

QUADRUPLE 2-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS

SCLS345F – MAY 1996 – REVISED JANUARY 2000

- **EPIC™** (Enhanced-Performance Implanted CMOS) Process
- Operating Range 2-V to 5.5-V V_{CC}
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model ($C = 200$ pF, $R = 0$)
- Package Options Include Plastic Small-Outline (D), Shrink Small-Outline (DB), Thin Very Small-Outline (DGV), Thin Shrink Small-Outline (PW), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) DIPs

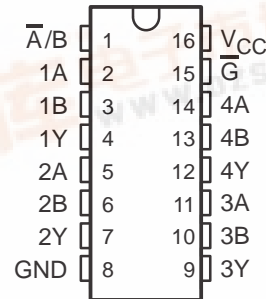
description

These quadruple 2-line to 1-line data selectors/multiplexers are designed for 2-V to 5.5-V V_{CC} operation.

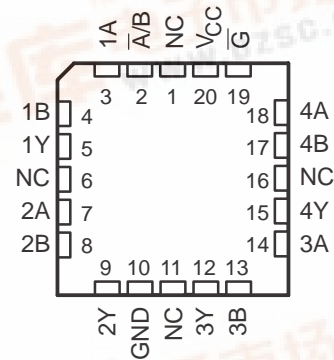
The 'AHC157 devices feature a common strobe (\bar{G}) input. When the strobe is high, all outputs are low. When the strobe is low, a 4-bit word is selected from one of two sources and is routed to the four outputs. The devices provide true data.

The SN54AHC157 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74AHC157 is characterized for operation from -40°C to 85°C .

SN54AHC157 ... J OR W PACKAGE
SN74AHC157 ... D, DB, DGV, N, OR PW PACKAGE
(TOP VIEW)



SN54AHC157 ... FK PACKAGE
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE

| \bar{G} | INPUTS | | | OUTPUT Y |
|-----------|-------------------|---|---|-------------|
| | \bar{A}/\bar{B} | A | B | |
| H | X | X | X | L |
| L | L | L | X | L |
| L | L | H | X | H |
| L | H | X | L | L |
| L | H | X | H | H |

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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

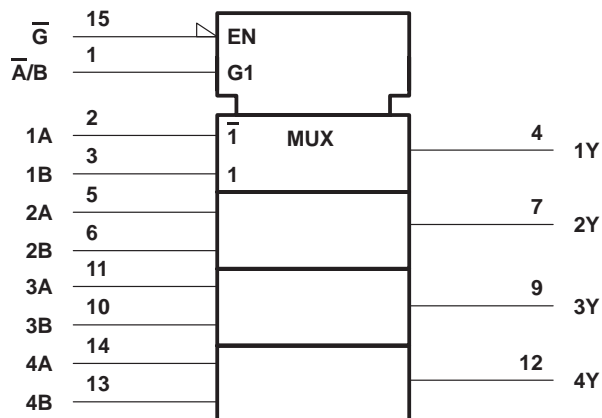
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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

SN54AHC157, SN74AHC157 QUADRUPLE 2-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS

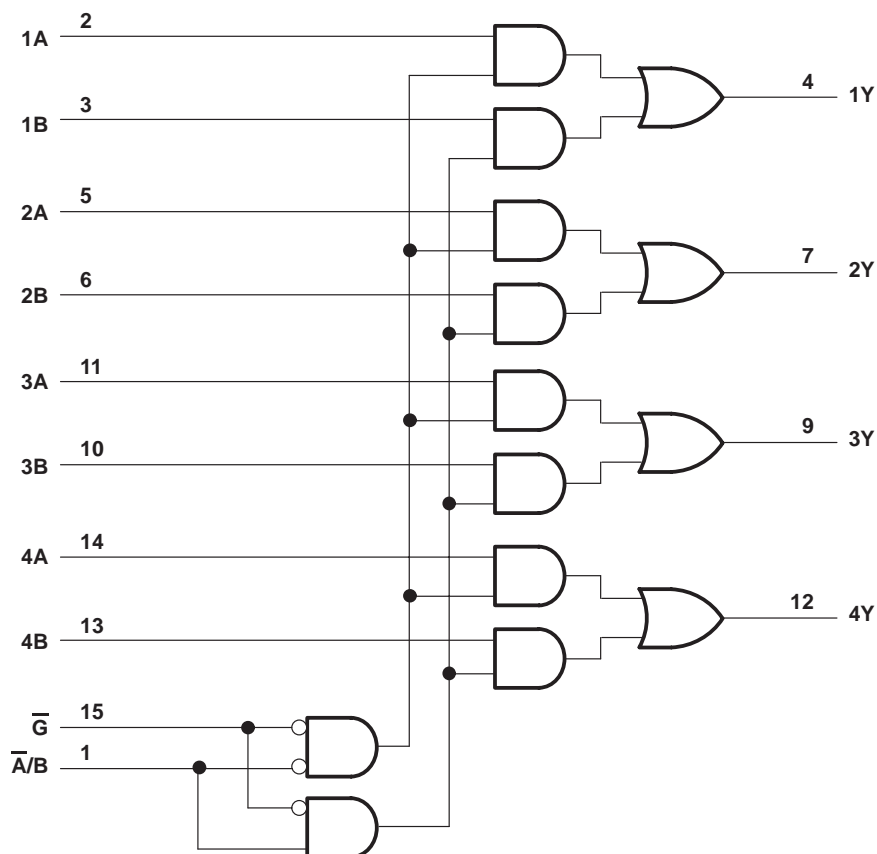
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logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for the D, DB, DGV, J, N, PW, and W packages.

logic diagram (positive logic)



Pin numbers shown are for the D, DB, DGV, J, N, PW, and W packages.

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

| | |
|--|----------------------------|
| Supply voltage range, V_{CC} | –0.5 V to 7 V |
| Input voltage range, V_I (see Note 1) | –0.5 V to 7 V |
| Output voltage range, V_O (see Note 1) | –0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, I_{IK} ($V_I < 0$) | –20 mA |
| Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) | ±20 mA |
| Continuous output current, I_O ($V_O = 0$ to V_{CC}) | ±25 mA |
| Continuous current through V_{CC} or GND | ±50 mA |
| Package thermal impedance, θ_{JA} (see Note 2): | |
| D package | 73°C/W |
| DB package | 82°C/W |
| DGV package | 120°C/W |
| N package | 67°C/W |
| PW package | 108°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. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JEDEC 51, except for through-hole packages, which use a trace length of zero.

recommended operating conditions (see Note 3)

| | | | SN54AHC157 | | SN74AHC157 | | UNIT |
|---------------------|------------------------------------|--------------------------|------------|----------|------------|----------|------|
| | | | MIN | MAX | MIN | MAX | |
| V_{CC} | Supply voltage | | 2 | 5.5 | 2 | 5.5 | V |
| V_{IH} | High-level input voltage | $V_{CC} = 2$ V | 1.5 | | 1.5 | | V |
| | | $V_{CC} = 3$ V | 2.1 | | 2.1 | | |
| | | $V_{CC} = 5.5$ V | 3.85 | | 3.85 | | |
| V_{IL} | Low-level input voltage | $V_{CC} = 2$ V | | 0.5 | | 0.5 | V |
| | | $V_{CC} = 3$ V | | 0.9 | | 0.9 | |
| | | $V_{CC} = 5.5$ V | | 1.65 | | 1.65 | |
| V_I | Input voltage | | 0 | 5.5 | 0 | 5.5 | V |
| V_O | Output voltage | | 0 | V_{CC} | 0 | V_{CC} | V |
| I_{OH} | High-level output current | $V_{CC} = 2$ V | | –50 | | –50 | µA |
| | | $V_{CC} = 3.3$ V ± 0.3 V | | –4 | | –4 | mA |
| | | $V_{CC} = 5$ V ± 0.5 V | | –8 | | –8 | |
| I_{OL} | Low-level output current | $V_{CC} = 2$ V | | 50 | | 50 | µA |
| | | $V_{CC} = 3.3$ V ± 0.3 V | | 4 | | 4 | mA |
| | | $V_{CC} = 5$ V ± 0.5 V | | 8 | | 8 | |
| $\Delta t/\Delta v$ | Input transition rise or fall rate | $V_{CC} = 3.3$ V ± 0.3 V | | 100 | | 100 | ns/V |
| | | $V_{CC} = 5$ V ± 0.5 V | | 20 | | 20 | |
| T_A | Operating free-air temperature | | –55 | 125 | –40 | 85 | °C |

NOTE 3: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

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

| PARAMETER | TEST CONDITIONS | V _{CC} | T _A = 25°C | | | SN54AHC157 | | SN74AHC157 | | UNIT |
|-----------------|--------------------------|---|-----------------------|-----|------|------------|-----|------------|------|------|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| V _{OH} | I _{OH} = -50 µA | 2 V | 1.9 | 2 | | 1.9 | | 1.9 | | V |
| | | 3 V | 2.9 | 3 | | 2.9 | | 2.9 | | |
| | | 4.5 V | 4.4 | 4.5 | | 4.4 | | 4.4 | | |
| | I _{OH} = -4 mA | 3 V | 2.58 | | | 2.48 | | 2.48 | | |
| | I _{OH} = -8 mA | 4.5 V | 3.94 | | | 3.8 | | 3.8 | | |
| V _{OL} | I _{OL} = 50 µA | 2 V | | | 0.1 | | 0.1 | | 0.1 | V |
| | | 3 V | | | 0.1 | | 0.1 | | 0.1 | |
| | | 4.5 V | | | 0.1 | | 0.1 | | 0.1 | |
| | I _{OL} = 4 mA | 3 V | | | 0.36 | | 0.5 | | 0.44 | |
| | I _{OL} = 8 mA | 4.5 V | | | 0.36 | | 0.5 | | 0.44 | |
| I _I | A or B inputs | V _I = V _{CC} or GND | 0 V to 5.5 V | | ±0.1 | | ±1* | | ±1 | µA |
| I _{CC} | | V _I = V _{CC} or GND, I _O = 0 | 5.5 V | | 4 | | 40 | | 40 | µA |
| C _i | | V _I = V _{CC} or GND | 5 V | | 2 10 | | | | 10 | pF |

* On products compliant to MIL-PRF-38535, this parameter is not production tested at V_{CC} = 0 V.

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE | T _A = 25°C | | | SN54AHC157 | | SN74AHC157 | | UNIT |
|------------------|-------------------|-------------|------------------------|-----------------------|-------|--------|------------|--------|------------|------|------|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| t _{PLH} | A or B | Y | C _L = 15 pF | | 6.2** | 9.7** | 1** | 11.5** | 1 | 11.5 | ns |
| t _{PHL} | | | | | 6.2** | 9.7** | 1** | 11.5** | 1 | 11.5 | |
| t _{PLH} | \bar{A}/\bar{B} | Y | C _L = 15 pF | | 8.4** | 13.2** | 1** | 15.5** | 1 | 15.5 | ns |
| t _{PHL} | | | | | 8.4** | 13.2** | 1** | 15.5** | 1 | 15.5 | |
| t _{PLH} | \bar{G} | Y | C _L = 15 pF | | 8.7** | 13.6** | 1** | 16** | 1 | 16 | ns |
| t _{PHL} | | | | | 8.7** | 13.6** | 1** | 16** | 1 | 16 | |
| t _{PLH} | A or B | Y | C _L = 50 pF | | 8.7 | 13.2 | 1 | 15 | 1 | 15 | ns |
| t _{PHL} | | | | | 8.7 | 13.2 | 1 | 15 | 1 | 15 | |
| t _{PLH} | \bar{A}/\bar{B} | Y | C _L = 50 pF | | 10.9 | 16.7 | 1 | 19 | 1 | 19 | ns |
| t _{PHL} | | | | | 10.9 | 16.7 | 1 | 19 | 1 | 19 | |
| t _{PLH} | \bar{G} | Y | C _L = 50 pF | | 11.2 | 17.1 | 1 | 19.5 | 1 | 19.5 | ns |
| t _{PHL} | | | | | 11.2 | 17.1 | 1 | 19.5 | 1 | 19.5 | |

** On products compliant to MIL-PRF-38535, this parameter is not production tested.

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**switching characteristics over recommended operating free-air temperature range,
V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)**

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE | T _A = 25°C | | | SN54AHC157 | | SN74AHC157 | | UNIT |
|------------------|-----------------|----------------|------------------------|-----------------------|------|-----|------------|-----|------------|-----|------|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| t _{PLH} | A or B | Y | C _L = 15 pF | 4.1* | 6.4* | 1* | 7.5* | 1 | 7.5 | | ns |
| t _{PHL} | | | | 4.1* | 6.4* | 1* | 7.5* | 1 | 7.5 | | |
| t _{PLH} | \bar{A}/B | Y | C _L = 15 pF | 5.3* | 8.1* | 1* | 9.5* | 1 | 9.5 | | ns |
| t _{PHL} | | | | 5.3* | 8.1* | 1* | 9.5* | 1 | 9.5 | | |
| t _{PLH} | \bar{G} | Y | C _L = 15 pF | 5.6* | 8.6* | 1* | 10* | 1 | 10 | | ns |
| t _{PHL} | | | | 5.6* | 8.6* | 1* | 10* | 1 | 10 | | |
| t _{PLH} | A or B | Y | C _L = 50 pF | 5.6 | 8.4 | 1 | 9.5 | 1 | 9.5 | | ns |
| t _{PHL} | | | | 5.6 | 8.4 | 1 | 9.5 | 1 | 9.5 | | |
| t _{PLH} | \bar{A}/B | Y | C _L = 50 pF | 6.8 | 10.1 | 1 | 11.5 | 1 | 11.5 | | ns |
| t _{PHL} | | | | 6.8 | 10.1 | 1 | 11.5 | 1 | 11.5 | | |
| t _{PLH} | \bar{G} | Y | C _L = 50 pF | 7.1 | 10.6 | 1 | 12 | 1 | 12 | | ns |
| t _{PHL} | | | | 7.1 | 10.6 | 1 | 12 | 1 | 12 | | |

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

noise characteristics V_{CC} = 5 V, C_L = 50 pF, T_A = 25°C (see Note 4)

| PARAMETER | | SN74AHC157 | | | UNIT |
|--------------------|---|------------|-----|------|------|
| | | MIN | TYP | MAX | |
| V _{OL(P)} | Quiet output, maximum dynamic V _{OL} | | | 0.8 | V |
| V _{OL(V)} | Quiet output, minimum dynamic V _{OL} | | | –0.8 | V |
| V _{OH(V)} | Quiet output, minimum dynamic V _{OH} | | 4.8 | | V |
| V _{IH(D)} | High-level dynamic input voltage | 3.5 | | | V |
| V _{IL(D)} | Low-level dynamic input voltage | | 1.5 | | V |

NOTE 4: Characteristics are for surface-mount packages only.

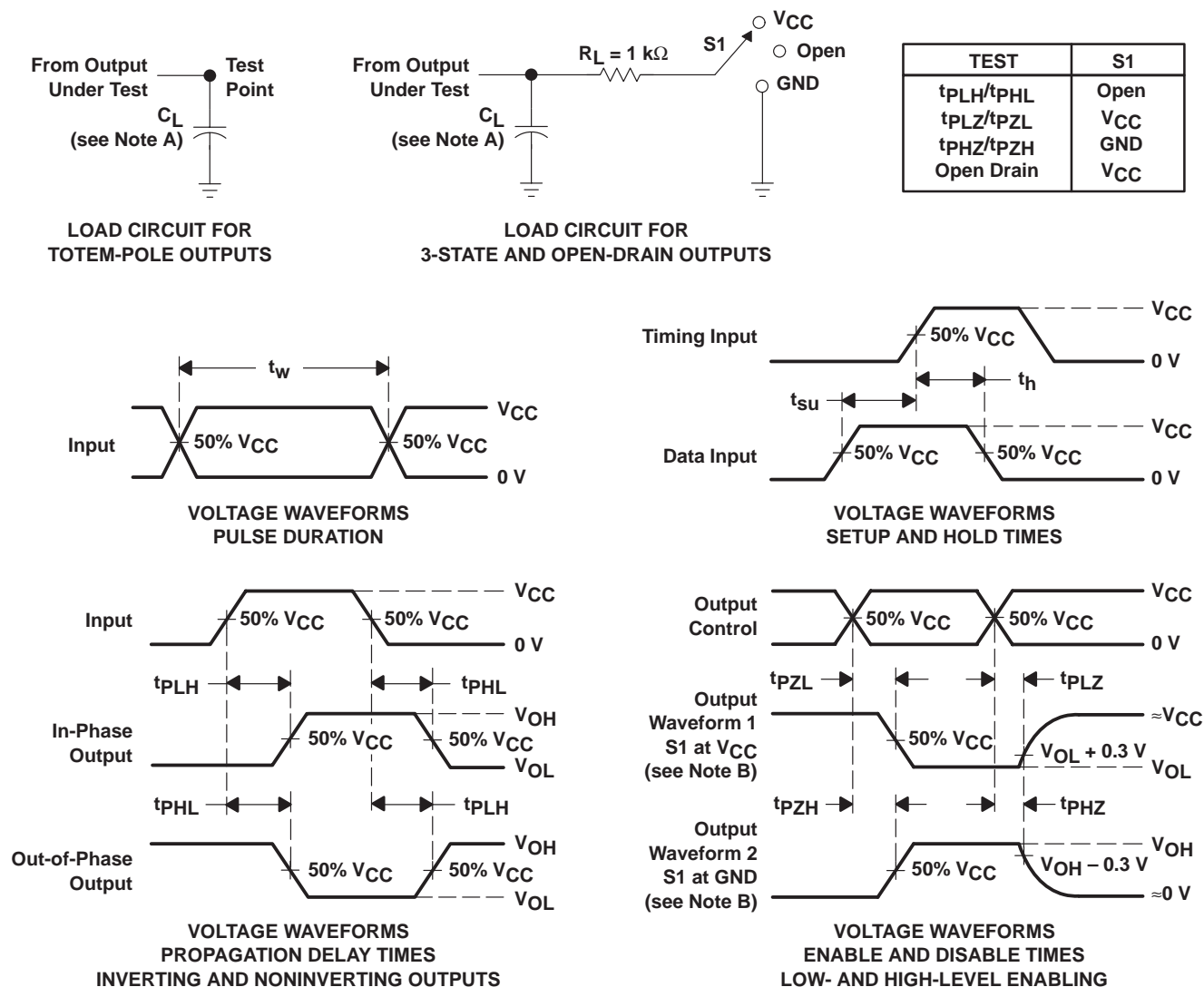
operating characteristics, V_{CC} = 5 V, T_A = 25°C

| PARAMETER | | TEST CONDITIONS | TYP | UNIT |
|-----------------|-------------------------------|--------------------|-----|------|
| C _{pd} | Power dissipation capacitance | No load, f = 1 MHz | 11 | pF |

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PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C_L includes probe and jig capacitance.
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
 C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 3\text{ ns}$, $t_f \leq 3\text{ ns}$.
 D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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