

# SN54159, SN74159

## 4-LINE TO 16-LINE DECODERS/DEMULTIPLEXERS

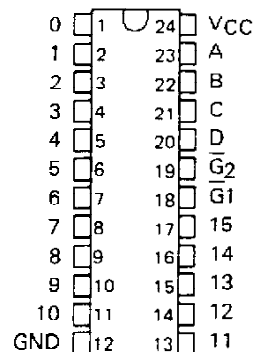
### WITH OPEN-COLLECTOR OUTPUTS

DECEMBER 1972 - REVISED MARCH 1988

- Open-Collector Outputs for Interfacing with MOS or Memory Decoders/Drivers
- Decodes 4 Binary-Coded Inputs into One of 16 Mutually Exclusive Outputs
- Performs the Demultiplexing Function by Distributing Data from One Input Line to Any One of 16 Outputs
- Typical Average Propagation Delay Times:  
24 ns through 3 levels of Logic  
19 ns from Strobe Input
- Output Off-State Current is Less Than 50  $\mu$ A
- Fully Compatible with Most TTL and MSI Circuits

SN54159 . . . J OR W PACKAGE  
SN74159 . . . N PACKAGE

(TOP VIEW)



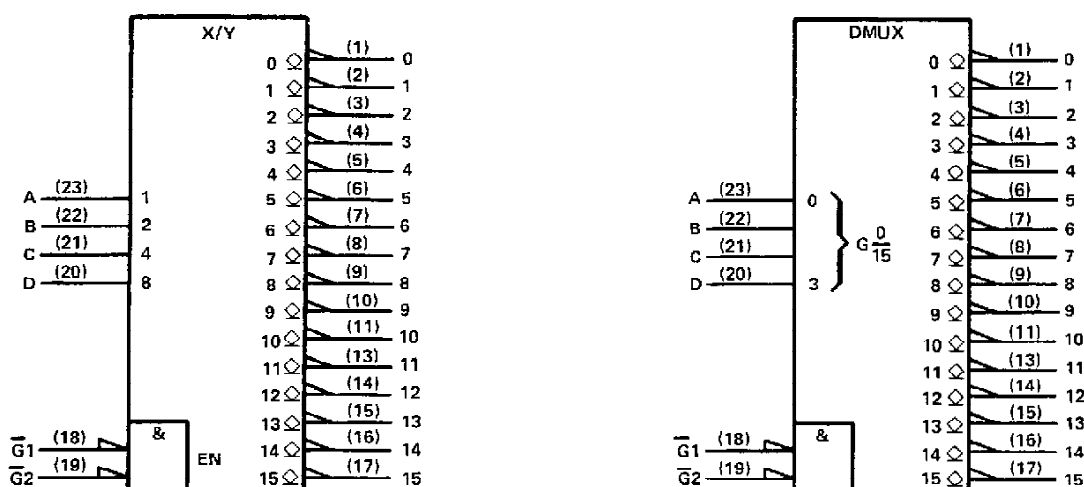
### description

Each of these monolithic, 4-line-to-16 line decoders utilizes TTL circuitry to decode four binary-coded inputs into one of sixteen mutually exclusive open-collector outputs when both the strobe inputs,  $\overline{G1}$  and  $\overline{G2}$ , are low. The demultiplexing function is performed by using the 4 input lines to address the output line, passing data from one of the strobe inputs with the other strobe input low. When either strobe input is high, all outputs are high. These demultiplexers are ideally suited for implementing MOS memory decoding or for interfacing with discrete memory address drivers. For ultra-high-speed applications, the SN54S138/SN74S138 or SN54S139/SN74S139 is recommended.

These circuits are fully compatible for use with most other TTL circuits. Input clamping diodes are provided to minimize transmission-line effects and thereby simplify system design. Input buffers are used to lower the fan-in requirement to only one normalized Series 54/74 load. A fan-out to 10 normalized Series 54/74 loads in the low-level state is available from each of the sixteen outputs. Typical power dissipation is 170 mW.

The SN54159 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ; the SN74159 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

### logic symbols (alternatives)<sup>†</sup>



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

PRODUCTION DATA documents contain 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.

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**SN54159, SN74159**  
**4-LINE TO 16-LINE DECODERS/DEMULTIPLEXERS**  
**WITH OPEN-COLLECTOR OUTPUTS**

FUNCTION TABLE

| INPUTS          |                 |   |   |   | OUTPUTS |   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|-----------------|-----------------|---|---|---|---------|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
| $\overline{G}1$ | $\overline{G}2$ | D | C | B | A       | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| L               | L               | L | L | L | L       | L | H | H | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| L               | L               | L | L | L | H       | H | L | H | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| L               | L               | L | L | H | L       | H | H | L | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| L               | L               | L | L | H | H       | H | H | L | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| L               | L               | L | H | L | L       | H | H | H | H | L | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| L               | L               | L | H | L | H       | H | H | H | H | L | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| L               | L               | L | H | H | L       | H | H | H | H | H | L | H | H | H | H | H  | H  | H  | H  | H  | H  |
| L               | L               | L | H | H | H       | L | H | H | H | H | H | L | H | H | H | H  | H  | H  | H  | H  | H  |
| L               | L               | L | H | H | H       | H | H | L | H | H | H | H | L | H | H | H  | H  | H  | H  | H  | H  |
| L               | L               | H | L | L | L       | H | H | H | H | H | H | H | H | L | H | H  | H  | H  | H  | H  | H  |
| L               | L               | H | L | L | H       | H | H | H | H | H | H | H | H | H | L | H  | H  | H  | H  | H  | H  |
| L               | L               | H | L | H | L       | H | H | H | H | H | H | H | H | H | L | H  | H  | H  | H  | H  | H  |
| L               | L               | H | L | H | H       | H | H | H | H | H | H | H | H | H | L | H  | H  | H  | H  | H  | H  |
| L               | L               | H | H | L | L       | H | H | H | H | H | H | H | H | H | H | L  | H  | H  | H  | H  | H  |
| L               | L               | H | H | L | H       | H | H | H | H | H | H | H | H | H | H | H  | L  | H  | H  | H  | H  |
| L               | L               | H | H | H | L       | H | H | H | H | H | H | H | H | H | H | H  | H  | L  | H  | H  | H  |
| L               | L               | H | H | H | H       | H | H | H | H | H | H | H | H | H | H | H  | H  | H  | L  | H  | H  |
| L               | H               | X | X | X | X       | H | H | H | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| H               | L               | X | X | X | X       | H | H | H | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |
| H               | H               | X | X | X | X       | H | H | H | H | H | H | H | H | H | H | H  | H  | H  | H  | H  | H  |

H = high level, L = low level, X = irrelevant

**logic diagram**

Same as SN54154, SN74154.

**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          |
| Off-state output voltage                               | 5.5 V          |
| Operating free-air temperature range: SN54159 Circuits | -55°C to 125°C |
| SN74159 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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# SN54159, SN74159

## 4-LINE TO 16-LINE DECODERS/DEMULTIPLEXERS

### WITH OPEN-COLLECTOR OUTPUTS

#### recommended operating conditions

|                                       | SN54159 |     |     | SN74159 |     |      | UNIT         |
|---------------------------------------|---------|-----|-----|---------|-----|------|--------------|
|                                       | MIN     | NOM | MAX | MIN     | NOM | MAX  |              |
| Supply voltage, $V_{CC}$              | 4.5     | 5   | 5.5 | 4.75    | 5   | 5.25 | V            |
| 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†                                                                                        | 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                 | $V_{CC} = \text{MIN}$ , $I_I = -12 \text{ mA}$                                                          |     |      | -1.5 | V       |
| $I_{OH}$ High-level output current           | $V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ ,<br>$V_{IL} = 0.8 \text{ V}$ , $V_{OH} = 5.5 \text{ V}$ |     |      | 50   | $\mu$ A |
| $V_{OL}$ Low-level output voltage            | $V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ ,<br>$V_{IL} = 0.8 \text{ V}$ , $I_{OL} = 16 \text{ mA}$ |     |      | 0.4  | 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            | $V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$                                                           |     |      | 40   | $\mu$ A |
| $I_{IL}$ Low-level input current             | $V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$                                                           |     |      | -1.6 | mA      |
| $I_{CC}$ Supply current                      | $V_{CC} = \text{MAX}$ , All inputs grounded                                                             |     | 34   | 56   | mA      |

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

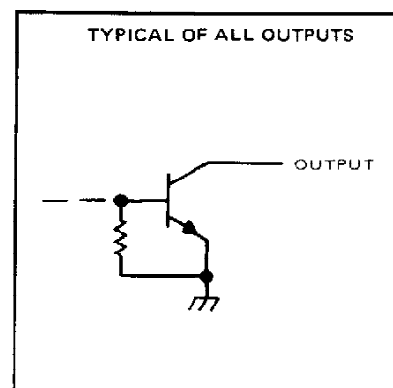
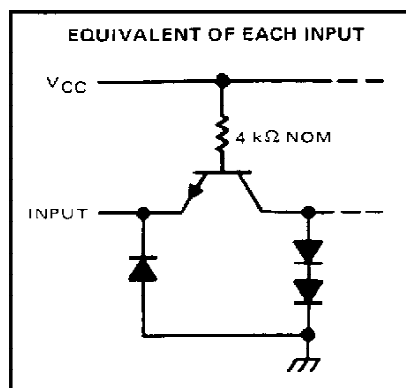
‡All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^{\circ}\text{C}$ .

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

| PARAMETER                                                                                                       | TEST CONDITIONS                                         | MIN | TYP | MAX | UNIT |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|-----|-----|-----|------|
| $t_{PLH}$ Propagation delay time, low-to-high-level output, from A, B, C, or D inputs through 3 levels of logic | $C_L = 15 \text{ pF}$ , $R_L = 400 \Omega$ , See Note 2 |     | 23  | 36  | ns   |
| $t_{PHL}$ Propagation delay time, high-to-low-level output, from A, B, C, or D inputs through 3 levels of logic |                                                         |     | 24  | 36  | ns   |
| $t_{PLH}$ Propagation delay time, low-to-high-level output, from either strobe input                            |                                                         |     | 15  | 25  | ns   |
| $t_{PHL}$ Propagation delay time, high-to-low-level output, from either strobe input                            |                                                         |     | 22  | 36  | ns   |

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

#### schematics of inputs and outputs



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## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)   | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples |
|------------------|---------------|--------------|--------------------|------|----------------|-------------------|-------------------------|----------------------|--------------|-------------------------|---------|
| SN74159N         | LIFEBUY       | PDIP         | N                  | 24   | 15             | Pb-Free<br>(RoHS) | CU NIPDAU               | N / A for Pkg Type   | 0 to 70      | SN74159N                |         |

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

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**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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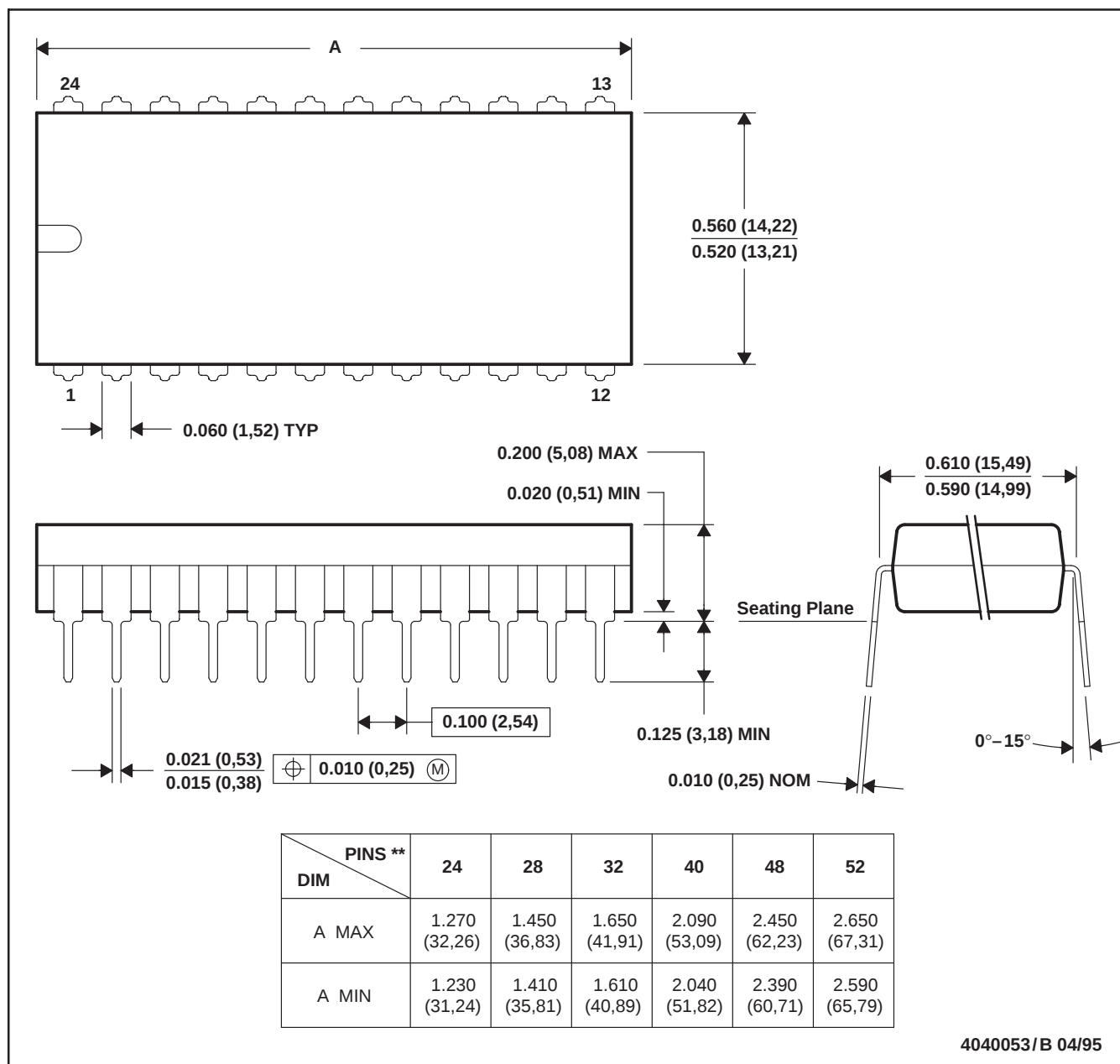
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## N (R-PDIP-T\*\*)

## PLASTIC DUAL-IN-LINE PACKAGE

24 PIN SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MS-011
  - D. Falls within JEDEC MS-015 (32 pin only)

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