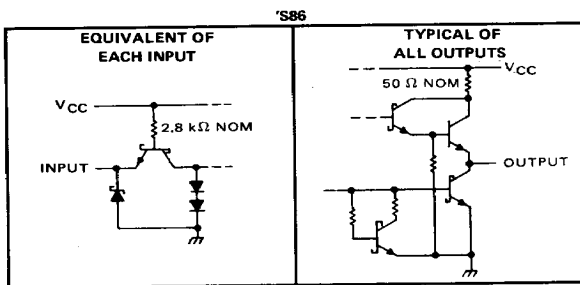
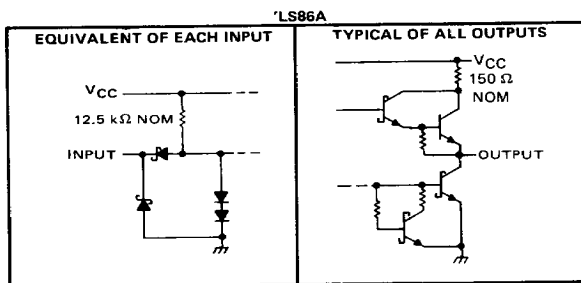
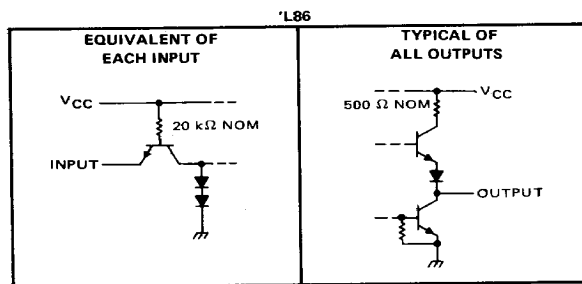
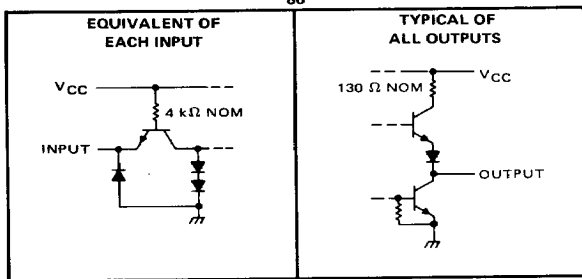


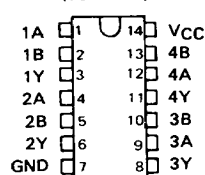
TYPES SN5486, SN54L86, SN54LS86A, SN54S86, SN7486, SN74LS86A, SN74S86 QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

DECEMBER 1972—REVISED DECEMBER 1983

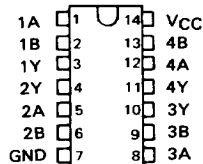
schematics of inputs and outputs



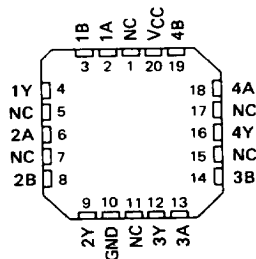
SN5486, SN54LS86A, SN54S86 ... J OR W PACKAGE
SN7486 ... J OR N PACKAGE
SN74LS86A, SN74S86 ... D, J OR N PACKAGE



SN54L86 ... J PACKAGE
(TOP VIEW)



SN54LS86A, SN54S86 ... FK PACKAGE
SN74LS86A, SN74S86 ... FN PACKAGE
(TOP VIEW)



NC - No internal connection

FUNCTION TABLES

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

H = high level, L = low level

| TYPE | TYPICAL AVERAGE PROPAGATION DELAY TIME | TYPICAL TOTAL POWER DISSIPATION |
|--------|----------------------------------------|---------------------------------|
| '86 | 14 ns | 150 mW |
| 'L86 | 55 ns | 15 mW |
| 'LS86A | 10 ns | 30.5 mW |
| 'S86 | 7 ns | 250 mW |

PRODUCTION DATA

This document contains 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.

TEXAS INSTRUMENTS

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3

TTL DEVICES

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TYPES SN5486, SN7486 QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

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: SN5486 | -55°C to 125°C |
| SN7486 | 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

| | SN5486 | | | SN7486 | | | 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 | °C |

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

| PARAMETER | TEST CONDITIONS [†] | SN5486 | | | SN7486 | | | 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 | $V_{CC} = \text{MIN}, I_I = -8 \text{ mA}$ | -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 | 30 | 43 | | 30 | 50 | mA | |

[†]For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.

[‡]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 the inputs grounded and the outputs open.

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

| PARAMETER [¶] | FROM (INPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------------|--------------|------------------|--------------------------------------------------------|-----|-----|------|
| | | | | | | |
| t_{PLH} | A or B | Other input low | $C_L = 15 \text{ pF}, R_L = 400 \Omega,$ See Note 3 | 15 | 23 | ns |
| t_{PHL} | | | | 11 | 17 | |
| t_{PLH} | A or B | Other input high | | 18 | 30 | ns |
| t_{PHL} | | | | 13 | 22 | |

[¶] t_{PLH} = propagation delay time, low-to-high level output

t_{PHL} = propagation delay time, high-to-low level output

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

3 TTL DEVICES

TYPES SN54L86

QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

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

| | |
|--------------------------------------------------------|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage (see Note 4) | 5.5 V |
| Operating free-air temperature range SN54L86 | -55°C to 125°C |
| Storage temperature range | -65°C to 150°C |

- NOTES: 1. Voltage values are with respect to network ground terminal.
 4. Input voltages must be zero or positive with respect to network ground terminal.

recommended operating conditions

| | MIN | NOM | MAX | UNIT |
|--------------------------------------|-----|-----|------|------|
| V_{CC} Supply voltage | 4.5 | 5 | 5.5 | V |
| V_{IH} High-level input voltage | 2 | | | V |
| V_{IL} Low-level input voltage | | | 0.7 | V |
| I_{OH} High-level output current | | | -0.1 | mA |
| I_{OL} Low-level output current | | | 2 | 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_{OH} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.7 \text{ V}$, $I_{OH} = -0.1 \text{ mA}$ | | 2.4 | 3.3 | | V |
| V_{OL} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = 0.7 \text{ V}$, $I_{OL} = 2 \text{ mA}$ | | | 0.15 | 0.3 | V |
| I_I | $V_{CC} = \text{MAX}$, $V_I = 5.5 \text{ V}$ | | | | 0.2 | mA |
| I_{IH} | $V_{CC} = \text{MAX}$, $V_I = 2.4 \text{ V}$ | | | | 20 | μA |
| I_{IL} | $V_{CC} = \text{MAX}$, $V_I = 0.3 \text{ V}$ | | | | -0.36 | mA |
| I_{OS} | $V_{CC} = \text{MAX}$ | | -3 | | -15 | mA |
| I_{CCH} | $V_{CC} = \text{MAX}$, See Note 5 | | | 2.2 | 4.4 | mA |
| I_{CCL} | $V_{CC} = \text{MAX}$, See Note 6 | | | 3.8 | 6.68 | mA |

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

‡ All typical values are at $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$.

NOTES: 5. I_{CCH} is measured with all outputs open, one input of each gate at 4.5 V, and the other inputs grounded.

6. I_{CCL} is measured with all outputs open and all inputs at 4.5 V.

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

| PARAMETER‡ | FROM (INPUT) | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|------------|--------------|------------------|----------------------------------------------------------------------|-----|-----|-----|------|
| | | | | | | | |
| t_{PLH} | A or B | Other input low | $C_L = 50 \text{ pF}$, $R_L = 4 \text{ k}\Omega$, See Note 3 | 75 | 150 | | ns |
| t_{PHL} | | | | 60 | 150 | | |
| t_{PLH} | A or B | Other input high | See Note 3 | 50 | 90 | | ns |
| t_{PHL} | | | | 35 | 60 | | |

‡ t_{PLH} = propagation delay time, low-to-high-level output

‡ t_{PHL} = propagation delay time, high-to-low-level output

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

TTL DEVICES



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TYPES SN54LS86A, SN74LS86A QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

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

| | |
|-------------------------------------------------|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage | 7 V |
| Operating free-air temperature range: SN54LS86A | -55°C to 125°C |
| SN74LS86A | 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

| | SN54LS86A | | | SN74LS86A | | | 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 | °C |

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

| PARAMETER | TEST CONDITIONS† | SN54LS86A | | | SN74LS86A | | | 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 | 3.4 | | 2.7 | 3.4 | | V |
| V_{OL} Low-level output voltage | $V_{CC} = \text{MIN.}$, $I_{OL} = 4 \text{ mA}$ | | 0.25 | 0.4 | | 0.25 | 0.4 | V |
| | $V_{IH} = 2 \text{ V}$, $V_{IL} = V_{IL \text{ max.}}$, $I_{OL} = 8 \text{ mA}$ | | | | | 0.35 | 0.5 | |
| I_I Input current at maximum input voltage | $V_{CC} = \text{MAX.}$, $V_I = 7 \text{ V}$ | | | 0.2 | | | 0.2 | mA |
| I_{IH} High-level input current | $V_{CC} = \text{MAX.}$, $V_I = 2.7 \text{ V}$ | | | 40 | | | 40 | μ A |
| I_{IL} Low-level input current | $V_{CC} = \text{MAX.}$, $V_I = 0.4 \text{ V}$ | | | -0.8 | | | -0.8 | mA |
| I_{OS} Short-circuit output current§ | $V_{CC} = \text{MAX.}$ | -20 | | -100 | -20 | | -100 | mA |
| I_{CC} Supply current | $V_{CC} = \text{MAX.}$, See Note 2 | | 6.1 | 10 | | 6.1 | 10 | mA |

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

‡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 the inputs grounded and the outputs open.

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

| PARAMETER¶ | FROM (INPUT) | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|------------|--------------|------------------|----------------------------------------------------------------------|-----|-----|-----|------|
| | | Other input low | Other input high | | | | |
| t_{PLH} | A or B | Other input low | $C_L = 15 \text{ pF}$, $R_L = 2 \text{ k}\Omega$, See Note 3 | 12 | 23 | | ns |
| t_{PHL} | | | | | | | |
| t_{PLH} | A or B | Other input high | | 20 | 30 | | ns |
| t_{PHL} | | | | 13 | 22 | | |

¶ t_{PLH} = propagation delay time, low-to-high-level output

¶ t_{PHL} = propagation delay time, high-to-low-level output

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

TYPES SN54S86, SN74S86 QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

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: SN54S86 | -55°C to 125°C |
| SN74S86 | 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

| | SN54S86 | | | SN74S86 | | | 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 |
| 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† | SN54S86 | | | SN74S86 | | | UNIT |
|----------------------------------------------|---------------------------------------------------------------------------------------------|---------|------|------|---------|------|------|------|
| | | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| V_{IH} High-level input voltage | | 2 | | | 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 | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = -1 \text{ mA}$ | 2.5 | 3.4 | | 2.7 | 3.4 | | V |
| V_{OL} Low-level output voltage | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 20 \text{ mA}$ | | | | 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 | -40 | | -100 | mA |
| I_{CC} Supply current | $V_{CC} = \text{MAX}, \text{ See Note 2}$ | | | | 50 | | 75 | mA |

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

‡ 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 the inputs grounded and the outputs open.

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

| PARAMETER ¶ | FROM (INPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-------------|--------------|------------------|-----|------|-----|------|
| t_{PLH} | A or B | Other input low | 7 | 10.5 | | ns |
| t_{PHL} | | | | | | |
| t_{PLH} | A or B | Other input high | 7 | 10.5 | | ns |
| t_{PHL} | | | | | | |

$C_L = 15 \text{ pF}, R_L = 280 \Omega, \text{ See Note 3}$

¶ t_{PLH} = propagation delay time, low-to-high-level output

t_{PHL} = propagation delay time, high-to-low-level output

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

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TTL DEVICES