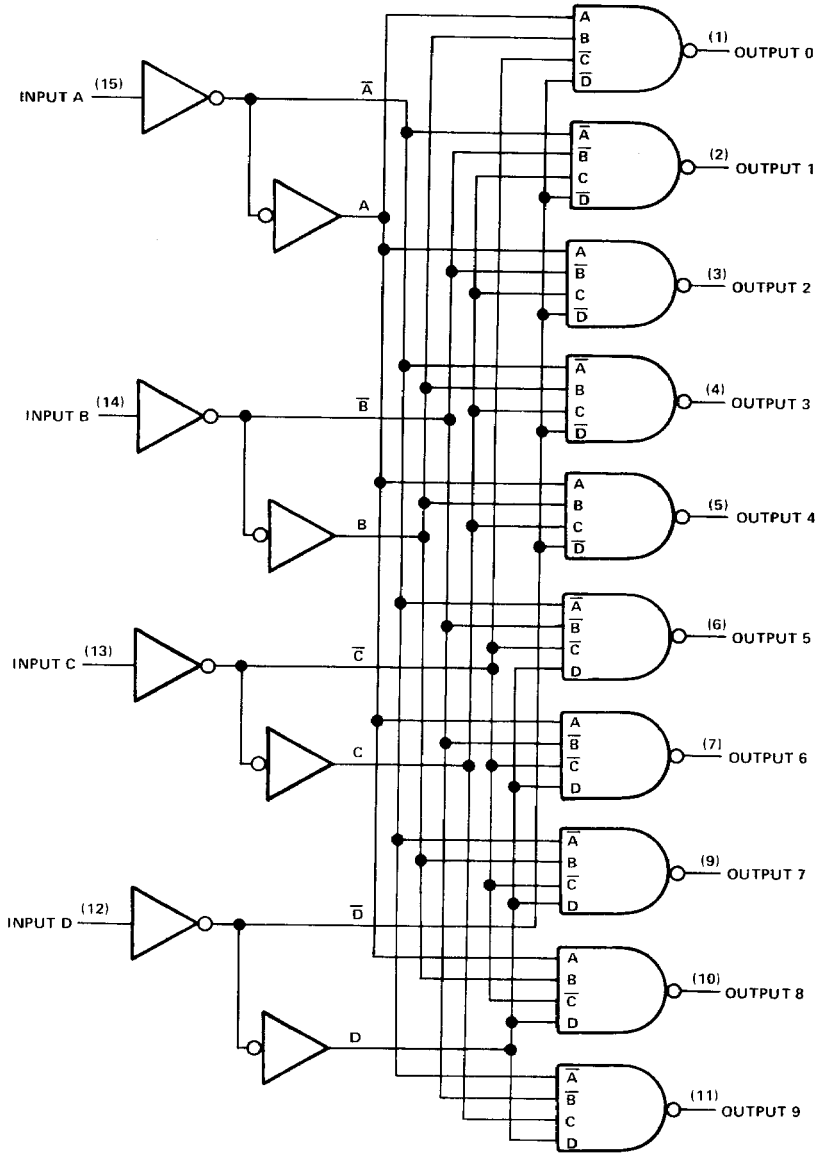
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 TTL DEVICES

TYPES SN5443A, SN54L43, SN7443A
4-LINE TO 10-LINE DECODERS (1-OF-10)

logic diagrams (continued)



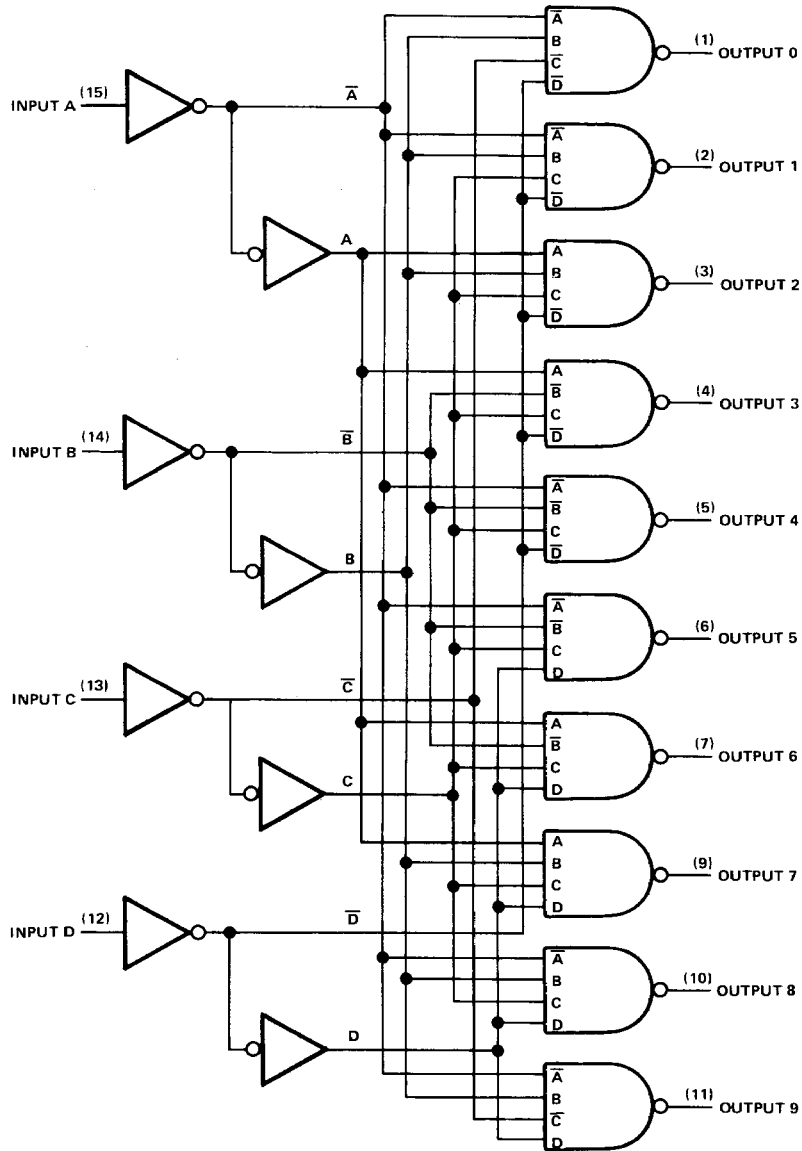
Pin numbers shown on logic notation are for D, J or N packages.

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TTL DEVICES

TYPES SN5444A, SN54L44, SN7444A
4-LINE TO 10-LINE DECODERS (1-OF-10)

logic diagrams (continued)



Pin numbers shown on logic notation are for D, J or N packages.



TTL DEVICES

TYPES SN54S195, SN74S195 4-BIT PARALLEL-ACCESS SHIFT REGISTERS

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

| | |
|---------------------------------------|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage | 5.5 V |
| Operating free-air temperature range: | |
| SN54S195 | -55°C to 125°C |
| SN74S195 | 0°C to 70°C |
| Storage temperature range | -65°C to 150°C |

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

| | SN54S195 | | | SN74S195 | | | UNIT |
|--|--------------------------|-----|-----|----------|-----|------|------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| Supply voltage, V_{CC} | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| High-level output current, I_{OH} | | | -1 | | | -1 | mA |
| Low-level output current, I_{OL} | | | 20 | | | 20 | mA |
| Clock frequency, f_{clock} | 0 | | 70 | 0 | | 70 | MHz |
| Width of clock input pulse, $t_w(\text{clock})$ | 7 | | | 7 | | | ns |
| Width of clear input pulse, $t_w(\text{clear})$ | 12 | | | 12 | | | ns |
| Setup time, t_{SU} (see Figure 1) | Shift/load | | 11 | | | 11 | ns |
| | Serial and parallel data | | 5 | | | 5 | |
| | Clear inactive-state | | 9 | | | 9 | |
| Shift/load release time, $t_{release}$ (see Figure 1) | | | 6 | | | 6 | ns |
| Serial and parallel data hold time, t_h (see Figure 1) | | | 3 | | | 3 | ns |
| Operating free-air temperature, T_A | -55 | | 125 | 0 | | 70 | °C |

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

| PARAMETER | TEST CONDITIONS† | | MIN | TYP‡ | MAX | UNIT |
|--|---|--|----------|------|------|------|
| V_{IH} High-level input voltage | | | 2 | | | V |
| V_{IL} Low-level input voltage | | | | | 0.8 | V |
| V_{IK} Input clamp voltage | $V_{CC} = \text{MIN}$, | $I_I = -18 \text{ mA}$ | | | -1.2 | V |
| V_{OH} High-level output voltage | $V_{CC} = \text{MIN}$, $V_{IL} = 0.8 \text{ V}$, | $V_{IH} = 2 \text{ V}$, $I_{OH} = -1 \text{ mA}$ | SN54S195 | 2.5 | 3.4 | V |
| | | | SN74S195 | 2.7 | 3.4 | |
| V_{OL} Low-level output voltage | $V_{CC} = \text{MIN}$, $V_{IL} = 0.8 \text{ V}$, | $V_{IH} = 2 \text{ V}$, $I_{OL} = 20 \text{ mA}$ | | | 0.5 | V |
| I_I Input current at maximum input voltage | $V_{CC} = \text{MAX}$, | $V_I = 5.5 \text{ V}$ | | | 1 | mA |
| I_{IH} High-level input current | $V_{CC} = \text{MAX}$, | $V_I = 2.7 \text{ V}$ | | | 50 | µA |
| I_{IL} Low-level input current | $V_{CC} = \text{MAX}$, | $V_I = 0.5 \text{ V}$ | | | -2 | mA |
| I_{OS} Short-circuit output current‡ | $V_{CC} = \text{MAX}$ | | -40 | | -100 | mA |
| I_{CC} Supply current | $V_{CC} = \text{MAX}$, | See Note 2 | SN54S195 | 70 | 99 | mA |
| | | | SN74S195 | 70 | 109 | |

† 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 duration of the short-circuit should not exceed one second.

NOTE 2: With all outputs open, shift/load grounded, and 4.5 V applied to the J, K, and data inputs, I_{CC} is measured by applying a momentary ground, followed by 4.5 V, to clear, and then applying a momentary ground, followed by 4.5 V, to clock.

switching characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT | |
|---|---|-----|------|------|------|----|
| f_{max} Maximum clock frequency | $C_L = 15 \text{ pF}$, $R_L = 280 \Omega$, See Figure 1 | 70 | 105 | | MHz | |
| t_{PHL} Propagation delay time, high-to-low-level output from clear | | | 12.5 | 18.5 | ns | |
| t_{PLH} Propagation delay time, low-to-high-level output from clock | | | | 8 | 12 | ns |
| t_{PHL} Propagation delay time, high-to-low-level output from clock | | | 11 | 16.5 | | ns |

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TTL DEVICES

**TYPES SN5442A THRU SN5444A, SN54L42 THRU SN54L44,
SN54LS42, SN7442A THRU SN7444A, SN74LS42
4-LINE TO 10-LINE DECODERS (1-OF-10)**

FUNCTION TABLE

| NO. | '42A, 'L42, 'LS42 BCD INPUT | | | | '43A, 'L43 EXCESS-3-INPUT | | | | '44A, 'L44 GRAY INPUT | | | | ALL TYPES DECIMAL OUTPUT | | | | | | | | | | |
|---------|--------------------------------|---|---|---|------------------------------|---|---|---|--------------------------|---|---|---|-----------------------------|---|---|---|---|---|---|---|---|---|---|
| | D | C | B | A | D | C | B | A | D | C | B | A | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| | 0 | L | L | L | L | L | L | H | H | L | L | H | L | L | H | H | H | H | H | H | H | H | H |
| 1 | L | L | L | H | L | H | L | L | L | H | H | L | L | H | H | H | H | H | H | H | H | H | H |
| 2 | L | L | H | L | L | H | L | H | L | H | H | L | L | H | H | L | H | H | H | H | H | H | H |
| 3 | L | L | H | H | L | H | H | L | L | L | H | L | H | L | H | H | H | H | H | H | H | H | H |
| 4 | L | H | L | L | L | H | H | H | L | L | H | L | L | L | H | H | H | L | H | H | H | H | H |
| 5 | L | H | L | H | H | L | L | L | L | H | H | L | L | L | H | H | H | H | L | H | H | H | H |
| 6 | L | H | H | L | H | L | L | H | L | H | H | L | H | H | H | H | H | H | L | H | H | H | H |
| 7 | L | H | H | H | H | L | H | L | H | H | H | H | H | H | H | H | H | H | H | L | H | H | H |
| 8 | H | L | L | L | H | L | H | H | H | H | H | L | L | H | H | H | H | H | H | H | L | H | H |
| 9 | H | L | L | H | H | H | L | L | L | H | L | H | L | L | H | H | H | H | H | H | H | H | L |
| INVALID | H | L | H | L | H | H | L | H | H | L | H | H | H | H | H | H | H | H | H | H | H | H | H |
| | H | L | H | H | H | H | H | L | L | L | H | H | H | H | H | H | H | H | H | H | H | H | H |
| | H | H | L | L | H | H | H | H | L | L | L | L | H | H | H | H | H | H | H | H | H | H | H |
| | H | H | H | L | L | L | L | H | L | L | L | H | H | H | H | H | H | H | H | H | H | H | H |
| | H | H | H | H | L | L | L | H | L | L | H | H | H | H | H | H | H | H | H | H | H | H | H |

H = high level, L = low level

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

| | |
|---------------------------------------|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage: '42A, '43A, '44A | 5.5 V |
| 'L42, 'L43, 'L44 | 5.5 V |
| 'LS42 | 7 V |
| Operating free-air temperature: SN54' | -55°C to 125°C |
| SN74' | 0°C to 70°C |
| Storage temperature range | -65°C to 150°C |

NOTE 1: Voltage values are with respect to network ground terminal.

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TTL DEVICES

TYPES SN5442A, SN5443A, SN5444A, SN7442A, SN7443A, SN7444A
4-LINE TO 10-LINE DECODERS (1-OF-10)

recommended operating conditions

| | SN5442A SN5443A SN5444A | | | SN7442A SN7443A SN7444A | | | UNIT |
|---------------------------------------|-------------------------------|-----|-----|-------------------------------|-----|------|--------------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| Supply voltage, V_{CC} | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| High-level output current, I_{OH} | -800 | | | -800 | | | μ A |
| Low-level output current, I_{OL} | 16 | | | 16 | | | mA |
| Operating free-air temperature, T_A | -55 | 125 | | 0 | 70 | | $^{\circ}$ C |

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

| PARAMETER | TEST CONDITIONS† | SN5442A SN5443A SN5444A | | | SN7442A SN7443A SN7444A | | | UNIT |
|--|--|-------------------------------|------|-----|-------------------------------|------|-----|---------|
| | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| V_{IH} High-level input voltage | | 2 | | | 2 | | | V |
| V_{IL} Low-level input voltage | | 0.8 | | | 0.8 | | | V |
| V_{IK} Input clamp voltage | $V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$ | 1.5 | | | -1.5 | | | V |
| V_{OH} High-level output voltage | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = -800 \mu\text{A}$ | 2.4 | 3.4 | | 2.4 | 3.4 | | V |
| V_{OL} Low-level output voltage | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 16 \text{ mA}$ | | 0.2 | 0.4 | | 0.2 | 0.4 | V |
| I_I Input current at maximum input voltage | $V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$ | 1 | | | 1 | | | mA |
| I_{IH} High-level input current | $V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$ | 40 | | | 40 | | | μ A |
| I_{IL} Low level input current | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ | -1.6 | | | -1.6 | | | mA |
| I_{OS} Short-circuit output current § | $V_{CC} = \text{MAX}$ | -20 | -55 | | -18 | -55 | | mA |
| I_{CC} Supply current | $V_{CC} = \text{MAX}$, See Note 2 | 28 | 41 | | 28 | 56 | | mA |

† For conditions shown as MIN or MAX, use the appropriate values 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.

NOTE 2: I_{CC} is measured with all outputs open and all inputs grounded.

switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|--|-----|-----|-----|------|
| t_{PHL} Propagation delay time, high-to-low-level output from A, B, C, or D through 2 levels of logic | $C_L = 15 \text{ pF}, R_L = 400 \Omega,$ See Note 3 | | 14 | 25 | ns |
| t_{PHL} Propagation delay time, high-to-low-level output from A, B, C, or D through 3 levels of logic | | | 17 | 30 | ns |
| t_{PLH} Propagation delay time, low-to-high-level output from A, B, C, and D through 2 levels of logic | | | 10 | 25 | ns |
| t_{PLH} Propagation delay time, low-to-high-level output from A, B, C, and D through 3 levels of logic | | | 17 | 30 | ns |

NOTE 3: See General Information Section for load circuits and voltage waveforms

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TTL DEVICES

TYPES SN54L42, SN54L43, SN54L44
4-LINE TO 10-LINE DECODERS (1-OF-10)

recommended operating conditions

| | SN54L42 SN54L43 SN54L44 | | | UNIT |
|---|-------------------------------|-----|------|------|
| | MIN | NOM | MAX | |
| V _{CC} Supply voltage | 4.5 | 5 | 5.5 | V |
| V _{IH} High-level input voltage | 2 | | | V |
| V _{IL} Low-level input voltage | | | 0.8 | V |
| I _{OH} High-level output current | | | -0.4 | mA |
| I _{OL} Low-level output current | | | 8 | 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† | MIN | TYP | MAX | UNIT |
|-------------------|--|-----|-----|------|------|
| V _{IK} | V _{CC} = MIN, I _I = -12 mA | | | -1.5 | V |
| V _{OH} | V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OH} = -400 μA | 2.4 | 3.4 | | V |
| V _{OL} | V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OL} = 8 mA | | 0.2 | 0.4 | V |
| I _I | V _{CC} = MAX, V _I = 5.5 V | | | 1 | mA |
| I _{IH} | V _{CC} = MAX, V _I = 2.4 V | | | 20 | μA |
| I _{IL} | V _{CC} = MAX, V _I = 0.4 V | | | -0.8 | mA |
| I _{OS} ‡ | V _{CC} = MAX | -9 | | -28 | mA |
| I _{CC} | V _{CC} = MAX, See Note 2 | | 14 | 22 | mA |

† For conditions shown as MIN or MAX, use the appropriate values 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.

NOTE 2: I_{CC} is measured with all outputs open and inputs grounded.

switching characteristics, V_{CC} = 5 V, T_A = 25° C

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|--|-----|-----|-----|------|
| t _{PHL} Propagation delay time, high-to-low-level output from A, B, C, or D through 2 levels of logic | C _L = 15 pF, R _L = 800 Ω, See Note 3 | 10 | 44 | 60 | ns |
| t _{PHL} Propagation delay time, high-to-low-level output from A, B, C, or D through 3 levels of logic | | 46 | 70 | | ns |
| t _{PLH} Propagation delay time, low-to-high-level output from A, B, C, and D through 2 levels of logic | | 10 | 34 | 50 | ns |
| t _{PLH} Propagation delay time, low-to-high-level output from A, B, C, and D through 3 levels of logic | | 52 | 70 | | ns |

NOTE 3: See General Information Section for load circuits and voltage waveforms.

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TTL DEVICES

TYPES SN54LS42, SN74LS42 4-LINE TO 10-LINE DECODERS (1-OF-10)

recommended operating conditions

| | SN54LS42 | | | SN74LS42 | | | UNIT |
|---------------------------------------|----------|-----|------|----------|-----|------|--------------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| Supply voltage, V_{CC} | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| High-level output current, I_{OH} | | | -400 | | | -400 | μ A |
| Low-level output current, I_{OL} | | | 4 | | | 8 | mA |
| Operating free-air temperature, T_A | -55 | | 125 | 0 | | 70 | $^{\circ}$ C |

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

| PARAMETER | TEST CONDITIONS† | SN54LS42 | | | SN74LS42 | | | UNIT |
|--|---|----------|------|------|----------|------|------|---------|
| | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| V_{IH} High-level input voltage | | 2 | | | 2 | | | V |
| V_{IL} Low-level input voltage | | | | 0.7 | | | 0.8 | V |
| V_{IK} Input clamp voltage | $V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$ | | | -1.5 | | | -1.5 | V |
| V_{OH} High-level output voltage | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OH} = -400 \mu\text{A}$ | 2.5 | 3.5 | | 2.7 | 3.5 | | V |
| V_{OL} Low-level output voltage | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}$ | | | 0.25 | 0.4 | 0.25 | 0.4 | V |
| | | | | | | 0.35 | 0.5 | |
| I_I Input current at maximum input voltage | $V_{CC} = \text{MAX}, V_I = 7 \text{ V}$ | | | 0.1 | | | 0.1 | mA |
| I_{IH} High-level input current | $V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$ | | | 20 | | | 20 | μ A |
| I_{IL} Low-level input current | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ | | | -0.4 | | | -0.4 | mA |
| I_{OS} Short-circuit output current§ | $V_{CC} = \text{MAX}$ | | | -20 | -100 | -20 | -100 | mA |
| I_{CC} Supply current | $V_{CC} = \text{MAX}, \text{ See Note 2}$ | | | 7 | 13 | 7 | 13 | 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 duration of the short-circuit should not exceed one second.

NOTE 2. I_{CC} is measured with all outputs open and inputs grounded.

switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^{\circ}\text{C}$

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|--|-----|-----|-----|------|
| t_{PHL} Propagation delay time, high-to-low-level output from A, B, C, or D through 2 levels of logic | $C_L = 15 \text{ pF}, R_L = 2 \text{ k}\Omega, \text{ See Note 3}$ | | 15 | 25 | ns |
| t_{PHL} Propagation delay time, high-to-low-level output from A, B, C, or D through 3 levels of logic | | | 20 | 30 | ns |
| t_{PLH} Propagation delay time, low-to-high-level output from A, B, C, and D through 2 levels of logic | | | 15 | 25 | ns |
| t_{PLH} Propagation delay time, low-to-high-level output from A, B, C, and D through 3 levels of logic | | | 20 | 30 | ns |

Note 3: See General Information Section for load circuits and voltage waveforms.

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TTL DEVICES