

DS8921,DS8921A,DS8921AT

DS8921/DS8921A/DS8921AT Differential Line Driver and Receiver Pair



Literature Number: SNLS374B

DS8921/DS8921A/DS8921AT Differential Line Driver and Receiver Pair

General Description

The DS8921, DS8921A are Differential Line Driver and Receiver pairs designed specifically for applications meeting the ST506, ST412 and ESDI Disk Drive Standards. In addition, these devices meet the requirements of the EIA Standard RS-422.

The DS8921, DS8921A receivers offer an input sensitivity of 200 mV over a $\pm 7V$ common mode operating range. Hysteresis is incorporated (typically 70 mV) to improve noise margin for slowly changing input waveforms.

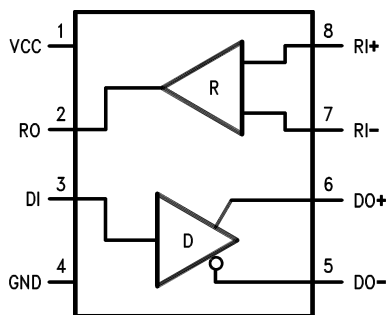
The DS8921, DS8921A drivers are designed to provide unipolar differential drive to twisted pair or parallel wire transmission lines. Complementary outputs are logically ANDed and provide an output skew of 0.5 ns (typ.) with propagation delays of 12 ns.

The DS8921, DS8921A are designed to be compatible with TTL and CMOS.

Features

- 12 ns typical propagation delay
- Output skew - 0.5 ns typical
- Meet the requirements of EIA Standard RS-422
- Complementary Driver Outputs
- High differential or common-mode input voltage ranges of $\pm 7V$
- $\pm 0.2V$ receiver sensitivity over the input voltage range
- Receiver input hysteresis-70 mV typical
- DS8921AT industrial temperature operation: ($-40^{\circ}C$ to $+85^{\circ}C$)

Connection Diagram



00851201

Order Number DS8921M, DS8921N, DS8921AM, DS8921AN, DS8921ATM, or DS8921ATN
See NS Package Number M08A or N08E

Truth Table

Receiver		Driver		
Input	V_{OUT}	Input	V_{OUT}	$\overline{V_{OUT}}$
$V_{ID} \geq V_{TH}$ (MAX)	1	1	1	0
$V_{ID} \leq V_{TH}$ (MIN)	0	0	0	1
Open	1			

Absolute Maximum Ratings (Note 1)

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

Supply Voltage	7V
Driver Input Voltage	-0.5V to +7V
Output Voltage	5.5V
Receiver Output Sink Current	50 mA
Receiver Input Voltage	±10V
Differential Input Voltage	±12V
Maximum Package Power Dissipation @ +25°C	
M Package	730 mW
N Package	1160 mW
Derate M Package	9.3 mW/°C above +25°C
Derate N Package	5.8 mW/°C above +25°C

Storage Temperature

Range -65°C to +165°C

Lead Temperature +260°C

(Soldering, 4 sec.) +260°C

Maximum Junction Temperature +150°C

Recommended Operating Conditions

	Min	Max	Units
Supply Voltage	4.5	5.5	V
Temperature (T _A)			
DS8921/DS8921A	0	70	°C
DS8921AT	-40	+85	°C

DS8921/DS8921A Electrical Characteristics (Notes 2, 3, 4)

Symbol	Conditions	Min	Typ	Max	Units
RECEIVER					
V _{TH}	-7V ≤ V _{CM} ≤ +7V	-200	±35	+200	mV
V _{HYST}	-7V ≤ V _{CM} ≤ +7V	15	70		mV
R _{IN}	V _{IN} = -7V, +7V (Other Input = GND)	4.0	6.0		kΩ
I _{IN}	V _{IN} = 10V			3.25	mA
	V _{IN} = -10V			-3.25	mA
V _{OH}	I _{OH} = -400 μA	2.5			V
V _{OL}	I _{OL} = 8 mA			0.5	V
I _{SC}	V _{CC} = MAX, V _{OUT} = 0V	-15		-100	mA
DRIVER					
V _{IH}		2.0			V
V _{IL}				0.8	V
I _{IL}	V _{CC} = MAX, V _{IN} = 0.4V		-40	-200	μA
I _{IH}	V _{CC} = MAX, V _{IN} = 2.7V			20	μA
I _I	V _{CC} = MAX, V _{IN} = 7.0V			100	μA
V _{CL}	V _{CC} = MIN, I _{IN} = -18 mA			-1.5	V
V _{OH}	V _{CC} = MIN, I _{OH} = -20 mA	2.5			V
V _{OL}	V _{CC} = MIN, I _{OL} = +20 mA			0.5	V
I _{OFF}	V _{CC} = 0V, V _{OUT} = 5.5V			100	μA
V _T - $\overline{V_T}$				0.4	V
V _T		2.0			V
V _{OS} - $\overline{V_{OS}}$				0.4	V
I _{SC}	V _{CC} = MAX, V _{OUT} = 0V	-30		-150	mA
DRIVER and RECEIVER					
I _{CC}	V _{CC} = MAX, V _{OUT} = Logic 0			35	mA

Receiver Switching Characteristics

Figure 1(Figure 2)

Symbol	Conditions	Min	Typ	Max			Units
				8921	8921A	8921AT	
T_{pLH}	$C_L = 30 \text{ pF}$ (Figures 1, 2)		14	22.5	20	20	ns
T_{pHL}	$C_L = 30 \text{ pF}$ (Figures 1, 2)		14	22.5	20	20	ns
$ T_{pLH} - T_{pHL} $	$C_L = 30 \text{ pF}$ (Figures 1, 2)		0.5	5	3.5	5	ns

Driver Switching Characteristics

SINGLE ENDED CHARACTERISTICS (Figures 3, 4)

Symbol	Conditions	Min	Typ	Max			Units
				8921	8921A	8921AT	
T_{pLH}	$C_L = 30 \text{ pF}$ (Figures 3, 4)		10	15	15	15	ns
T_{pHL}	$C_L = 30 \text{ pF}$ (Figures 3, 4)		10	15	15	15	ns
T_{TLH}	$C_L = 30 \text{ pF}$ (Figures 7, 8)		5	8	8	9.5	ns
T_{THL}	$C_L = 30 \text{ pF}$ (Figures 7, 8)		5	8	8	9.5	ns
Skew	$CL = 30 \text{ pF}$ (Figures 3, 4)		1	5	3.5	3.5	ns

Driver Switching Characteristics (Note 6)

DIFFERENTIAL CHARACTERISTICS (Figures 3, 5)

Symbol	Conditions	Min	Typ	Max			Units
				8921	8921A	8921AT	
T_{pLH}	$C_L = 30 \text{ pF}$ (Figures 3, 5, 6)		10	15	15	15	ns
T_{pHL}	$C_L = 30 \text{ pF}$ (Figures 3, 5, 6)		10	15	15	15	ns
$ T_{pLH} - T_{pHL} $	$C_L = 30 \text{ pF}$ (Figures 3, 5, 6)		0.5	6	2.75	2.75	ns

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 device should be operated at these limits. The Table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: All currents into device pins are shown as positive values; all currents out of the device are shown as negative; all voltages are referenced to ground unless otherwise specified. All values shown as max or min are classified on absolute value basis.

Note 3: All typical values are $V_{CC} = 5V$, $T_A = 25^\circ C$.

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

Note 5: Difference between complementary outputs at the 50% point.

Note 6: Differential Delays are defined as calculated results from single ended rise and fall time measurements. This approach in establishing AC performance specifications has been taken due to limitations of available Automatic Test Equipment (ATE).

The calculated ATE results assume a linear transition between measurement points and are a result of the following equations:

$$T_{cr} = \frac{(T_{fb} \times T_{rb}) - (T_{ra} \times T_{fa})}{T_{rb} - T_{ra} - T_{fa} + T_{fb}}$$

Where: T_{cr} = Crossing Point

T_{ra} , T_{rb} , T_{fa} and T_{fb} are time measurements with respect to the input. See Figure 6.



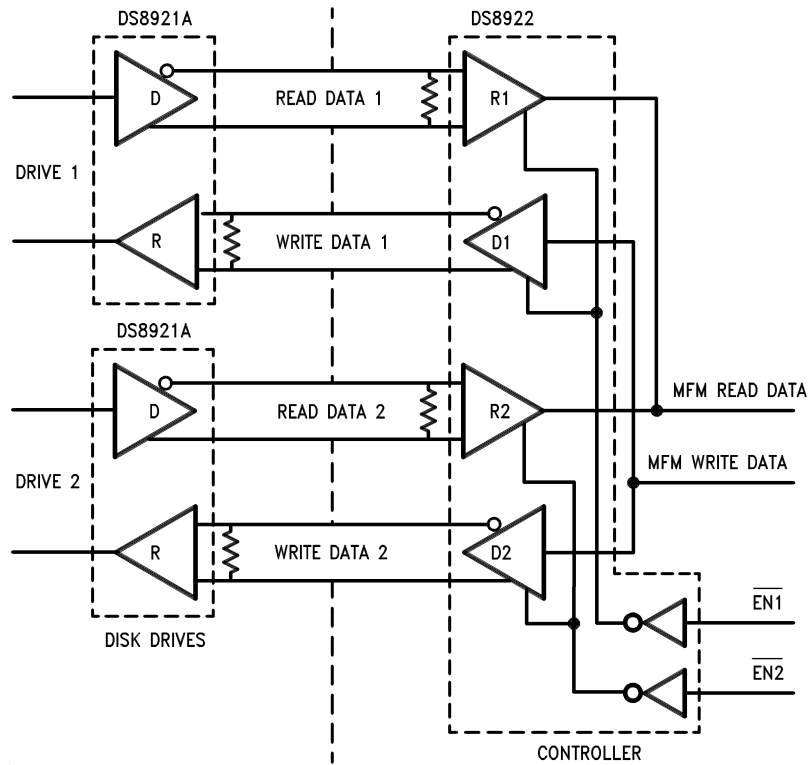
NOTE: R1 = 100 Ohms, C1 = C2 = C3 = 30 Pf

00851205

4

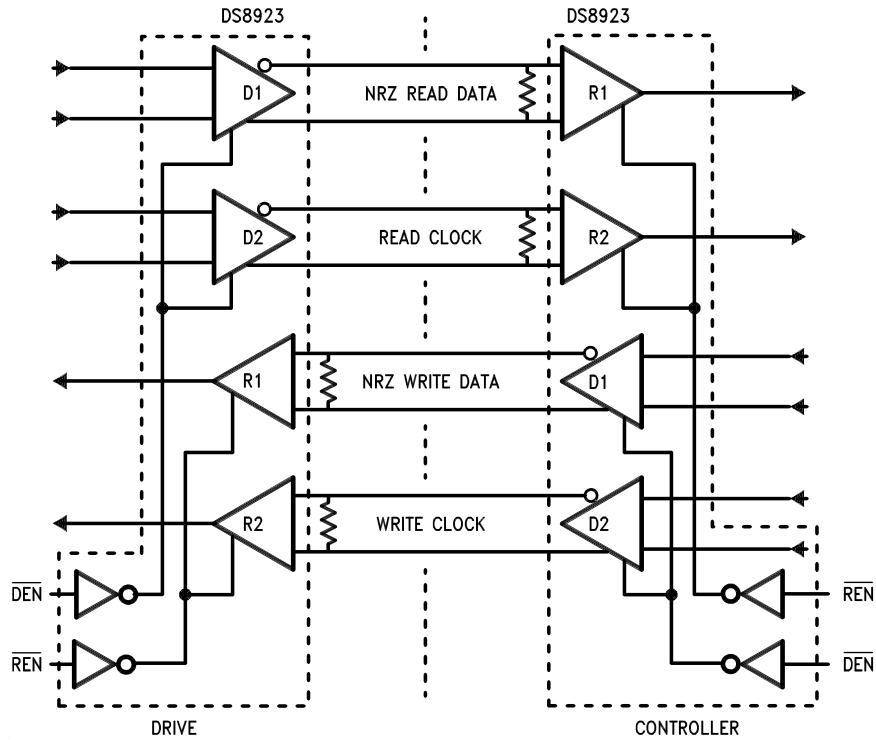
Typical Applications

ST506 and ST412 Application



00851208

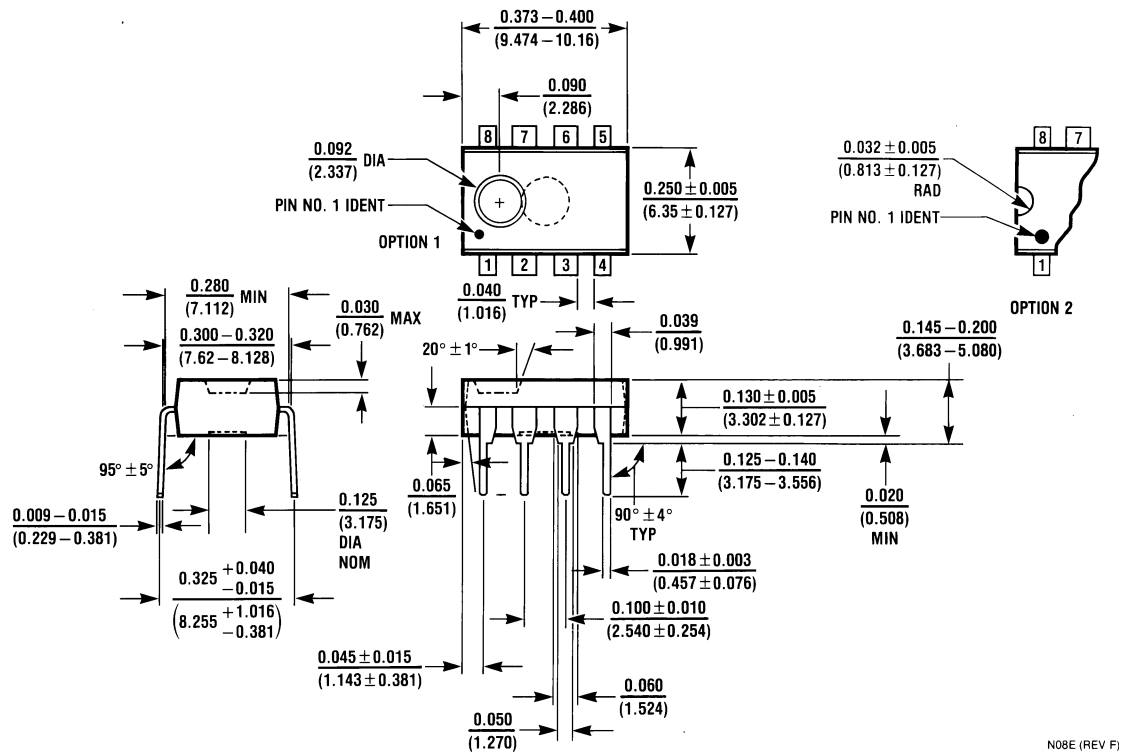
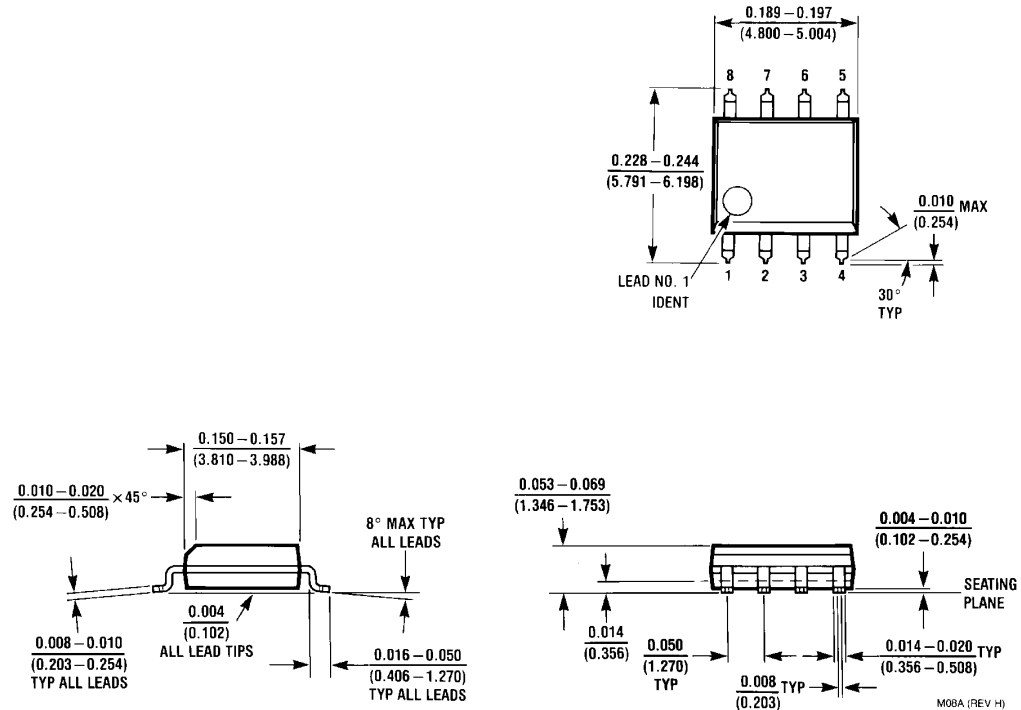
ESDI Application



00851209

Physical Dimensions inches (millimeters)

unless otherwise noted



Notes

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.

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

LIFE SUPPORT POLICY

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

1. Life support devices or systems are devices or systems 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.
2. A critical component is any component of 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.

BANNED SUBSTANCE COMPLIANCE

National Semiconductor certifies that the products and packing materials meet the provisions of the Customer Products Stewardship Specification (CSP-9-111C2) and the Banned Substances and Materials of Interest Specification (CSP-9-111S2) and contain no "Banned Substances" as defined in CSP-9-111S2.



National Semiconductor
Americas Customer
Support Center
Email: new.feedback@nsc.com
Tel: 1-800-272-9959

www.national.com

National Semiconductor
Europe Customer Support Center
Fax: +49 (0) 180-530 85 86
Email: europa.support@nsc.com
Deutsch Tel: +49 (0) 69 9508 6208
English Tel: +44 (0) 870 24 0 2171
Français Tel: +33 (0) 1 41 91 8790

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

National Semiconductor
Japan Customer Support Center
Fax: 81-3-5639-7507
Email: jpn.feedback@nsc.com
Tel: 81-3-5639-7560

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Mobile Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Transportation and Automotive	www.ti.com/automotive
Video and Imaging	www.ti.com/video

TI E2E Community Home Page

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2011, Texas Instruments Incorporated