

National Semiconductor is now part of
Texas Instruments.

Search <http://www.ti.com/> for the latest technical
information and details on our current products and services.

DS9638QML

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.

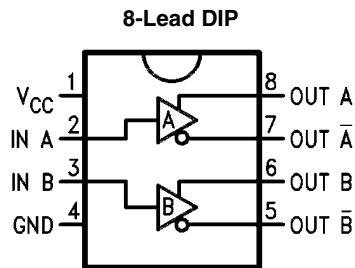
Features

- 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

Ordering Table

NS PART NUMBER	SMD PART NUMBER	NS PACKAGE NUMBER	PACKAGE DISCRIPTION
DS9638J/883	5962-8754601PA	J08A	8LD CERAMIC DIP

Connection Diagram



30059001

Top View
See NS Package Number J08A

Absolute Maximum Ratings (Note 1)

Storage Temperature Range	
Ceramic DIP	–65°C to +175°C
Lead Temperature	
Ceramic DIP (Soldering, 60 sec.)	300°C
Maximum Power Dissipation at 25°C (Note 2)	
Cavity Package	1300 mW
V_{CC} Lead Potential to Ground	–5V to 7V
Input Voltage	–0.5V to +7V

Recommended Operating Conditions

DS9638J/883	Min	Max	Units
Supply Voltage (V_{CC})	4.5	5.5	V
Output Current HIGH (I_{OH})		–50	mA
Output Current LOW (I_{OL})		50	mA
Operating Temperature (T_A)	–55	125	°C

Quality Conformance Inspection

MIL-STD-883, Method 5005 - Group A

Subgroup	Description	Temp (°C)
1	Static tests at	+25°C
2	Static tests at	+125°C
3	Static tests at	–55°C
4	Dynamic tests at	+25°C
5	Dynamic tests at	+125°C
6	Dynamic tests at	–55°C
7	Functional tests at	+25°C
8A	Functional tests at	+125°C
8B	Functional tests at	–55°C
9	Switching tests at	+25°C
10	Switching tests at	+125°C
11	Switching tests at	–55°C
12	Setting time at	+25°C
13	Setting time at	+125°C
14	Setting time at	–55°C

DS9638J/883 Electrical Characteristics

DC Parameters

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

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-Groups
V_{OL}	Output Voltage Low	$V_{CC} = 4.5V$, $F_{IOL} = 30mA$ for temp, $F_{IOL} = 35mA$ for room	(Note 3)		0.5	V	1, 2, 3
V_{FCD}	Input Clamped Voltage	$V_{CC} = 4.5V$, $F_{IFCD} = -18mA$		-1.2		V	1, 2, 3
V_{OHQVT}	V_T , $\bar{V}_T$ Terminated Output Voltage	$V_{CC} = 5.5V$, $R_O = 100\ \Omega$		2		V	1, 2, 3
V_{OH}	Logical "1" Output Voltage	$V_{CC} = 4.5V$, $F_{IOH} = -10mA$		2.5		V	1
				2.0			2, 3
V_{OHQ}	Logical "1" Output Voltage	$V_{CC} = 4.5V$, $F_{IOHQ} = -40mA$		2.0		V	1
				1.0			2, 3
V_{OHQBAL}	V_T - $\bar{V}_T$ Output Balance	$V_{CC} = 5.5V$, $R_O = 100\ \Omega$		-0.4	0.4	V	1, 2, 3
I_{IL}	Logical "0" Input Current	$V_{CC} = 5.5V$, $F_{VIL} = 0.5V$		-200		μA	1, 2, 3
I_{IH}	Logical "1" Input Current	$V_{CC} = 5.5V$, $F_{VIH} = 2.7V$			25	μA	1, 2, 3
I_{IHQH}	Logical "1" Input Current	$V_{CC} = 5.5V$, $F_{VIIHQH} = 5.5V$			50	μA	1, 2, 3
I_{OS}	Output Short Circuit Current	$V_{CC} = 5.5V$, $F_{V_{IOS}} = 0V$		-150	-50	mA	1
				-150	-40		2, 3
I_{CC}	Supply Current	$V_{CC} = 5.5V$, $F_{V_{CCH}} = 5.5V$			65	mA	1
					75		2, 3
I_{OHC}	I_O (off) Output Leakage	$V_{CC} = 5.5V$, $F_{V_{OH}} = 5.5V$			200	μA	1
$V_{OS}, \bar{V}_{OS}$	Output Offset Voltage		(Note 5)		3	V	1, 2, 3
$V_{OS} - \bar{V}_{OS}$	Output Offset Balance		(Note 4)		.4	V	1, 2, 3
V_{IH}	Input High Voltage		(Note 6)	2		V	1, 2, 3
V_{IL}	Input Low Voltage		(Note 6)		0.5	V	1, 2, 3
V_{HB}	I_X Output Leakage	$V_{CC} = 0.0V$, $F_{IOHBQI} = 150\ \mu A$		5.55		V	1
I_{CEX}	Output Leakage Current	$V_{CC} = 0.0V$, $F_{V_{CEX}} = 5.5V$			150	μA	2, 3
I_{CEXQI}	Output Leakage Current	$V_{CC} = 0.0V$, $F_{VICEXQ2} = -0.25V$		-150		μA	2, 3

AC Parameters

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

Symbol	Parameter	Conditions	Notes	Min	Max	Units	Sub-Groups
t_{PLH}	Propagation Delay to High Level	$V_{CC} = 5V$, $R_O = 100\ \Omega$, $C_L = 15pF$			20	nS	9
t_{PHL}	Propagation Delay to Low Level	$V_{CC} = 5V$, $R_O = 100\ \Omega$, $C_L = 15pF$			20	nS	9
t_F	Fall Time	$V_{CC} = 5V$, 90% - 10%			20	nS	9
t_R	Rise Time	$V_{CC} = 5V$, 10% - 90%			20	nS	9

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: Derate cavity package 8.7 mW/°C above 25°C.

Note 3: 35mA is more stringent than 30mA.

Note 4: Guaranteed by V_T - $\bar{V}_T$ test.

Note 5: Guaranteed by design.

Note 6: Guaranteed by V_{OH} & V_{OL} tests.

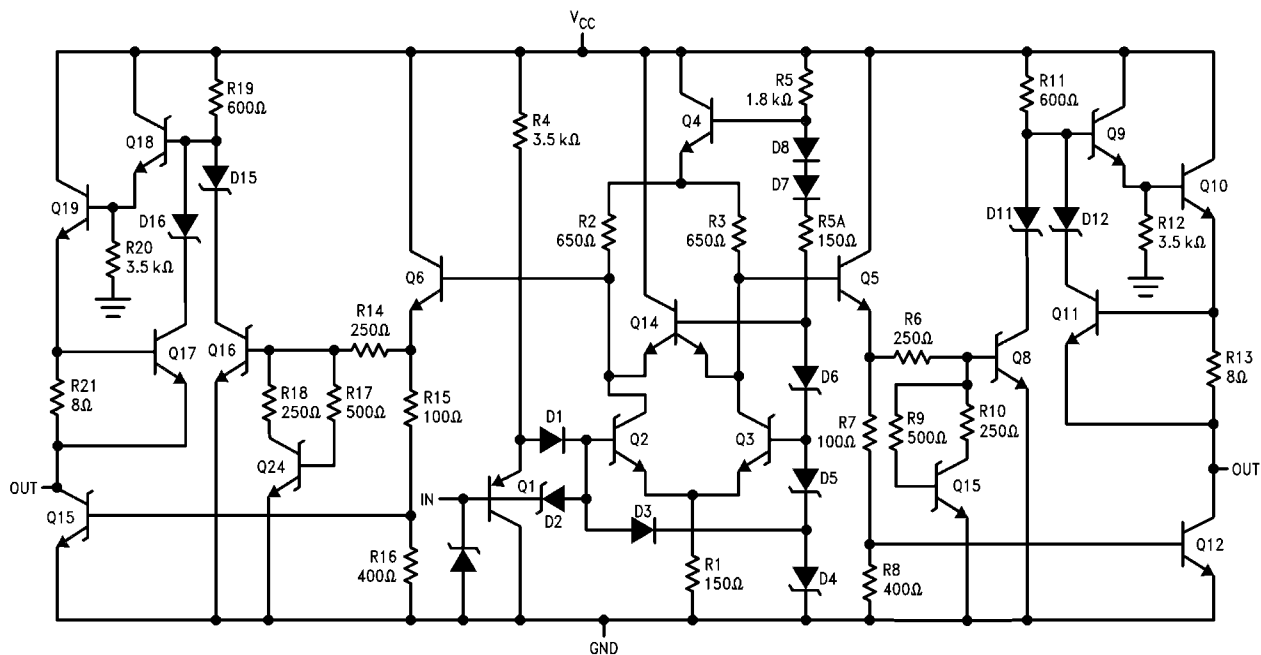


FIGURE 1. Equivalent Circuit

DC Test Circuit

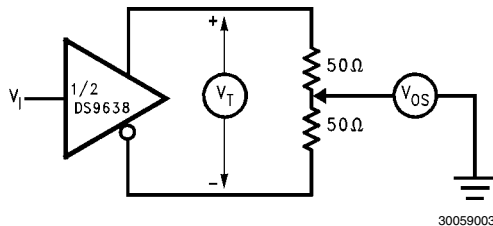
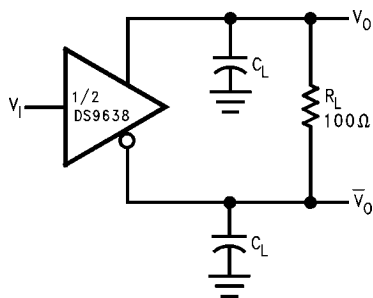
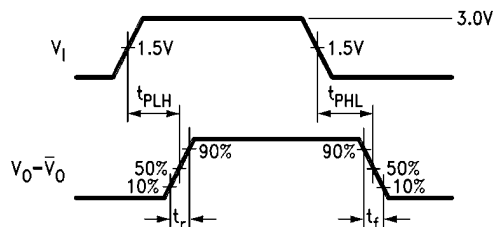


FIGURE 2. Terminated Output Voltage and Output Balance

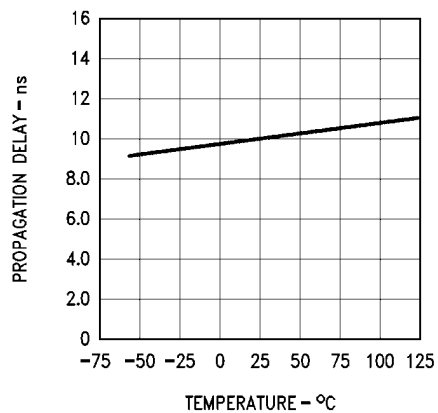


C_L includes probe and jig capacitance.
 PRR = 500 kHz, $t_w = 100$ ns,
 $t_r \leq 5.0$ ns, $Z_O = 50\Omega$.

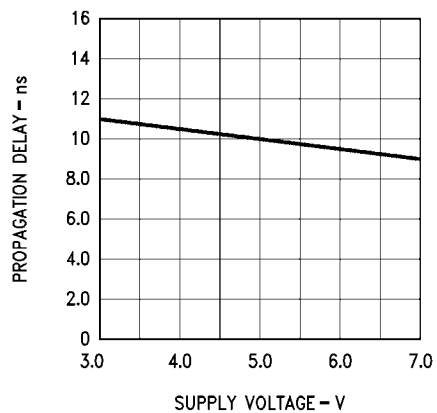


Note 7: The pulse generator has the following characteristics:

FIGURE 3. AC Test Circuit and Voltage Waveform



30059006



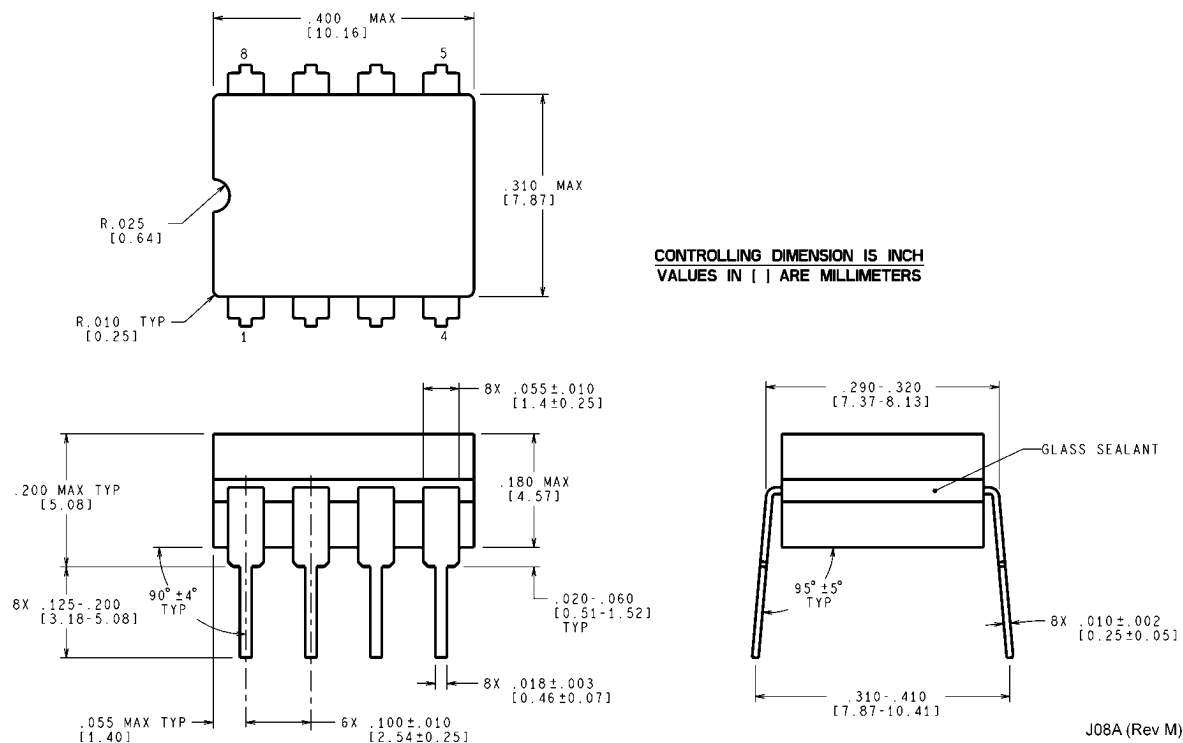
30059007

FIGURE 4. Typical Delay Characteristics

Revision History

Date Released	Revision	Section	Originator	Changes
05/27/08	A	New Release, Corporate Format, Change to DC Electrical Section	Bill Petcher	1 MDS data sheet converted into one Corp. data sheet format. Change made to V_{OH} , V_{OHQ} and I_{OS} . MNDS9638-X, Rev. 0AL data sheet will be Archived.

Physical Dimensions inches (millimeters) unless otherwise noted



**Ceramic Dual-In-Line Package (J)
NS Package Number J08A**

Notes

For more National Semiconductor product information and proven design tools, visit the following Web sites at:

Products		Design Support	
Amplifiers	www.national.com/amplifiers	WEBENCH	www.national.com/webench
Audio	www.national.com/audio	Analog University	www.national.com/AU
Clock Conditioners	www.national.com/timing	App Notes	www.national.com/appnotes
Data Converters	www.national.com/adac	Distributors	www.national.com/contacts
Displays	www.national.com/displays	Green Compliance	www.national.com/quality/green
Ethernet	www.national.com/ethernet	Packaging	www.national.com/packaging
Interface	www.national.com/interface	Quality and Reliability	www.national.com/quality
LVDS	www.national.com/lvds	Reference Designs	www.national.com/refdesigns
Power Management	www.national.com/power	Feedback	www.national.com/feedback
Switching Regulators	www.national.com/switchers		
LDOs	www.national.com/lido		
LED Lighting	www.national.com/led		
PowerWise	www.national.com/powerwise		
Serial Digital Interface (SDI)	www.national.com/sdi		
Temperature Sensors	www.national.com/tempsensors		
Wireless (PLL/VCO)	www.national.com/wireless		

THE CONTENTS OF THIS DOCUMENT ARE PROVIDED IN CONNECTION WITH NATIONAL SEMICONDUCTOR CORPORATION ("NATIONAL") PRODUCTS. NATIONAL MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE ACCURACY OR COMPLETENESS OF THE CONTENTS OF THIS PUBLICATION AND RESERVES THE RIGHT TO MAKE CHANGES TO SPECIFICATIONS AND PRODUCT DESCRIPTIONS AT ANY TIME WITHOUT NOTICE. NO LICENSE, WHETHER EXPRESS, IMPLIED, ARISING BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT.

TESTING AND OTHER QUALITY CONTROLS ARE USED TO THE EXTENT NATIONAL DEEMS NECESSARY TO SUPPORT NATIONAL'S PRODUCT WARRANTY. EXCEPT WHERE MANDATED BY GOVERNMENT REQUIREMENTS, TESTING OF ALL PARAMETERS OF EACH PRODUCT IS NOT NECESSARILY PERFORMED. NATIONAL ASSUMES NO LIABILITY FOR APPLICATIONS ASSISTANCE OR BUYER PRODUCT DESIGN. BUYERS ARE RESPONSIBLE FOR THEIR PRODUCTS AND APPLICATIONS USING NATIONAL COMPONENTS. PRIOR TO USING OR DISTRIBUTING ANY PRODUCTS THAT INCLUDE NATIONAL COMPONENTS, BUYERS SHOULD PROVIDE ADEQUATE DESIGN, TESTING AND OPERATING SAFEGUARDS.

EXCEPT AS PROVIDED IN NATIONAL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, NATIONAL ASSUMES NO LIABILITY WHATSOEVER, AND NATIONAL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY RELATING TO THE SALE AND/OR USE OF NATIONAL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS PRIOR WRITTEN APPROVAL OF THE CHIEF EXECUTIVE OFFICER AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

Life support devices or systems are devices which (a) are intended for surgical implant into the body, or (b) support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in a significant injury to the user. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system or to affect its safety or effectiveness.

National Semiconductor and the National Semiconductor logo are registered trademarks of National Semiconductor Corporation. All other brand or product names may be trademarks or registered trademarks of their respective holders.

Copyright© 2008 National Semiconductor Corporation

For the most current product information visit us at www.national.com



**National Semiconductor
Americas Technical
Support Center**
Email: support@nsc.com
Tel: 1-800-272-9959

**National Semiconductor Europe
Technical Support Center**
Email: europe.support@nsc.com
German Tel: +49 (0) 180 5010 771
English Tel: +44 (0) 870 850 4288

**National Semiconductor Asia
Pacific Technical Support Center**
Email: ap.support@nsc.com

**National Semiconductor Japan
Technical Support Center**
Email: jpn.feedback@nsc.com