

## Quad TRI-STATE<sup>®</sup> Line Driver

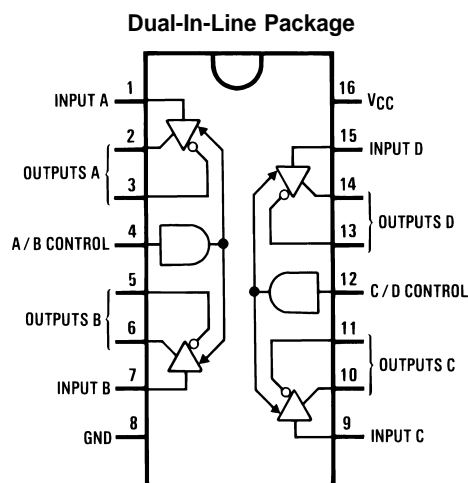
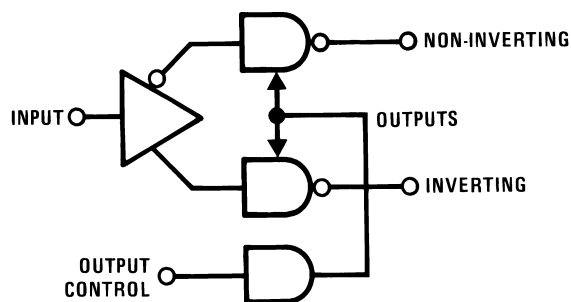
### General Description

National's quad RS-422 driver features four independent drivers which comply with EIA Standards for the electrical characteristics of balanced voltage digital interface circuits. The outputs are TRI-STATE structures which are forced to a high impedance state when the appropriate output control pin reaches a logic zero condition. All input pins are PNP buffered to minimize input loading for either logic one or logic zero inputs.

### Features

- Four independent drivers
- TRI-STATE<sup>®</sup> outputs
- Fast propagation times (typ 10 ns)
- TTL compatible
- 5V supply
- Output rise and fall times less than 15 ns
- Pin compatible with DS8924 and MC3487

### Block and Connection Diagrams



Top View(SOP16/DIP16)  
Order Number DS3487M or DS3487N

### Truth Table

| Input | Control Input | Non-Inverting Output | Inverting Output |
|-------|---------------|----------------------|------------------|
| H     | H             | H                    | L                |
| L     | H             | L                    | H                |
| X     | L             | Z                    | Z                |

L = Low logic state  
H = High logic state  
X = Irrelevant  
Z = TRI-STATE(high impedance)

### ORDERING INFORMATION

| DEVICE     | Package Type | MARKING | Packing | Packing Qty |
|------------|--------------|---------|---------|-------------|
| DS3487N    | DIP16        | DS3487  | TUBE    | 1000/box    |
| DS3487M/TR | SOP16        | DS3487  | REEL    | 2500/reel   |

**Absolute Maximum Ratings** (Note 2)

|  |                 |
|--|-----------------|
| Supply Voltage                             | 8V              |
| Input Voltage                              | 5.5V            |
| Storage Temperature                        | -65°C to +150°C |
| Maximum Power Dissipation (Note 1) at 25°C |                 |
| Molded DIP Package                         | 1476 mW         |
| SO Package                                 | 1051 mW         |
| Lead Temperature                           |                 |
| (Soldering, 4 seconds)                     | 260°C           |

**Operating Conditions**

|                          | Min  | Max  | Units |
|--------------------------|------|------|-------|
| Supply Voltage, $V_{CC}$ |      |      |       |
| DS3487                   | 4.75 | 5.25 | V     |
| Temperature ( $T_A$ )    |      |      |       |
| DS3487                   | 0    | +70  | °C    |

**Note 1:** Derate DIP molded package 11.9 mW/°C above 25°C. Derate SOP package 8.41 mW/°C above 25°C.

**Electrical Characteristics** (Notes 3, 4, 5, 6)

| Symbol                    | Parameter                                 | Conditions               | Min             | Typ | Max  | Units |
|---------------------------|---|--------------------------|-----------------|-----|------|-------|
| $V_{IL}$                  | Input Low Voltage                         |                          |                 |     | 0.8  | V     |
| $V_{IH}$                  | Input High Voltage                        |                          | 2.0             |     |      | V     |
| $I_{IL}$                  | Input Low Current                         | $V_{IL} = 0.5V$          |                 |     | -200 | μA    |
| $I_{IH}$                  | Input High Current                        |                          | $V_{IH} = 2.7V$ |     | 50   | μA    |
|                           |   |                          | $V_{IH} = 5.5V$ |     | 100  | μA    |
| $V_{CL}$                  | Input Clamp Voltage                       | $I_{CL} = -18\text{ mA}$ |                 |     | -1.5 | V     |
| $V_{OL}$                  | Output Low Voltage                        | $I_{OL} = 48\text{ mA}$  |                 |     | 0.5  | V     |
| $V_{OH}$                  | Output High Voltage                       | $I_{OH} = -20\text{ mA}$ | 2.5             |     |      | V     |
| $I_{OS}$                  | Output Short-Circuit Current              |                          | -40             |     | -140 | mA    |
| $I_{OZ}$                  | Output Leakage Current (TRI-STATE)        |                          | $V_O = 0.5V$    |     | -100 | μA    |
|                           |   |                          | $V_O = 5.5V$    |     | 100  | μA    |
| $I_{OFF}$                 | Output Leakage Current Power OFF          | $V_{CC} = 0V$            | $V_O = 6V$      |     | 100  | μA    |
|                           |   |                          | $V_O = -0.25V$  |     | -100 | μA    |
| $ V_{OS} - \bar{V}_{OS} $ | Difference in Output Offset Voltage       |                          |                 |     | 0.4  | V     |
| $V_T$                     | Differential Output Voltage               |                          | 2.0             |     |      | V     |
| $ V_T  - \bar{ V_T }$     | Difference in Differential Output Voltage |                          |                 |     | 0.4  | V     |
| $I_{CC}$                  | Power Supply Current                      |                          | Active          | 50  | 80   | mA    |
|                           |   |                          | TRI-STATE®      | 35  | 60   | mA    |

**Switching Characteristics**

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

| Symbol    | Parameter              | Conditions   | Min | Typ | Max | Units |
|-----------|------------------------|--|-----|-----|-----|-------|
| $t_{PHL}$ | Input to Output        |  |     | 10  | 15  | ns    |
| $t_{PLH}$ | Input to Output        |  |     | 10  | 15  | ns    |
| $t_{THL}$ | Differential Fall Time |  |     | 10  | 15  | ns    |
| $t_{TLH}$ | Differential Rise Time |  |     | 10  | 15  | ns    |
| $t_{PHZ}$ | Enable to Output       | $R_L = 200\Omega$ , $C_L = 50\text{ pF}$           |     | 17  | 25  | ns    |
| $t_{PLZ}$ | Enable to Output       | $R_L = 200\Omega$ , $C_L = 50\text{ pF}$           |     | 15  | 25  | ns    |
| $t_{PZH}$ | Enable to Output       | $R_L = \infty$ , $C_L = 50\text{ pF}$ , S1 Open    |     | 11  | 25  | ns    |
| $t_{PZL}$ | Enable to Output       | $R_L = 200\Omega$ , $C_L = 50\text{ pF}$ , S2 Open |     | 15  | 25  | ns    |

**Note 2:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

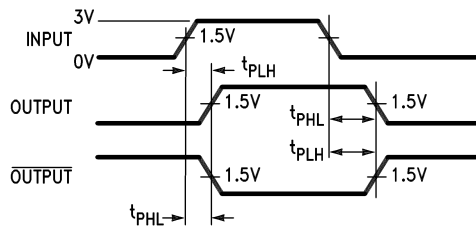
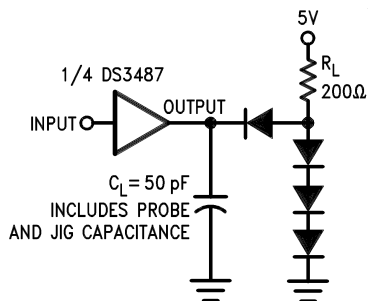
**Note 3:** Unless otherwise specified min/max limits apply across the 0°C to +70°C range for the DS3487. All typicals are given for  $V_{CC} = 5V$  and  $T_A = 25^\circ C$ .

**Note 4:** All currents into device pins are positive, all currents out of device pins as negative. All voltages are referenced to ground unless otherwise specified.

**Note 5:** Only one output at a time should be shorted.

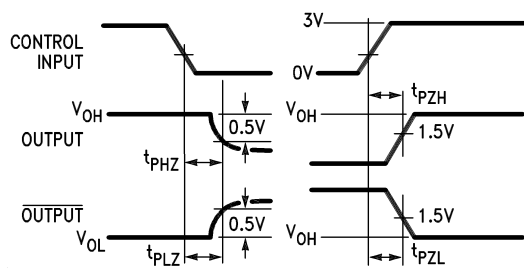
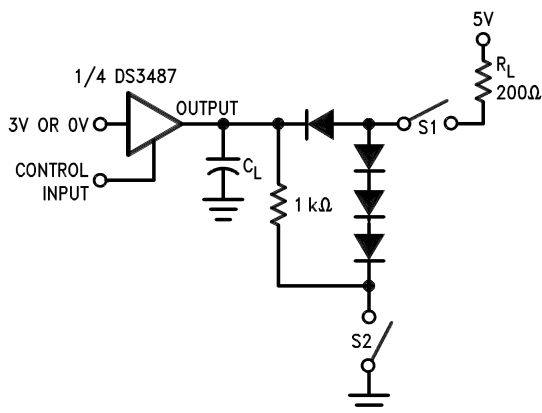
**Note 6:** Symbols and definitions correspond to EIA RS-422, where applicable.

## AC Test Circuits and Switching Time Waveforms



Input pulse:  $f = \text{MHz}$ , 50%;  $t_r = t_f \leq 15 \text{ ns}$ .

**FIGURE 1. Propagation Delays**



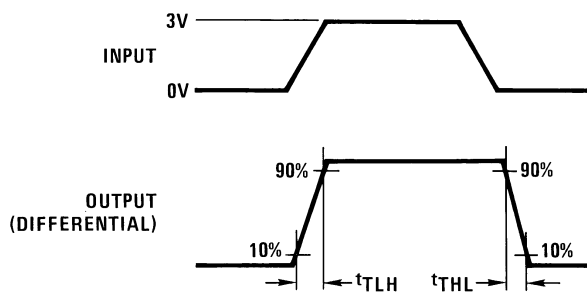
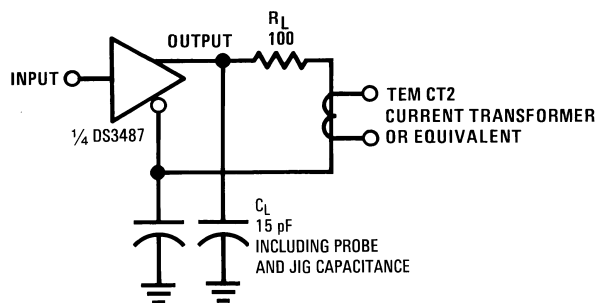
Input pulse:  $f = \text{MHz}$ , 50%;  $t_r = t_f \leq 15 \text{ ns}$ .

S1 = open for  $t_{PZH}$

S2 = open for  $t_{PZL}$

S1 and S2 closed except as noted.  
 $C_L$  includes probe and jig capacitance.

**FIGURE 2. TRI-STATE Enable and Disable Delays**

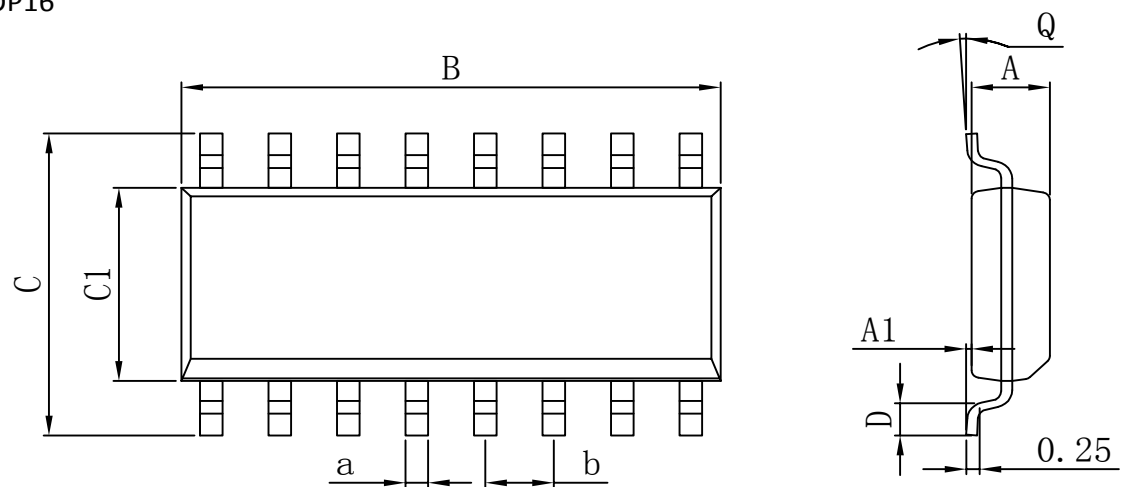


Input pulse:  $f = \text{MHz}$ , 50%;  $t_r = t_f \leq 15 \text{ ns}$ .

**FIGURE 3. Differential Rise and Fall Times**

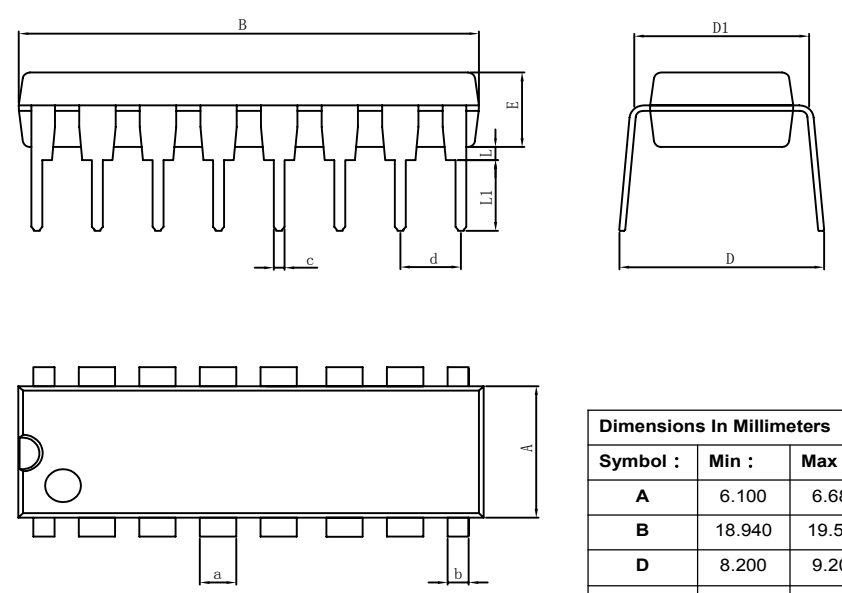
**PACKAGE**

SOP16



| Dimensions In Millimeters |       |       |          |           |       |
|---------------------------|-------|-------|----------|-----------|-------|
| Symbol :                  | Min : | Max : | Symbol : | Min :     | Max : |
| A                         | 1.225 | 1.570 | D        | 0.400     | 0.950 |
| A1                        | 0.100 | 0.250 | Q        | 0°        | 8°    |
| B                         | 9.800 | 10.00 | a        | 0.420 TYP |       |
| C                         | 5.800 | 6.250 | b        | 1.270 TYP |       |
| C1                        | 3.800 | 4.000 |          |           |       |

DIP16



| Dimensions In Millimeters |        |        |          |           |       |
|---------------------------|--------|--------|----------|-----------|-------|
| Symbol :                  | Min :  | Max :  | Symbol : | Min :     | Max : |
| A                         | 6.100  | 6.680  | L        | 0.500     | 0.800 |
| B                         | 18.940 | 19.560 | a        | 1.524 TYP |       |
| D                         | 8.200  | 9.200  | b        | 0.889 TYP |       |
| D1                        | 7.42   | 7.820  | c        | 0.457 TYP |       |
| E                         | 3.100  | 3.550  | d        | 2.540 TYP |       |
| L                         | 0.500  | 0.800  |          |           |       |

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