National Semiconductor

PRELIMINARY

T-75-45-05

DS9638/μA9638
RS-422 Dual High Speed Differential Line Driver

General Description

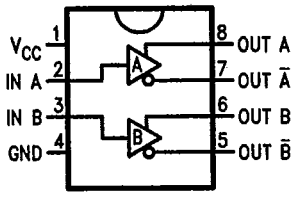
The DS9638/μA9638 is a Schottky, TTL compatible, dual differential line driver designed specifically to meet the EIA Standard RS-422 specifications. It is designed to provide unipolar differential drive to twisted pair or parallel wire transmission lines. The inputs are TTL compatible. The outputs are 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 outupt 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

8-Lead DIP and SO-8 Package



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Top View

Order Number DS9638MJ, μA9638RM, DS9638CJ or μA9638RC
See NS Package Number J08A*

Order Number DS9638CM or μA9638SC
See NS Package Number M08A

Order Number DS9638CN or μA9638TC
See NS Package Number N08E

*For most current package information: contact product marketing.

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, 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 and SO Package (Soldering, 10 sec.): 265°C

Maximum Power Dissipation* 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

*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.

Recommended Operating Conditions

	DS9638M/μA9638M			DS9638C/μA9638C			
	Min	Typ	Max	Min	Typ	Max	Units
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})				40		50	mA
Operating Temperature (T_A)	−55	25	125	0	25	70	°C

Electrical Characteristics Over recommended operating temperature and supply voltage ranges, unless otherwise specified (Notes 2 & 3)

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				0.8	V
		−55°C to +125°C				0.5	
V_{IC}	Input Clamp Voltage	V_{CC} = Min, I_I = −18 mA			−1.0	−1.2	V
V_{OH}	Output Voltage HIGH	V_{CC} = Min, V_{IH} = $V_{IH\ Min}$, V_{IL} = $V_{IL\ Max}$	I_{OH} = −10 mA	2.5	3.5		V
			I_{OH} = −40 mA	2.0			
V_{OL}	Output Voltage LOW	V_{CC} = Min, V_{IH} = $V_{IH\ Min}$, V_{IL} = $V_{IL\ Max}$, I_{OL} = 40 mA				0.5	V
I_I	Input Current at Maximum Input Voltage	V_{CC} = Max, $V_{I\ Max}$ = 5.5V				50	μA
I_{IH}	Input Current HIGH	V_{CC} = Max, V_{IH} = 2.7V				25	μA
I_{IL}	Input Current LOW	V_{CC} = Max, V_{IL} = 0.5V				−200	μA
I_{OS}	Output Short Circuit Current	V_{CC} = Max, V_O = 0V (Note 4)		−50		−150	mA
V_T, $\overline{V}_T$	Terminated Output Voltage	See *Figure 1*		2.0			V
V_T−$\overline{V}_T$	Output Balance					0.4	V
V_{OS}, $\overline{V}_{OS}$	Output Offset Voltage					3.0	V
V_{OS}−$\overline{V}_{OS}$	Output Offset Balance					0.4	V
I_X	Output Leakage Current	T_A = 25°C, −0.25V < V_X < 6.0V				100	μA
I_{CC}	Supply Current (Both Drivers)	V_{CC} = 5.5V, All Input at 0V, No Load			45	65	mA

Note 1: "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 2: 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} = 5V and T_A = 25°C.

Note 3: 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 4: Only one output at a time should be shorted.

Switching Characteristics V_{CC} = 5.0V, T_A = 25°C.

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Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PHL}	Propagation Delay	C_L = 15 pF R_L = 100Ω, 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
$t_{PO}-t_{\overline{PO}}$	Skew Between Outputs A/$\overline{A}$ and B/$\overline{B}$			1.0		ns

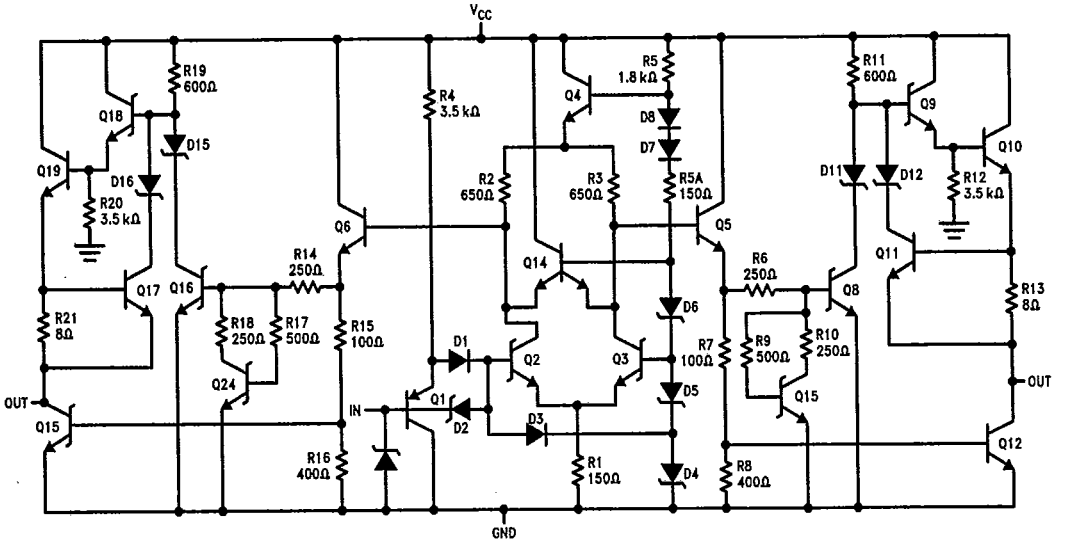

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FIGURE 1. Equivalent Circuit

DC Test Circuit

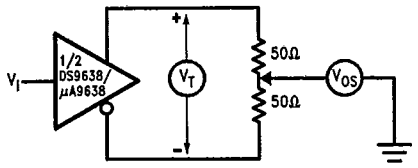

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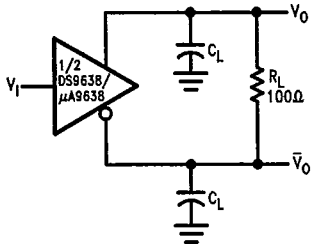
FIGURE 2. Terminated Output Voltage and Output Balance



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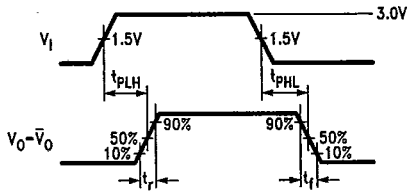

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FIGURE 3a

Note:

The pulse generator has the following characteristics:
PRR = 500 kHz, t_W = 100 ns,
$t_r \leq 5.0$ ns, $Z_O = 50\Omega$.

C_L includes probe and jig capacitance.

FIGURE 3. AC Test Circuit and Voltage Waveform

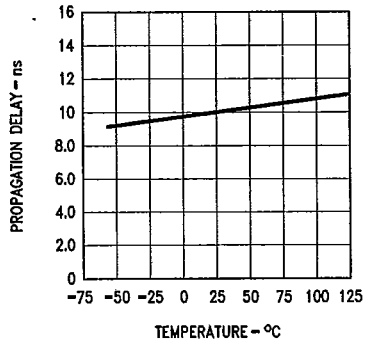

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FIGURE 4. Typical Delay Characteristics

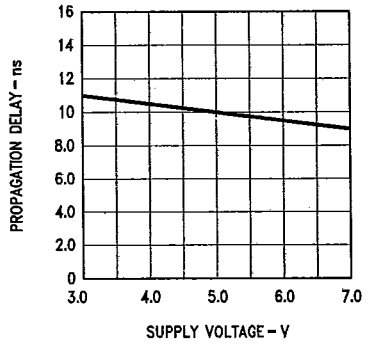

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FIGURE 4a

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