

DS9638

RS-422 Dual High Speed Differential Line Driver

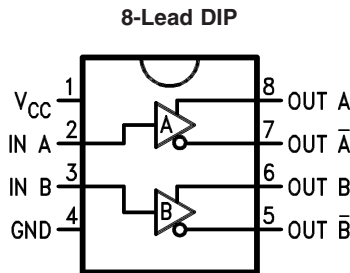
General Description

The DS9638 is a Schottky, TTL compatible, dual differential line driver designed specifically to meet the EIA Standard RS-422 specifications. It is designed to provide unipolar differential drive to twisted pair or parallel wire transmission lines. The inputs are TTL compatible. The outputs are similar to totem pole TTL outputs, with active pull-up and pull-down. The device features a short circuit protected active pull-up with low output impedance and is specified to drive 50Ω transmission lines at high speed. The mini-DIP provides high package density.

Features

- Single 5V supply
- Schottky technology
- TTL and CMOS compatible inputs
- Output short circuit protection
- Input clamp diodes
- Complementary outputs
- Minimum output skew (<1.0 ns typical)
- 50 mA output drive capability for 50Ω transmission lines
- Meets EIA RS-422 specifications
- Propagation delay of less than 10 ns
- "Glitchless" differential output
- Delay time stable with V_{CC} and temperature variations (<2.0 ns typical) (Figure 3)
- Extended temperature range

Connection Diagram



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Top View

Order Number DS9638CM or DS9638CN
 See NS Package Number M08A or N08E
 For Complete Military Product Specifications,
 refer to the appropriate SMD or MDS.
 Order Number DS9638MJ/883
 See NS Package Number J08A

Absolute Maximum Ratings (Note 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Storage Temperature Range

| | |
|---------------------|--------------------|
| Ceramic DIP | -65°C to +175°C |
| Molded DIP and SO-8 | -65°C to +150°C |

Lead Temperature

Ceramic DIP (Soldering, 60 sec.) 300°C

Molded DIP (Soldering, 10 sec.) 265°C

Maximum Power Dissipation (Note 1) at 25°C

Cavity Package 1300 mW

Molded Package 930 mW

SO Package 810 mW

 V_{CC} Lead Potential to Ground -5V to 7V

Input Voltage -0.5V to +7V

Recommended Operating Conditions

| | DS9638M | | | DS9638C | | | Units |
|----------------------------------|---------|-----|-----|---------|-----|------|-------|
| | Min | Typ | Max | Min | Typ | Max | |
| Supply Voltage (V_{CC}) | 4.5 | 5.0 | 5.5 | 4.75 | 5.0 | 5.25 | V |
| Output Current HIGH (I_{OH}) | | | -50 | | | -50 | mA |
| Output Current LOW (I_{OL}) | | | 50 | 40 | | 50 | mA |
| Operating Temperature (T_A) | -55 | 25 | 125 | 0 | 25 | 70 | °C |

Note 1: Derate cavity package 8.7 mW/°C above 25°C; derate molded DIP package 7.5 mW/°C above 25°C; derate SO package 6.5 mW/°C above 25°C.

Electrical Characteristics (Notes 3, 4)

Over recommended operating temperature and supply voltage ranges, unless otherwise specified

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---------------------------|--|---|--|------------|------------|-------|
| V_{IH} | Input Voltage HIGH | | 2.0 | | | V |
| V_{IL} | Input Voltage LOW | 0°C to +70°C -55°C to +125°C | | | 0.8 0.5 | V |
| V_{IC} | Input Clamp Voltage | $V_{CC} = \text{Min}$, $I_I = -18 \text{ mA}$ | | -1.0 | -1.2 | V |
| V_{OH} | Output Voltage HIGH | $V_{CC} = \text{Min}$, $V_{IH} = V_{IH \text{ Min}}$, $V_{IL} = V_{IL \text{ Max}}$ | $I_{OH} = -10 \text{ mA}$ $I_{OH} = -40 \text{ mA}$ | 2.5 2.0 | 3.5 | V |
| V_{OL} | Output Voltage LOW | $V_{CC} = \text{Min}$, $V_{IH} = V_{IH \text{ Min}}$, $V_{IL} = V_{IL \text{ Max}}$, $I_{OL} = 40 \text{ mA}$ | | | 0.5 | V |
| I_I | Input Current at Maximum Input Voltage | $V_{CC} = \text{Max}$, $V_I \text{ Max} = 5.5 \text{ V}$ | | | 50 | μA |
| I_{IH} | Input Current HIGH | $V_{CC} = \text{Max}$, $V_{IH} = 2.7 \text{ V}$ | | | 25 | μA |
| I_{IL} | Input Current LOW | $V_{CC} = \text{Max}$, $V_{IL} = 0.5 \text{ V}$ | | | -200 | μA |
| I_{OS} | Output Short Circuit Current | $V_{CC} = \text{Max}$, $V_O = 0 \text{ V}$ (Note 4) | -50 | | -150 | mA |
| V_T , \bar{V}_T | Terminated Output Voltage | See Figure 1 | 2.0 | | | V |
| $V_T - \bar{V}_T$ | Output Balance | | | | 0.4 | V |
| V_{OS} , \bar{V}_{OS} | Output Offset Voltage | | | | 3.0 | V |
| $V_{OS} - \bar{V}_{OS}$ | Output Offset Balance | | | | 0.4 | V |
| I_X | Output Leakage Current | $T_A = 25^\circ\text{C}$ $-0.25 \text{ V} < V_X < 5.5 \text{ V}$ | | | 100 | μA |
| I_{CC} | Supply Current (Both Drivers) | $V_{CC} = 5.5 \text{ V}$, All input at 0V, No Load | | 45 | 65 | mA |

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 tables of "Electrical Characteristics provide conditions for actual device operation.

Note 3: Unless otherwise specified min/max limits apply across the -55°C to +125°C temperature range for the DS9638M and across the 0°C to +70°C range for the DS9638C. All typicals are given for $V_{CC} = 5 \text{ V}$ and $T_A = 25^\circ\text{C}$.

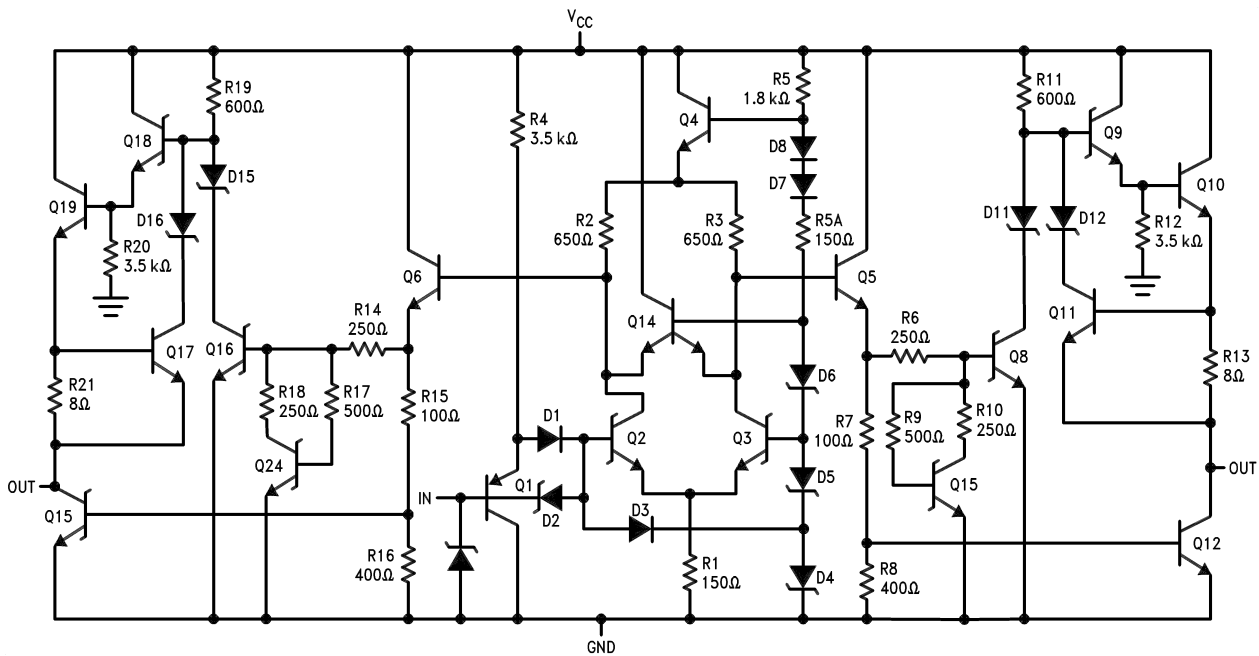
Note 4: All currents into the device pins are positive; all currents out of the device pins are negative. All voltages are referenced to ground unless otherwise specified.

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

Switching Characteristics

$V_{CC} = 5.0V, T_A = 25^\circ C.$

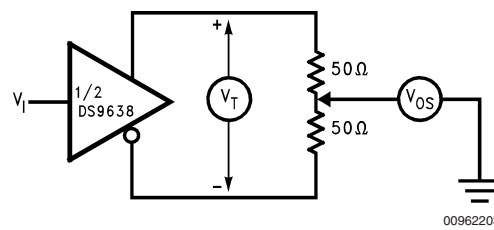
| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|------------------------------|---|---|-----|-----|-----|-------|
| t_{PHL} | Propagation Delay | $C_L = 15\text{ pF}$ $R_L = 100\Omega, \text{ See Figure 2}$ | | 10 | 20 | ns |
| t_{PLH} | | | | 10 | 20 | ns |
| t_f | Fall Time, 90%–10% | | | 10 | 20 | ns |
| t_r | Rise Time, 10%–90% | | | 10 | 20 | ns |
| $t_{PO} - \overline{t_{PO}}$ | Skew Between Outputs A/ \overline{A} and B/ \overline{B} | | | 1.0 | | ns |



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FIGURE 1. Equivalent Circuit

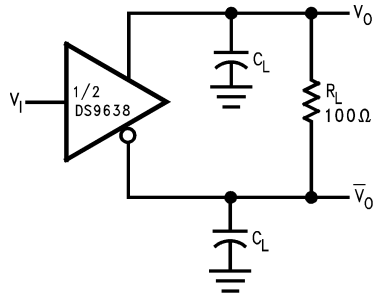
DC Test Circuit



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FIGURE 2. Terminated Output Voltage and Output Balance

DC Test Circuit (Continued)



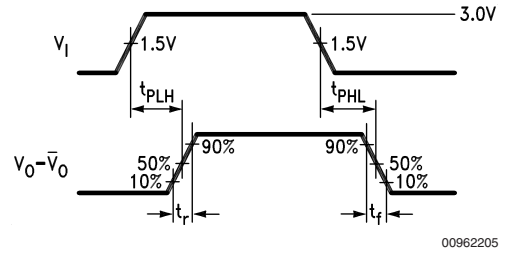
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Note 6: The pulse generator has the following characteristics:

C_L includes probe and jig capacitance.

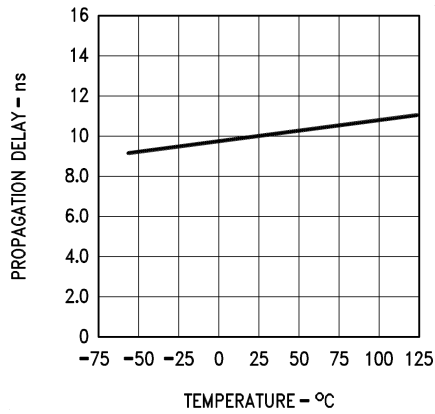
PRR = 500 kHz, $t_W = 100$ ns,

$t_r \leq 5.0$ ns, $Z_O = 50\Omega$.

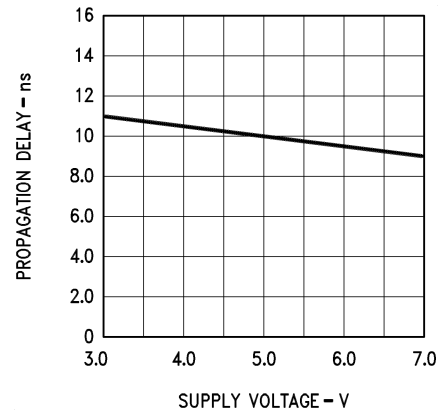


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FIGURE 3. AC Test Circuit and Voltage Waveform



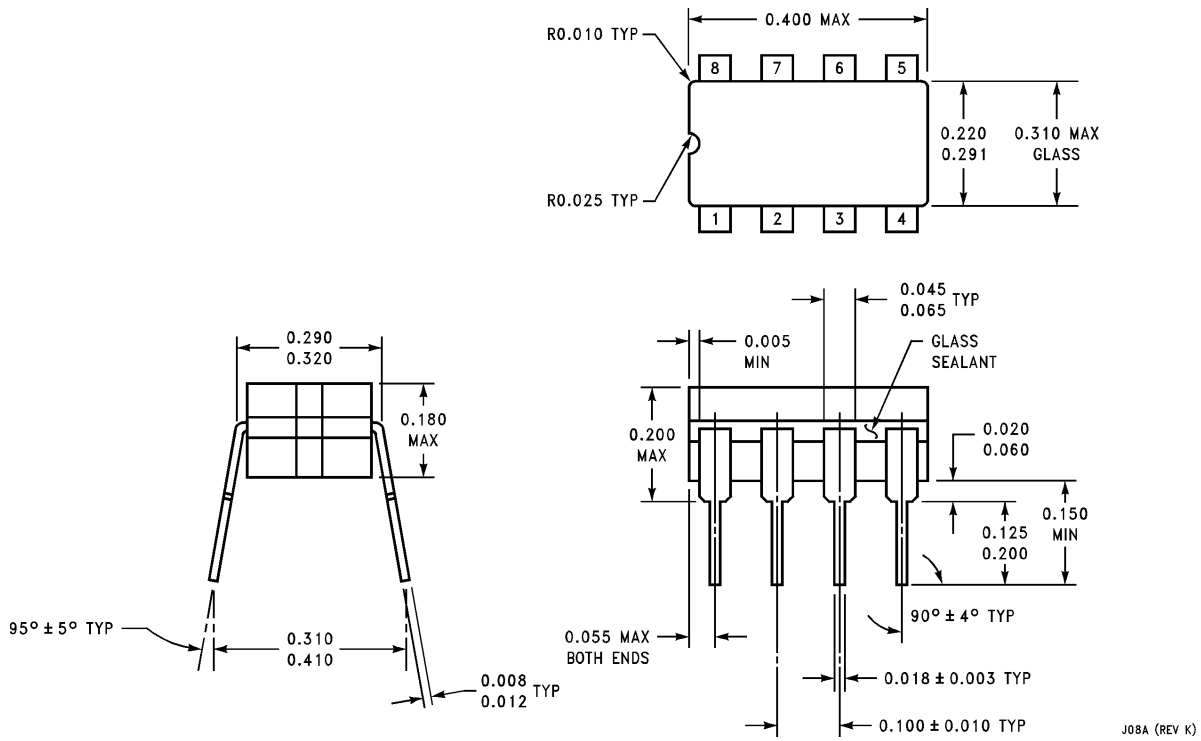
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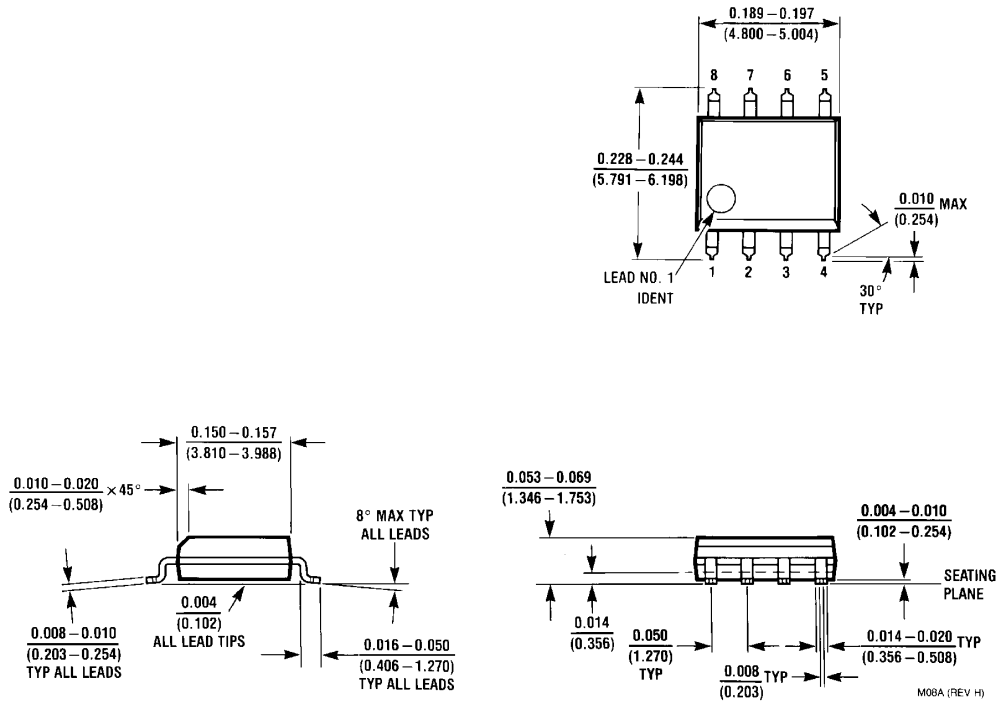
FIGURE 4. Typical Delay Characteristics

Physical Dimensions inches (millimeters) unless otherwise noted



Ceramic Dual-In-Line Package (J)
Order Number DS9638MJ/883
NS Package Number J08A

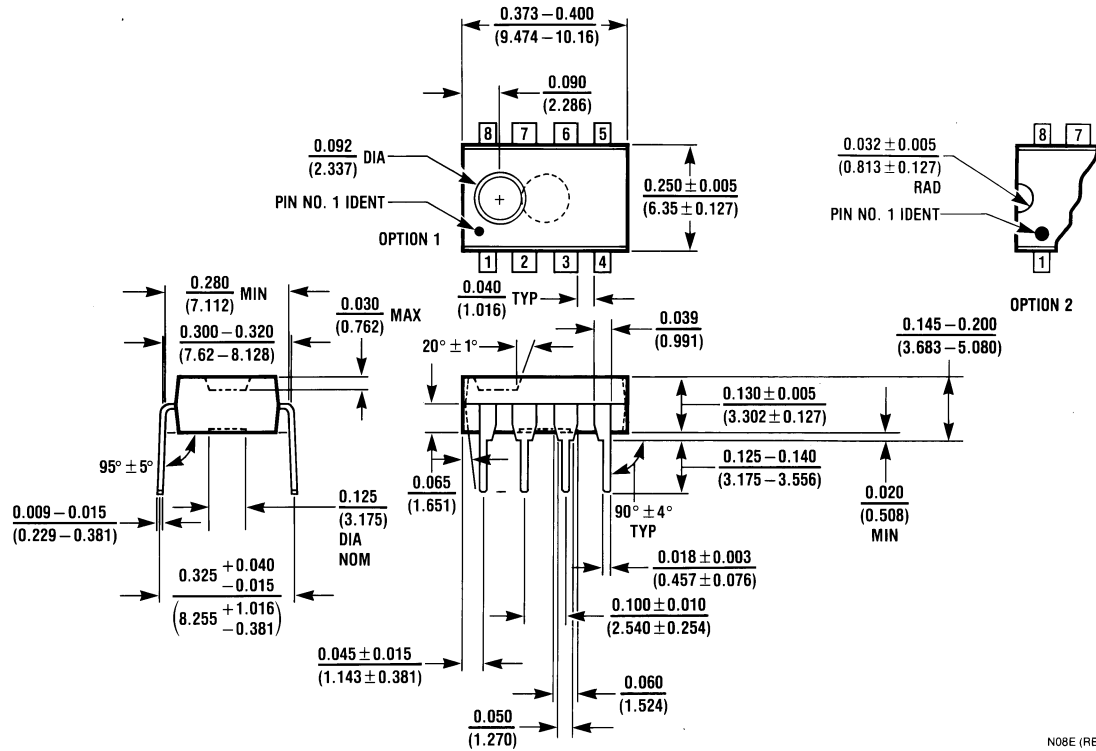
J08A (REV K)



Ceramic Dual-In-Line Package (M)
Order Number DS9638CM
NS Package Number M08A

M08A (REV H)

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



Molded Dual-In-Line Package (N)
Order Number DS9638CN
NS Package Number N08E

N08E (REV F)

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