# SN54150, SN54151A, SN54LS151, SN54S151, SN74150, SN74151A, SN74LS151, SN74S151 DATA SELECTORS/MULTIPLEXERS

DECEMBER 1972—REVISED MARCH 1988

- '150 Selects One-of-Sixteen Data Sources
- Others Select One-of-Eight Data Sources
- All Perform Parallel-to-Serial Conversion
- All Permit Multiplexing from N Lines to One Line
- Also For Use as Boolean Function Generator
- Input-Clamping Diodes Simplify System Design
- Fully Compatible with Most TTL Circuits

| TYPE | TYPICAL AVERAGE PROPAGATION DELAY TIME DATA INPUT TO W OUTPUT | TYPICAL POWER DISSIPATION |
|---|---|---|
| '150 | 13 ns | 200 mW |
| '151A | 8 ns | 145 mW |
| 'LS151 | 13 ns | 30 mW |
| 'S151 | 4.5 ns | 225 mW |

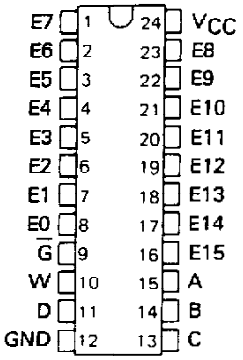
## description

These monolithic data selectors/multiplexers contain full on-chip binary decoding to select the desired data source. The '150 selects one-of-sixteen data sources; the '151A, 'LS151, and 'S151 select one-of-eight data sources. The '150, '151A, 'LS151, and 'S151 have a strobe input which must be at a low logic level to enable these devices. A high level at the strobe forces the W output high, and the Y output (as applicable) low.

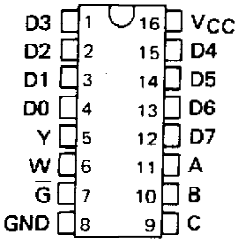
The '150 has only an inverted W output; the '151A, 'LS151, and 'S151 feature complementary W and Y outputs.

The '151A and '152A incorporate address buffers that have symmetrical propagation delay times through the complementary paths. This reduces the possibility of transients occurring at the output(s) due to changes made at the select inputs, even when the '151A outputs are enabled (i.e., strobe low).

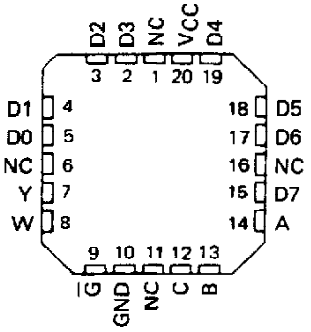
SN54150 . . . J OR W PACKAGE
SN74150 . . . N PACKAGE
(TOP VIEW)




SN54151A, SN54LS151, SN54S151 . . . J OR W PACKAGE
SN74151A . . . N PACKAGE
SN74LS151, SN74S151 . . . D OR N PACKAGE
(TOP VIEW)



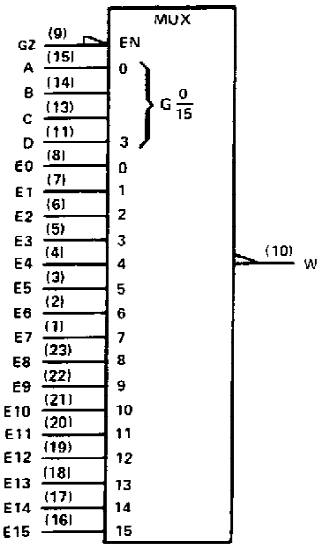

SN54LS151, SN54S151 . . . FK PACKAGE
(TOP VIEW)



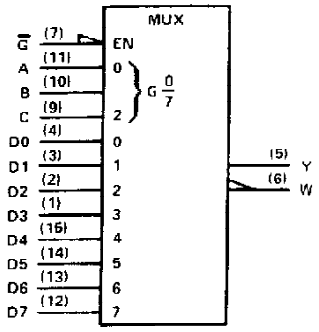

NC - No internal connection

## logic symbols†

'150




'151A, 'LS151, 'S151




†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.
Pin numbers shown are D, J, N, and W packages.

'150

**FUNCTION TABLE**

| INPUTS | | | | | OUTPUT |
|---|---|---|---|---|---|
| SELECT | | | | STROBE | |
| D | C | B | A | $\overline{G}$ | W |
| X | X | X | X | H | H |
| L | L | L | L | L | $\overline{E0}$ |
| L | L | L | H | L | $\overline{E1}$ |
| L | L | H | L | L | $\overline{E2}$ |
| L | L | H | H | L | $\overline{E3}$ |
| L | H | L | L | L | $\overline{E4}$ |
| L | H | L | H | L | $\overline{E5}$ |
| L | H | H | L | L | $\overline{E6}$ |
| L | H | H | H | L | $\overline{E7}$ |
| H | L | L | L | L | $\overline{E8}$ |
| H | L | L | H | L | $\overline{E9}$ |
| H | L | H | L | L | $\overline{E10}$ |
| H | L | H | H | L | $\overline{E11}$ |
| H | H | L | L | L | $\overline{E12}$ |
| H | H | L | H | L | $\overline{E13}$ |
| H | H | H | L | L | $\overline{E14}$ |
| H | H | H | H | L | $\overline{E15}$ |

'151A, 'LS151, 'S151

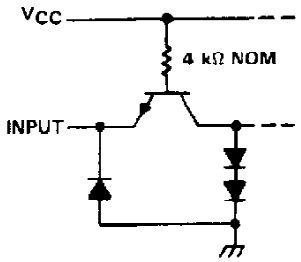
**FUNCTION TABLE**

| INPUTS | | | | OUTPUTS | |
|---|---|---|---|---|---|
| SELECT | | | STROBE | | |
| C | B | A | $\overline{G}$ | Y | W |
| X | X | X | H | L | H |
| L | L | L | L | D0 | $\overline{D0}$ |
| L | L | H | L | D1 | $\overline{D1}$ |
| L | H | L | L | D2 | $\overline{D2}$ |
| L | H | H | L | D3 | $\overline{D3}$ |
| H | L | L | L | D4 | $\overline{D4}$ |
| H | L | H | L | D5 | $\overline{D5}$ |
| H | H | L | L | D6 | $\overline{D6}$ |
| H | H | H | L | D7 | $\overline{D7}$ |

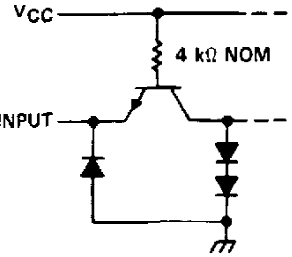
H = high level, L = low level, X = irrelevant
$\overline{E0}$, $\overline{E1}$ . . . $\overline{E15}$ = the complement of the level of the respective E input
D0, D1 . . . D7 = the level of the D respective input

## schematics of inputs and outputs

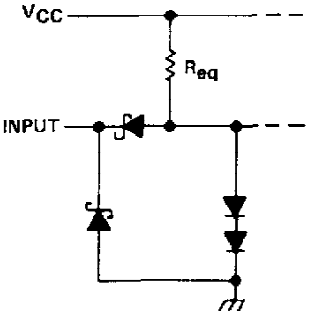
EQUIVALENT OF EACH INPUT OF '150




EQUIVALENT OF EACH INPUT OF '151A

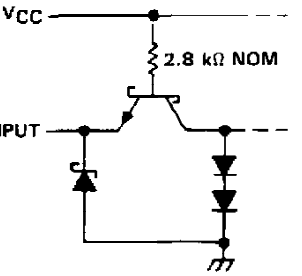



EQUIVALENT OF EACH INPUT OF 'LS151

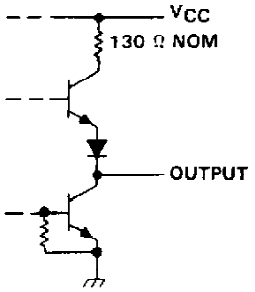



Data select and strobe $R_{eq}$ = 20 kΩ NOM
Data inputs $R_{eq}$ = 17 kΩ NOM

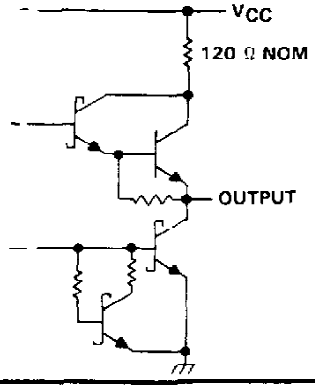
EQUIVALENT OF EACH INPUT OF 'S151



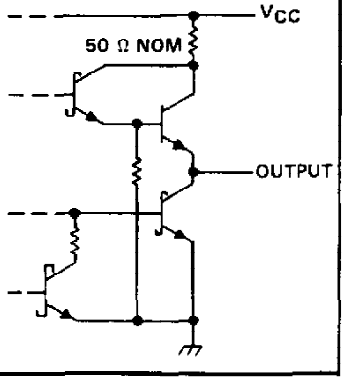

TYPICAL OF ALL OUTPUTS OF '150, '151A




TYPICAL OF ALL OUTPUTS OF 'LS151




TYPICAL OF ALL OUTPUTS OF 'S151



## recommended operating conditions

| | SN54' | | | SN74' | | | 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 | μA |
| 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† | | '150 | | | '151A | | | 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 | $V_{CC}$ = MIN, $I_I$ = −8 mA | | | | −1.5 | | | −1.5 | V |
| $V_{OH}$ | High-level output voltage | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = 0.8 V, $I_{OH}$ = −800 μA | | 2.4 | 3.4 | | 2.4 | 3.4 | | V |
| $V_{OL}$ | Low-level output voltage | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = 0.8 V, $I_{OL}$ = 16 mA | | | 0.2 | 0.4 | | 0.2 | 0.4 | V |
| $I_I$ | Input current at maximum input voltage | $V_{CC}$ = MAX, $V_I$ = 5.5 V | | | | 1 | | | 1 | mA |
| $I_{IH}$ | High-level input current | $V_{CC}$ = MAX, $V_I$ = 2.4 V | | | | 40 | | | 40 | μA |
| $I_{IL}$ | Low-level input current | $V_{CC}$ = MAX, $V_I$ = 0.4 V | | | | −1.6 | | | −1.6 | mA |
| $I_{OS}$ | Short-circuit output current§ | $V_{CC}$ = MAX | SN54' | −20 | | −55 | −20 | | −55 | mA |
| | | | SN74' | −18 | | −55 | −18 | | −55 | |
| $I_{CC}$ | Supply current | $V_{CC}$ = MAX, See Note 3 | | | 40 | 68 | | 29 | 48 | mA |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable device type.
‡ All typical values at $V_{CC}$ = 5 V, $T_A$ = 25°C.
§ Not more than one output of the '151A should be shorted at a time.
NOTE 3: $I_{CC}$ is measured with the strobe and data select inputs at 4.5 V, all other inputs and outputs open.

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

| PARAMETER¶ | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | '150 | | | '151A | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $t_{PLH}$ | A, B, or C (4 levels) | Y | $C_L$ = 15 pF, $R_L$ = 400 Ω, See Note 4 | | | | | 25 | 38 | ns |
| $t_{PHL}$ | | | | | | | | 25 | 38 | |
| $t_{PLH}$ | A, B, C, or D (3 levels) | W | | | 23 | 35 | | 17 | 26 | ns |
| $t_{PHL}$ | | | | | 22 | 33 | | 19 | 30 | |
| $t_{PLH}$ | Strobe $\overline{G}$ | Y | | | | | | 21 | 33 | ns |
| $t_{PHL}$ | | | | | | | | 22 | 33 | |
| $t_{PLH}$ | Strobe $\overline{G}$ | W | | | 15.5 | 24 | | 14 | 21 | ns |
| $t_{PHL}$ | | | | | 21 | 30 | | 15 | 23 | |
| $t_{PLH}$ | D0 thru D7 | Y | | | | | | 13 | 20 | ns |
| $t_{PHL}$ | | | | | | | | 18 | 27 | |
| $t_{PLH}$ | E0 thru E15, or D0 thru D7 | W | | | 8.5 | 14 | | 8 | 14 | ns |
| $t_{PHL}$ | | | | | 13 | 20 | | 8 | 14 | |

¶ $t_{PLH}$ = propagation delay time, low-to-high-level output
$t_{PHL}$ = propagation delay time, high-to-low-level output
NOTE 4: Load circuits and voltage waveforms are shown in Section 1.

## recommended operating conditions

| | SN54LS151 | | | SN74LS151 | | | 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 | μA |
| 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† | | SN54LS151 | | | SN74LS151 | | | 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 | $V_{CC}$ = MIN, $I_I$ = −18 mA | | | | −1.5 | | | −1.5 | V |
| $V_{OH}$ | High-level output voltage | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = $V_{IL}$max, $I_{OH}$ = −400 μA | | 2.5 | 3.4 | | 2.7 | 3.4 | | V |
| $V_{OL}$ | Low-level output voltage | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = $V_{IL}$max | $I_{OL}$ = 4 mA | | 0.25 | 0.4 | | 0.25 | 0.4 | V |
| | | | $I_{OL}$ = 8 mA | | | | | 0.35 | 0.5 | |
| $I_I$ | Input current at maximum input voltage | $V_{CC}$ = MAX, $V_I$ = 7 V | | | | 0.1 | | | 0.1 | mA |
| $I_{IH}$ | High-level input current | $V_{CC}$ = MAX, $V_I$ = 2.7 V | | | | 20 | | | 20 | μA |
| $I_{IL}$ | Low-level input current | $V_{CC}$ = MAX, $V_I$ = 0.4 V | | | | −0.4 | | | −0.4 | mA |
| $I_{OS}$ | Short-circuit output current§ | $V_{CC}$ = MAX | | −20 | | −100 | −20 | | −100 | mA |
| $I_{CC}$ | Supply current | $V_{CC}$ = MAX, Outputs open, All inputs at 4.5 V | | | 6.0 | 10 | | 6.0 | 10 | mA |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable device type.
‡ 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 short-circuit should not exceed one second.

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

| PARAMETER¶ | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | A, B, or C (4 levels) | Y | $C_L$ = 15 pF, $R_L$ = 2 kΩ, See Note 4 | | 27 | 43 | ns |
| $t_{PHL}$ | | | | | 18 | 30 | |
| $t_{PLH}$ | A, B, or C (3 levels) | W | | | 14 | 23 | ns |
| $t_{PHL}$ | | | | | 20 | 32 | |
| $t_{PLH}$ | Strobe $\overline{G}$ | Y | | | 26 | 42 | ns |
| $t_{PHL}$ | | | | | 20 | 32 | |
| $t_{PLH}$ | Strobe $\overline{G}$ | W | | | 15 | 24 | ns |
| $t_{PHL}$ | | | | | 18 | 30 | |
| $t_{PLH}$ | Any D | Y | | | 20 | 32 | ns |
| $t_{PHL}$ | | | | | 16 | 26 | |
| $t_{PLH}$ | Any D | W | | | 13 | 21 | ns |
| $t_{PHL}$ | | | | | 12 | 20 | |

¶ $t_{PLH}$ = propagation delay time, low-to-high-level output
$t_{PHL}$ = propagation delay time, high-to-low-level output
NOTE 4: Load circuits and voltage waveforms are shown in Section 1.

## recommended operating conditions

| | SN54S151 | | | SN74S151 | | | 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† | | 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 | $V_{CC}$ = MIN, $I_I$ = −18 mA | | | | −1.2 | V |
| $V_{OH}$ | High-level output voltage | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = 0.8 V, $I_{OH}$ = −1 mA | SN54S151 | 2.5 | 3.4 | | V |
| | | | SN74S151 | 2.7 | 3.4 | | |
| $V_{OL}$ | Low-level output voltage | $V_{CC}$ = MIN, $V_{IH}$ = 2 V, $V_{IL}$ = 0.8 V, $I_{OL}$ = 20 mA | | | | 0.5 | V |
| $I_I$ | Input current at maximum input voltage | $V_{CC}$ = MAX, $V_I$ = 5.5 V | | | | 1 | mA |
| $I_{IH}$ | High-level input current | $V_{CC}$ = MAX, $V_I$ = 2.7 V | | | | 50 | μA |
| $I_{IL}$ | Low-level input current | $V_{CC}$ = MAX, $V_I$ = 0.5 V | | | | −2 | mA |
| $I_{OS}$ | Short-circuit output current§ | $V_{CC}$ = MAX | | −40 | | −100 | mA |
| $I_{CC}$ | Supply current | $V_{CC}$ = MAX, All inputs at 4.5 V, All outputs open | | | 45 | 70 | mA |

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable device type.
‡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¶ | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $t_{PLH}$ | A, B, or C (4 levels) | Y | $C_L$ = 15 pF, $R_L$ = 280 kΩ, See Note 4 | | 12 | 18 | ns |
| $t_{PHL}$ | | | | | 12 | 18 | |
| $t_{PLH}$ | A, B, or C (3 levels) | W | | | 10 | 15 | ns |
| $t_{PHL}$ | | | | | 9 | 13.5 | |
| $t_{PLH}$ | Any D | Y | | | 8 | 12 | ns |
| $t_{PHL}$ | | | | | 8 | 12 | |
| $t_{PLH}$ | Any D | W | | | 4.5 | 7 | ns |
| $t_{PHL}$ | | | | | 4.5 | 7 | |
| $t_{PLH}$ | Strobe $\overline{G}$ | Y | | | 11 | 16.5 | ns |
| $t_{PHL}$ | | | | | 12 | 18 | |
| $t_{PLH}$ | Strobe $\overline{G}$ | W | | | 9 | 13 | ns |
| $t_{PHL}$ | | | | | 8.5 | 12 | |

¶$t_{PLH}$ = propagation delay time, low-to-high-level output
$t_{PHL}$ = propagation delay time, high-to-low-level output
NOTE 4: Load circuits and voltage waveforms are shown in Section 1.

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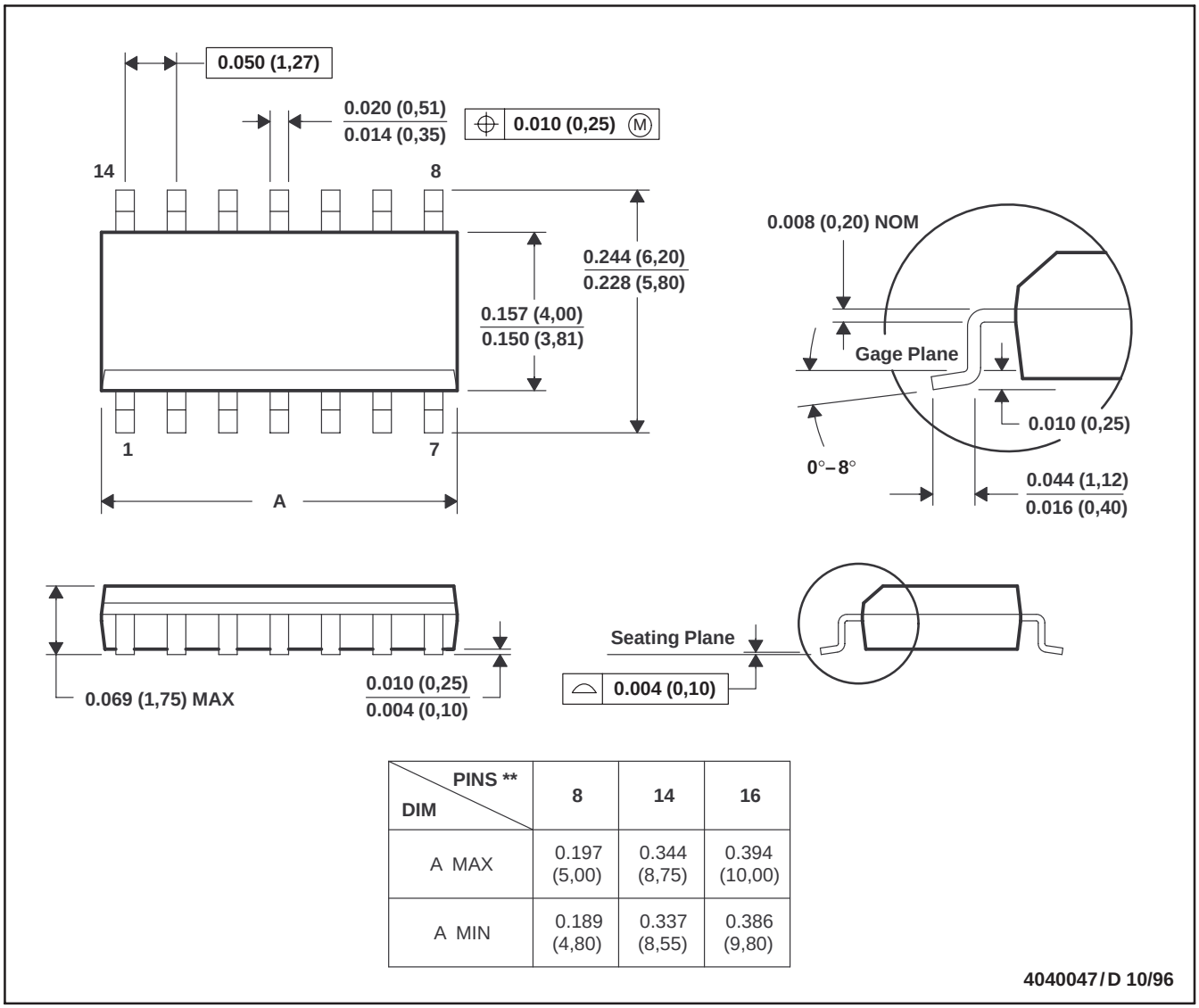
MSOI002A – JANUARY 1995 – REVISED JANUARY 1998

## D (R-PDSO-G**)

## PLASTIC SMALL-OUTLINE PACKAGE

**14 PINS SHOWN**




| DIM \ PINS ** | 8 | 14 | 16 |
|---|---|---|---|
| A MAX | 0.197 (5,00) | 0.344 (8,75) | 0.394 (10,00) |
| A MIN | 0.189 (4,80) | 0.337 (8,55) | 0.386 (9,80) |

**4040047/D 10/96**

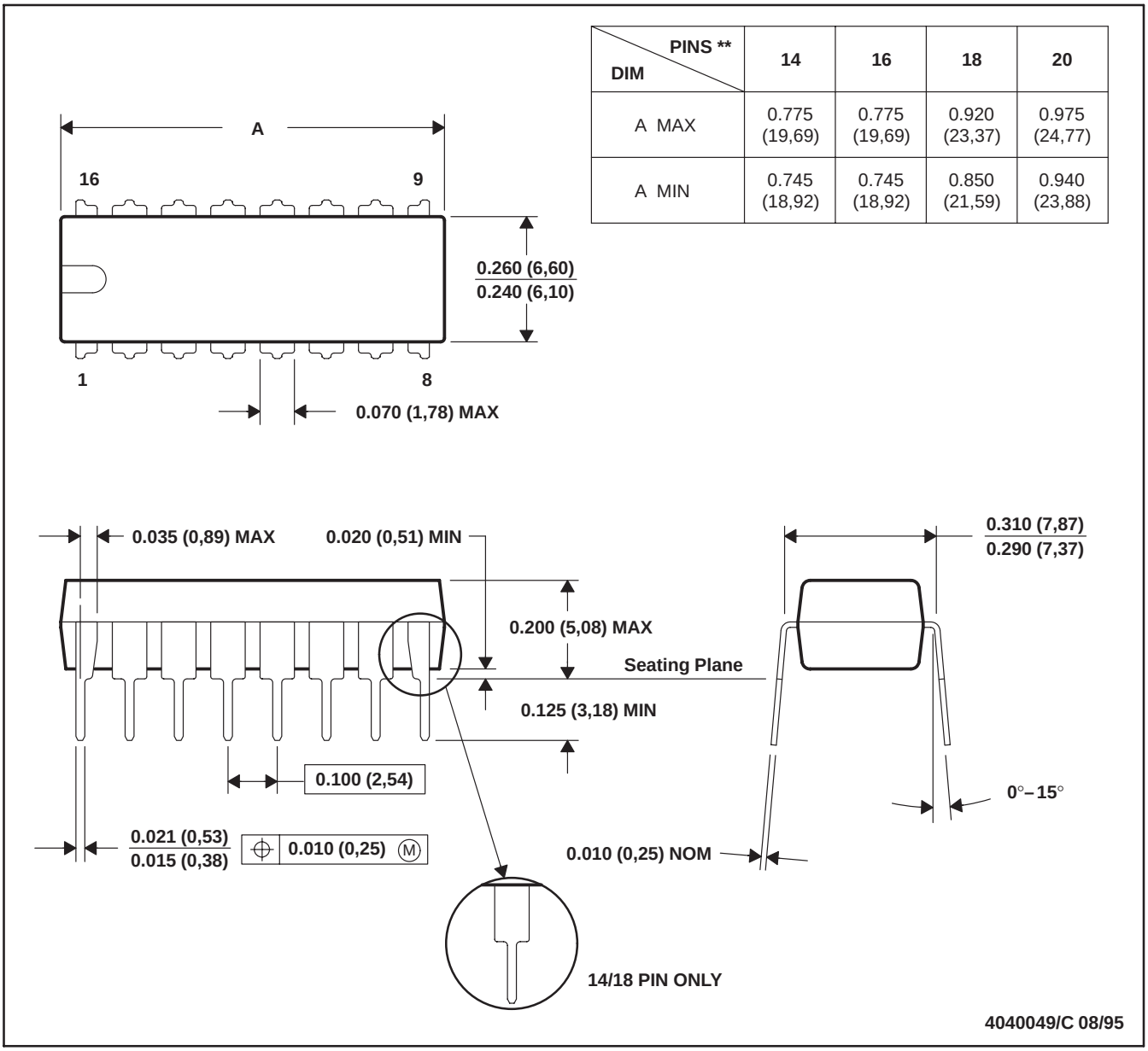
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-012

MPDI002A – JANUARY 1995 – REVISED OCTOBER 1995

**N (R-PDIP-T**)** **PLASTIC DUAL-IN-LINE PACKAGE**

**16 PINS SHOWN**

| DIM \ PINS ** | 14 | 16 | 18 | 20 |
|---|---|---|---|---|
| A MAX | 0.775 (19,69) | 0.775 (19,69) | 0.920 (23,37) | 0.975 (24,77) |
| A MIN | 0.745 (18,92) | 0.745 (18,92) | 0.850 (21,59) | 0.940 (23,88) |




NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001 (20-pin package is shorter than MS-001).