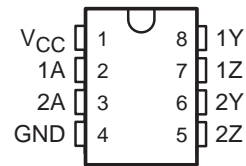


# uA9638C DUAL HIGH-SPEED DIFFERENTIAL LINE DRIVER

SLLS112C – OCTOBER 1980 – REVISED APRIL 1994

- Meets or Exceeds ANSI Standard EIA/TIA-422-B
- Operates From a Single 5-V Power Supply
- Drives Loads as Low as 50  $\Omega$  up to 15 Mbps
- TTL- and CMOS-Input Compatibility
- Output Short-Circuit Protection
- Interchangeable With National Semiconductor™ DS9638

D OR P PACKAGE  
(TOP VIEW)



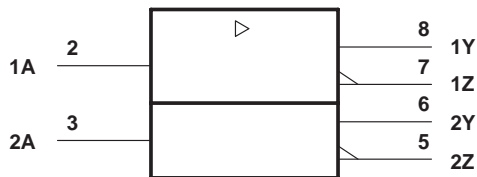
## description

The uA9638C is a dual high-speed differential line driver designed to meet ANSI Standard EIA/TIA-422-B. The inputs are TTL and CMOS compatible and have input clamp diodes. Schottky-diode-clamped transistors are used to minimize propagation delay time. This device operates from a single 5-V power supply and is supplied in an 8-pin package.

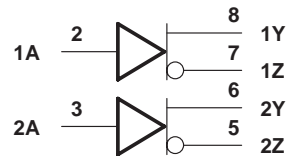
The uA9638 provides the current needed to drive low-impedance loads at high speeds. Typically used with twisted-pair cabling and differential receiver(s), base-band data transmission can be accomplished up to and exceeding 15 Mbps in properly designed systems. The uA9637A dual line receiver is commonly used as the receiver. For even faster switching speeds in the same pin configuration, see the SN75ALS191.

The uA9638C is characterized for operation from 0°C to 70°C.

## logic symbol†



## logic diagram



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.



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**TEXAS  
INSTRUMENTS**

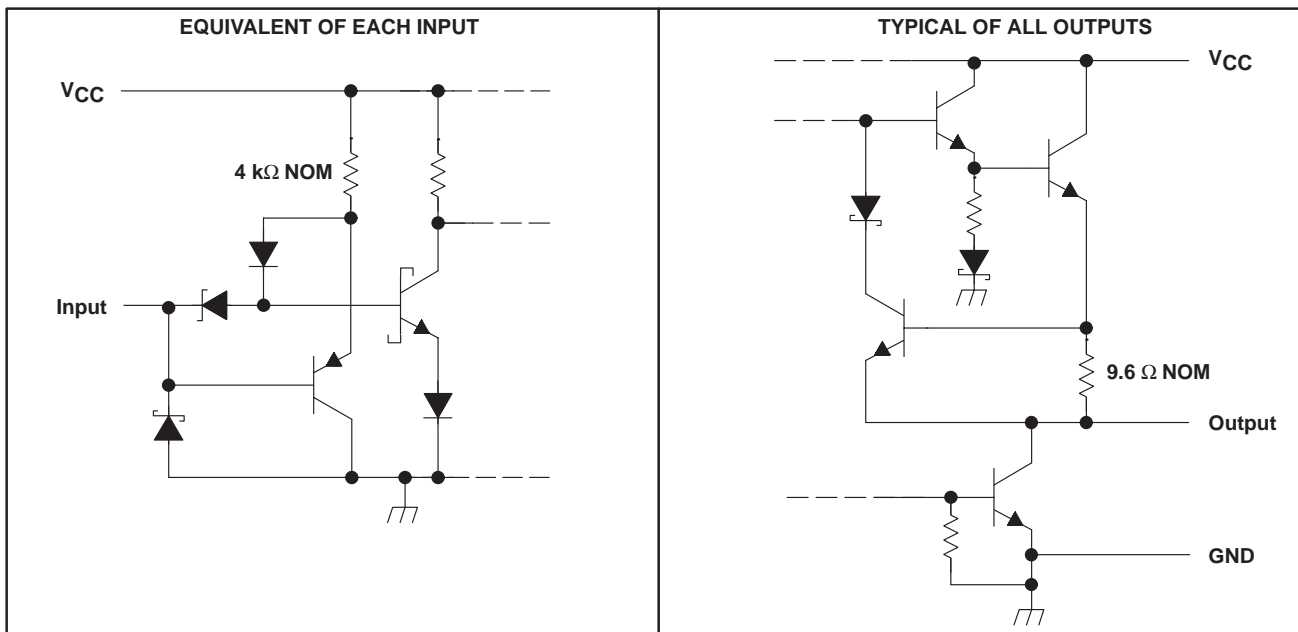
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## schematics of inputs and outputs



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

|   |       |                              |
|---|-------|------------------------------|
| Supply voltage range, $V_{CC}$ (see Note 1)         | ..... | -0.5 V to 7 V                |
| Input voltage range, $V_I$                          | ..... | -0.5 V to 7 V                |
| Continuous total power dissipation                  | ..... | See Dissipation Rating Table |
| Operating free-air temperature range, $T_A$         | ..... | 0°C to 70°C                  |
| Storage temperature range, $T_{stg}$                | ..... | -65°C to 150°C               |
| Lead temperature 1,6 mm (1/16 inch) from 10 seconds | ..... | 260°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.

NOTE 1: Voltage values except differential output voltages are with respect to network GND.

DISSIPATION RATING TABLE

| PACKAGE | $T_A = 25^\circ\text{C}$<br>POWER RATING | DERATING FACTOR<br>ABOVE $T_A = 25^\circ\text{C}$ | $T_A = 70^\circ\text{C}$<br>POWER RATING |
|---------|--|---|--|
| D       | 725 mW                                   | 5.8 mW/°C   | 464 mW                                   |
| P       | 1000 mW                                  | 8.0 mW/°C   | 640 mW                                   |

### recommended operating conditions

|                                       | MIN  | NOM | MAX  | UNIT |
|---------------------------------------|------|-----|------|------|
| Supply voltage, $V_{CC}$              | 4.75 | 5   | 5.25 | V    |
| High-level input voltage, $V_{IH}$    | 2    |     |      | V    |
| Low-level input voltage, $V_{IL}$     |      |     | 0.8  | V    |
| High-level output current, $I_{OH}$   |      |     | -50  | mA   |
| Low-level output current, $I_{OL}$    |      |     | 50   | mA   |
| Operating free-air temperature, $T_A$ | 0    |     | 70   | °C   |



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

| PARAMETER        |   | TEST CONDITIONS   |                                       | MIN       | TYP† | MAX        | UNIT          |   |
|------------------|---|---|---------------------------------------|-----------|------|------------|---------------|---|
| $V_{IK}$         | Input clamp voltage                                 | $V_{CC} = 4.75\text{ V}$ , $I_I = -18\text{ mA}$                              |                                       | -1        | -1.2 |            | V             |   |
| $V_{OH}$         | High-level output voltage                           | $V_{CC} = 4.75\text{ V}$ , $V_{IH} = 2\text{ V}$ ,<br>$V_{IL} = 0.8\text{ V}$ | $I_{OH} = -10\text{ mA}$              | 2.5       | 3.5  |            | V             |   |
|                  |   |   | $I_{OH} = -40\text{ mA}$              | 2         |      |            |               |   |
| $V_{OL}$         | Low-level output voltage                            | $V_{CC} = 4.75\text{ V}$ , $V_{IH} = 2\text{ V}$ ,<br>$I_{OL} = 40\text{ mA}$ | $V_{IL} = 0.8\text{ V}$ ,             |           |      | 0.5        | V             |   |
| $ V_{OD1} $      | Magnitude of differential output voltage            | $V_{CC} = 5.25\text{ V}$ , $I_O = 0$  |                                       |           |      | $2V_{OD2}$ | V             |   |
| $ V_{OD2} $      | Magnitude of differential output voltage            | $V_{CC} = 4.75\text{ V to } 5.25\text{ V}$ ,<br>See Figure 1                  |                                       | 2         |      |            | V             |   |
| $\Delta V_{OD} $ | Change in magnitude of differential output voltage‡ |   |                                       |           |      | $\pm 0.4$  | V             |   |
| $V_{OC}$         | Common-mode output voltage§                         |   |                                       |           |      | 3          |               | V |
| $\Delta V_{OC} $ | Change in magnitude of common-mode output voltage‡  |   |                                       |           |      | $\pm 0.4$  |               | V |
| $I_O$            | Output current with power off                       | $V_{CC} = 0$  | $V_O = 6\text{ V}$                    | 0.1       | 100  |            | $\mu\text{A}$ |   |
|                  |   |   | $V_O = -0.25\text{ V}$                | -0.1      | -100 |            |               |   |
|                  |   |   | $V_O = -0.25\text{ V to } 6\text{ V}$ | $\pm 100$ |      |            |               |   |
| $I_I$            | Input current                                       | $V_{CC} = 5.25\text{ V}$ , $V_I = 5.5\text{ V}$                               |                                       |           |      | 50         | $\mu\text{A}$ |   |
| $I_{IH}$         | High-level input current                            | $V_{CC} = 5.25\text{ V}$ , $V_I = 2.7\text{ V}$                               |                                       |           |      | 25         | $\mu\text{A}$ |   |
| $I_{IL}$         | Low-level input current                             | $V_{CC} = 5.25\text{ V}$ , $V_I = 0.5\text{ V}$                               |                                       |           |      | -200       | $\mu\text{A}$ |   |
| $I_{OS}$         | Short-circuit output current¶                       | $V_{CC} = 5.25\text{ V}$ , $V_O = 0$  |                                       | -50       |      | -150       | mA            |   |
| $I_{CC}$         | Supply current (both drivers)                       | $V_{CC} = 5.25\text{ V}$ , No load, All inputs at 0 V                         |                                       |           | 45   | 65         | mA            |   |

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

‡  $\Delta|V_{OD}|$  and  $\Delta|V_{OC}|$  are the changes in magnitude of  $V_{OD}$  and  $V_{OC}$ , respectively, that occur when the input is changed from a high level to a low level or vice versa.

§ In Standard EIA-422-A,  $V_{OC}$ , which is the average of the two output voltages with respect to ground, is called output offset voltage,  $V_{OS}$ .

¶ Only one output at a time should be shorted, and duration of the short circuit should not exceed one second.

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

| PARAMETER        |                                     | TEST CONDITIONS  |  | MIN          | TYP | MAX | UNIT |
|------------------|-------------------------------------|--|--|--------------|-----|-----|------|
| $t_d(\text{OD})$ | Differential output delay time      | $C_L = 15\text{ pF}$ , $R_L = 100\ \Omega$ ,<br>See Figure 2 |  |              | 10  | 20  | ns   |
| $t_t(\text{OD})$ | Differential output transition time |  |  |              | 10  | 20  | ns   |
| $t_{sk(o)}$      | Output skew                         |  |  | See Figure 2 |     | 1   |      |



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## PARAMETER MEASUREMENT INFORMATION

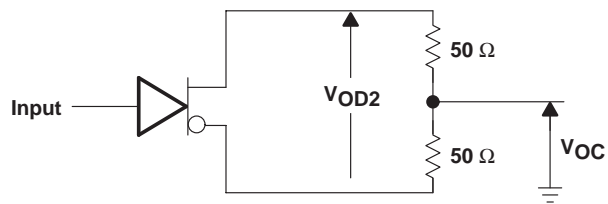
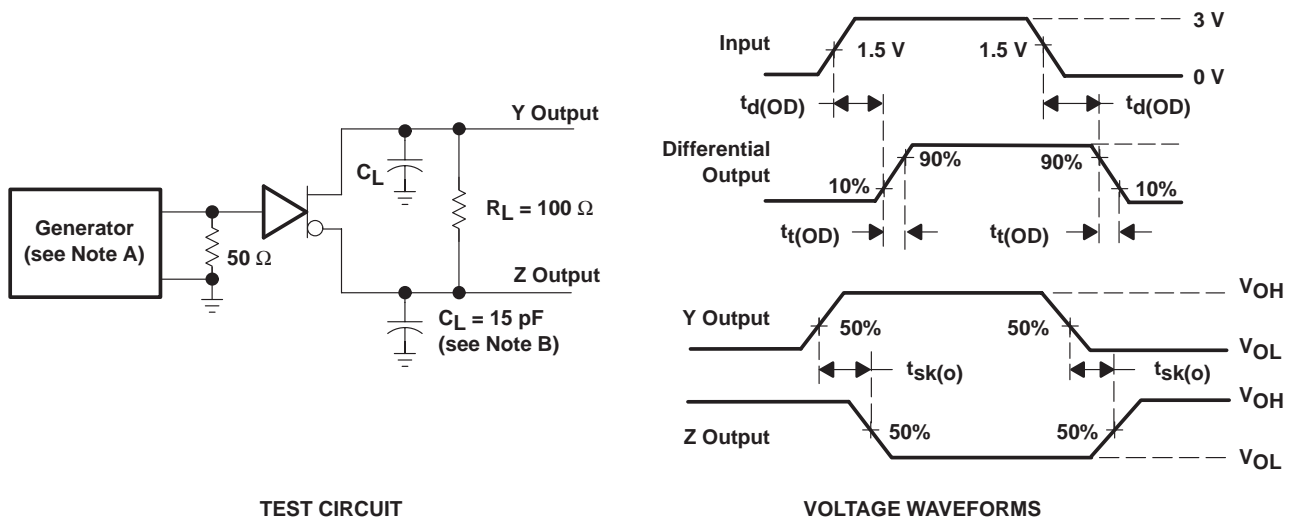


Figure 1. Differential and Common-Mode Output Voltages



### TEST CIRCUIT

### VOLTAGE WAVEFORMS

- NOTES: A. The input pulse generator has the following characteristics:  $Z_O = 50 \Omega$ ,  $PRR \leq 500 \text{ kHz}$ ,  $t_w = 100 \text{ ns}$ ,  $t_r = \leq 5 \text{ ns}$ .  
B.  $C_L$  includes probe and jig capacitance.

Figure 2. Test Circuit and Voltage Waveforms

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