

SN54LS240, SN54LS241, SN54LS244, SN54S240, SN54S241, SN54S244 SN74LS240, SN74LS241, SN74LS244, SN74S240, SN74S241, SN74S244 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

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- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- PNP Inputs Reduce D-C Loading
- Hysteresis at Inputs Improves Noise Margins

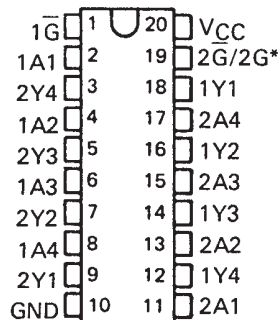
description

These octal buffers and line drivers are designed specifically to improve both the performance and density of three-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. The designer has a choice of selected combinations of inverting and noninverting outputs, symmetrical \bar{G} (active-low output control) inputs, and complementary G and \bar{G} inputs. These devices feature high fan-out, improved fan-in, and 400-mV noise-margin. The SN74LS' and SN74S' can be used to drive terminated lines down to 133 ohms.

The SN54' family is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74' family is characterized for operation from 0°C to 70°C .

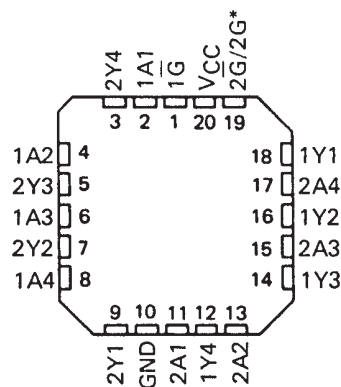
SN54LS', SN54S' . . . J OR W PACKAGE
SN74LS', SN74S' . . . DW OR N PACKAGE

(TOP VIEW)



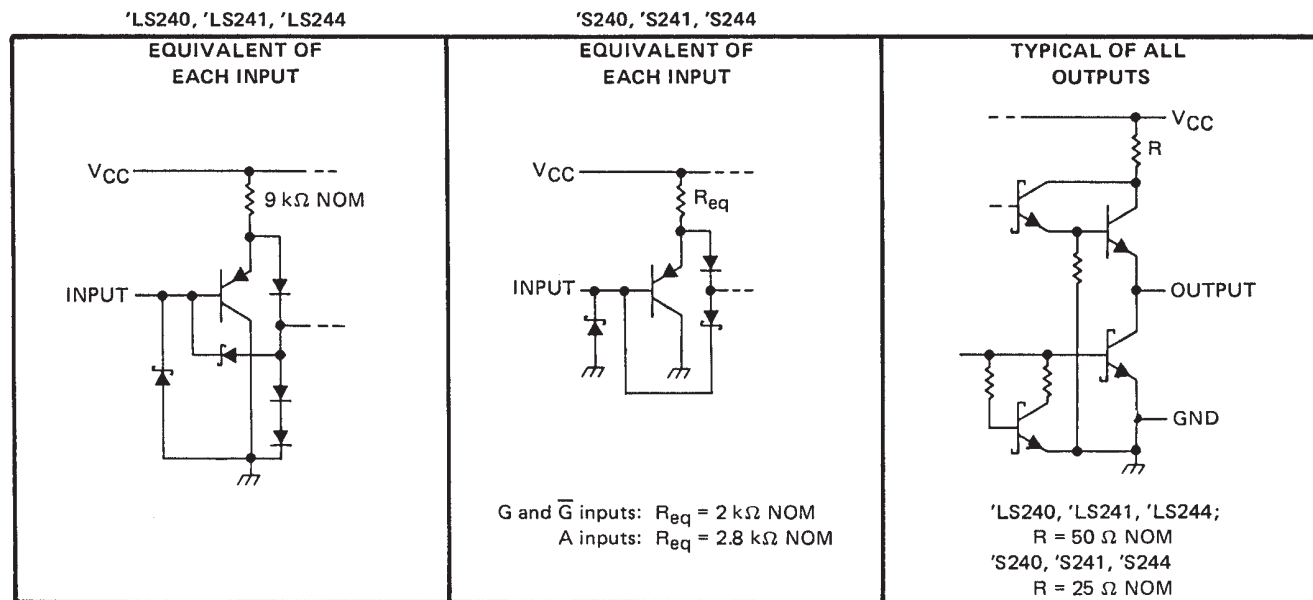
SN54LS', SN54S' . . . FK PACKAGE

(TOP VIEW)



*2G for 'LS241 and 'S241 or 2G for all other drivers.

schematics of inputs and outputs



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

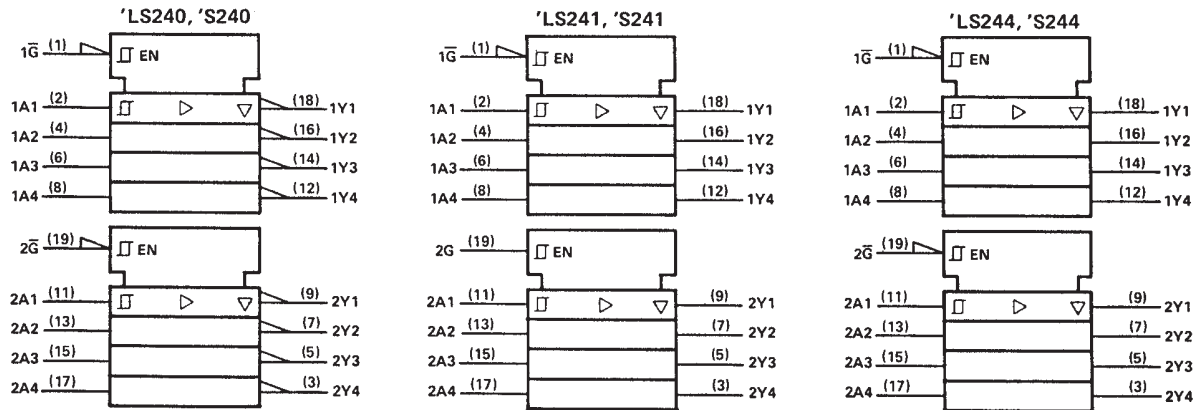
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SN54LS240, SN54LS241, SN54LS244, SN54S240, SN54S241, SN54S244 SN74LS240, SN74LS241, SN74LS244, SN74S240, SN74S241, SN74S244 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

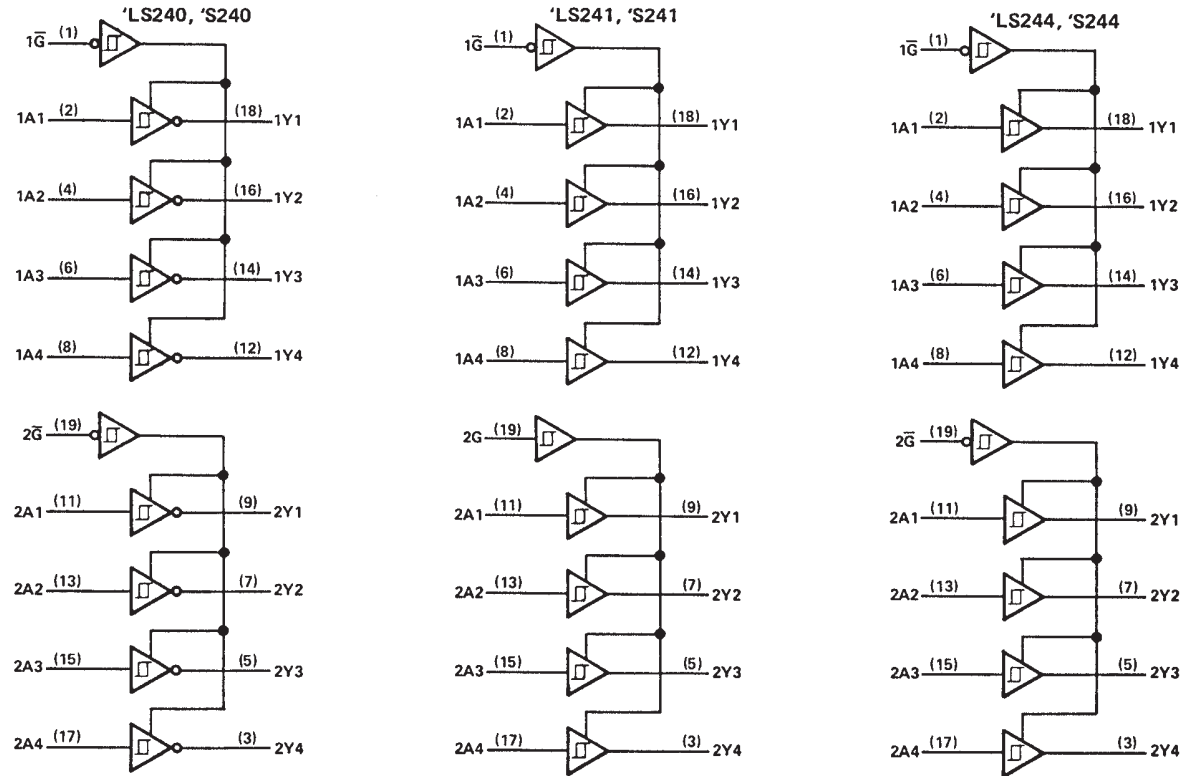
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logic symbols†



†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

logic diagrams (positive logic)



Pin numbers shown are for DW, J, N, and W packages.

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

| | |
|--|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage: 'LS Circuits | 7 V |
| 'S Circuits | 5.5 V |
| Off-state output voltage | 5.5 V |
| Operating free-air temperature range: SN54LS', SN54S' Circuits | -55°C to 125°C |
| SN74LS', SN74S' Circuits | 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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**SN54LS240, SN54LS241, SN54LS244, SN54S240, SN54S241, SN54S244
SN74LS240, SN74LS241, SN74LS244, SN74S240, SN74S241, SN74S244
OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS**

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recommended operating conditions

| PARAMETER | SN54LS' | | | SN74LS' | | | UNIT |
|---|---------|-----|-----|---------|-----|------|------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| V _{CC} Supply voltage (see Note 1) | 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 | | | -12 | | | -15 | mA |
| I _{OL} Low-level output current | | | 12 | | | 24 | mA |
| T _A Operating free-air temperature | -55 | | 125 | 0 | | 70 | °C |

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

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

| PARAMETER | TEST CONDITIONS† | SN54LS' | | SN74LS' | | UNIT | | |
|---|--|-------------------------|----------------|---------|-----|------|------|-----|
| | | MIN | TYP‡ | MAX | MIN | | TYP‡ | MAX |
| V _{IK} | V _{CC} = MIN, I _I = -18 mA | | | -1.5 | | -1.5 | V | |
| Hysteresis (V _{T+} - V _{T-}) | V _{CC} = MIN | 0.2 | 0.4 | | 0.2 | 0.4 | V | |
| V _{OH} | V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = MAX, I _{OH} = -3 mA | 2.4 | 3.4 | | 2.4 | 3.4 | V | |
| | V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.5 V, I _{OH} = MAX | 2 | | | 2 | | | |
| V _{OL} | V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = MAX | I _{OL} = 12 mA | | 0.4 | | 0.4 | V | |
| | | I _{OL} = 24 mA | | | | 0.5 | | |
| I _{OZH} | V _{CC} = MAX, V _{IH} = 2 V, V _O = 2.7 V | | | 20 | | 20 | μA | |
| I _{OZL} | V _{IL} = MAX, V _O = 0.4 V | | | -20 | | -20 | | |
| I _I | V _{CC} = MAX, V _I = 7 V | | | 0.1 | | 0.1 | mA | |
| I _{IH} | V _{CC} = MAX, V _I = 2.7 V | | | 20 | | 20 | μA | |
| I _{IL} | V _{CC} = MAX, V _{IL} = 0.4 V | | | -0.2 | | -0.2 | mA | |
| I _{OS} § | V _{CC} = MAX | -40 | | -225 | -40 | -225 | mA | |
| I _{CC} | V _{CC} = MAX, Output open | Outputs high | All | 17 | 27 | 17 | 27 | mA |
| | | Outputs low | 'LS240 | 26 | 44 | 26 | 44 | |
| | | | 'LS241, 'LS244 | 27 | 46 | 27 | 46 | |
| | | All outputs disabled | 'LS240 | 29 | 50 | 29 | 50 | |
| | | | 'LS241, 'LS244 | 32 | 54 | 32 | 54 | |

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

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

| PARAMETER | TEST CONDITIONS | 'LS240 | | | 'LS241, 'LS244 | | | UNIT |
|------------------|--|--------|-----|-----|----------------|-----|-----|------|
| | | MIN | TYP | MAX | MIN | TYP | MAX | |
| t _{PLH} | R _L = 667 Ω, C _L = 45 pF, See Note 2 | 9 | 14 | | 12 | 18 | ns | |
| t _{PHL} | | 12 | 18 | | 12 | 18 | ns | |
| t _{PZL} | | 20 | 30 | | 20 | 30 | ns | |
| t _{PZH} | | 15 | 23 | | 15 | 23 | ns | |
| t _{PLZ} | R _L = 667 Ω, C _L = 5 pF, See Note 2 | 10 | 20 | | 10 | 20 | ns | |
| t _{PHZ} | | 15 | 25 | | 15 | 25 | ns | |

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



SN54LS240, SN54LS241, SN54LS244, SN54S240, SN54S241, SN54S244 SN74LS240, SN74LS241, SN74LS244, SN74S240, SN74S241, SN74S244 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

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recommended operating conditions

| PARAMETER | SN54S' | | | SN74S' | | | UNIT |
|---|--------|-----|-----|--------|-----|------|------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| V _{CC} Supply voltage, (see Note 1) | 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 | | | -12 | | | -15 | mA |
| I _{OL} Low-level output current | | | 48 | | | 64 | mA |
| External resistance between any input and V _{CC} or ground | | | | | | | |
| | | | 40 | | | 40 | kΩ |
| T _A Operating free-air temperature (see Note 3) | -55 | | 125 | 0 | | 70 | °C |

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

3. An SN54S241J operating at free-air temperature above 116°C requires a heat sink that provides a thermal resistance from case to free-air R_{θCA}, of not more than 40°C/W.

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

| PARAMETER | TEST CONDITIONS† | | | SN54S' | | | SN74S' | | | UNIT |
|--|--|-------------------------------------|-----|---|------|------|--------|------|------|------|
| | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | MIN | TYP‡ | MAX | |
| V _{IK} | V _{CC} = MIN, I _I = -18 mA | | | | | -1.2 | | | -1.2 | V |
| Hysteresis (V _{T+} - V _{T-}) | V _{CC} = MIN | | | 0.2 | 0.4 | | 0.2 | 0.4 | | V |
| V _{OH} | V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OH} = -1 mA | | | | | | 2.7 | | | V |
| | V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OH} = -3 mA | | | 2.4 | 3.4 | | 2.4 | 3.4 | | |
| | V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.5 V, I _{OH} = MAX | | | 2 | | | 2 | | | |
| V _{OL} | V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = 0.8 V, I _{OL} = MAX | | | | | 0.55 | | | 0.55 | V |
| I _{OZH} | V _{CC} = MAX, V _{IH} = 2 V, V _O = 2.4 V | | | | | 50 | | | 50 | μA |
| I _{OZL} | V _{CC} = MAX, V _{IH} = 2 V, V _O = 0.5 V | | | | | -50 | | | -50 | |
| 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} | Any A | | | V _{CC} = MAX, V _I = 0.5 V | | | -400 | | | μA |
| | Any G | | | | | | -2 | | | mA |
| I _{OS} § | V _{CC} = MAX | | | -50 | | -225 | -50 | | -225 | mA |
| I _{CC} | Outputs high | V _{CC} = MAX, Outputs open | | 'S240 | 80 | 123 | 80 | 135 | mA | |
| | | | | 'S241, 'S244 | 95 | 147 | 95 | 160 | | |
| | Outputs low | | | 'S240 | 100 | 145 | 100 | 150 | | |
| | | | | 'S241, 'S244 | 120 | 170 | 120 | 180 | | |
| | Outputs disabled | | | 'S240 | 100 | 145 | 100 | 150 | | |
| | | | | 'S241, 'S244 | 120 | 170 | 120 | 180 | | |

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



SN54LS240, SN54LS241, SN54LS244, SN54S240, SN54S241, SN54S244
 SN74LS240, SN74LS241, SN74LS244, SN74S240, SN74S241, SN74S244
 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

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

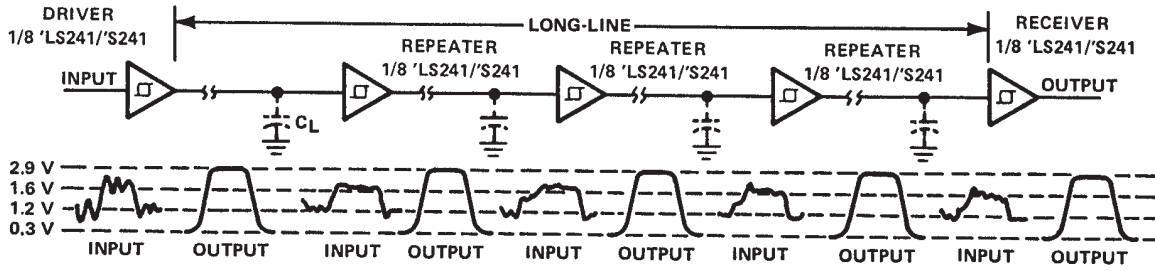
| PARAMETER | TEST CONDITIONS | 'S240 | | | 'S241, 'S244 | | | UNIT |
|------------------|---|-------|-----|-----|--------------|-----|-----|------|
| | | MIN | TYP | MAX | MIN | TYP | MAX | |
| t _{PLH} | $R_L = 90\ \Omega$, See Note 4 $C_L = 50\ \text{pF}$, | 4.5 | 7 | | 6 | 9 | ns | |
| t _{PHL} | | 4.5 | 7 | | 6 | 9 | ns | |
| t _{PZL} | | 10 | 15 | | 10 | 15 | ns | |
| t _{PZH} | | 6.5 | 10 | | 8 | 12 | ns | |
| t _{PLZ} | $R_L = 90\ \Omega$, See Note 4 $C_L = 5\ \text{pF}$, | 10 | 15 | | 10 | 15 | ns | |
| t _{PHZ} | | 6 | 9 | | 6 | 9 | ns | |

NOTE 4: Load circuits and voltage waveforms are shown in Section 1.

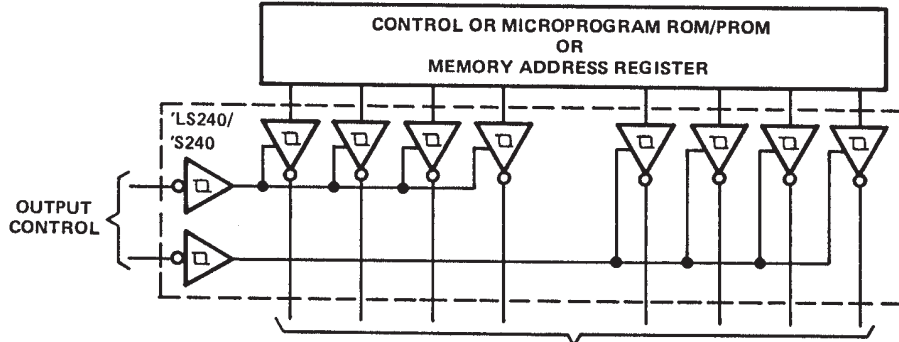


SN54LS240, SN54LS241, SN54LS244, SN54S240, SN54S241, SN54S244 SN74LS240, SN74LS241, SN74LS244, SN74S240, SN74S241, SN74S244 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

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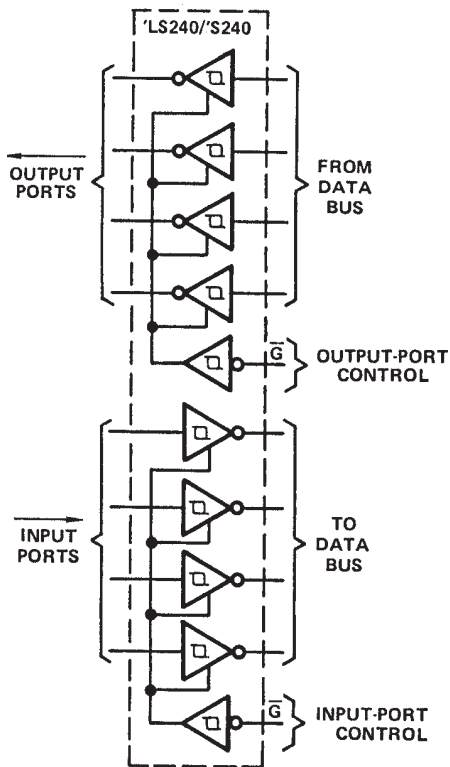


'LS241, 'S241 USED AS REPEATER/LEVEL RESTORER

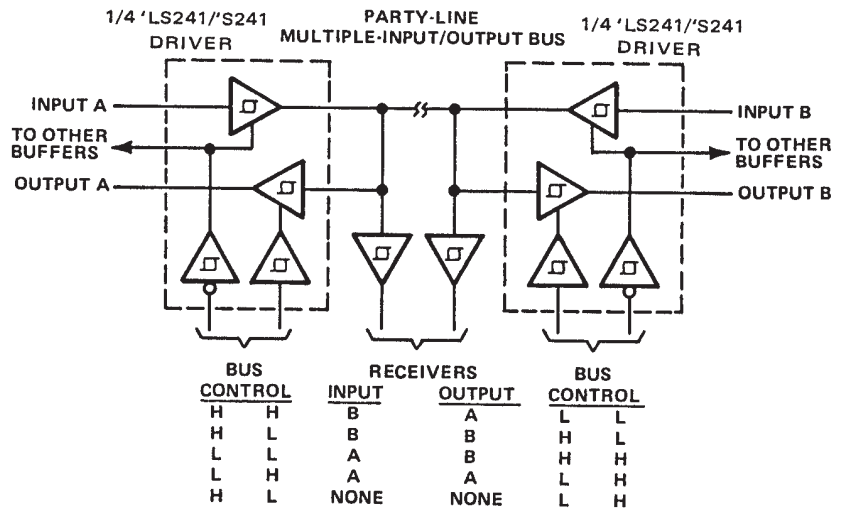


SYSTEM AND/OR MEMORY-ADDRESS BUS

'LS240/'S240 USED AS SYSTEM AND/OR MEMORY BUS DRIVER—4-BIT ORGANIZATION CAN BE APPLIED TO HANDLE BINARY OR BCD



INDEPENDENT 4-BIT BUS DRIVERS/RECEIVERS IN A SINGLE PACKAGE



PARTY-LINE BUS SYSTEM WITH MULTIPLE INPUTS, OUTPUTS, AND RECEIVERS

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