National Semiconductor

September 1993

DS7820A/DS8820A
Dual Line Receiver

General Description

The DS7820A and the DS8820A are improved performance digital line receivers with two completely independent units fabricated on a single silicon chip. Intended for use with digital systems connected by twisted pair lines, they have a differential input designed to reject large common mode signals while responding to small differential signals. The output is directly compatible with TTL or LS integrated circuits.

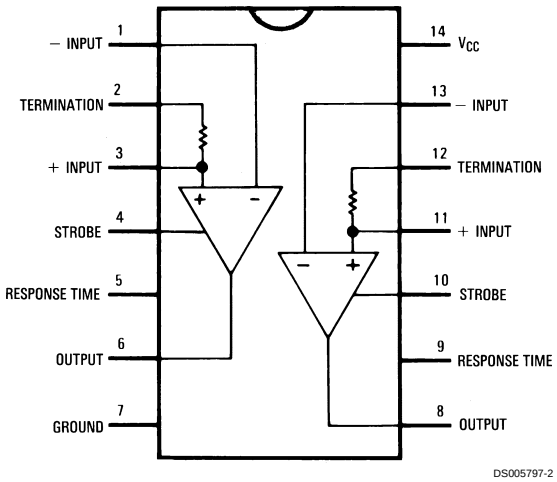
The response time can be controlled with an external capacitor to reject input noise spikes. The output state is a logic "1" for both inputs open. Termination resistors for the twisted pair line are also included in the circuit. Both the DS7820A and the DS8820A are specified, worst case, over their full operating temperature range (−55˚C to +125˚C and 0˚C to 70˚C respectively), over the entire input voltage range, for ±10% supply voltage variations.

Features

- Operation from a single +5V logic supply
- Input voltage range of ±15V
- Strobe low forces output to "1" state
- High input resistance
- Fanout of ten with TTL integrated circuits
- Outputs can be wire OR'ed
- Series 54/74 compatible

Connection Diagram

Dual-in-Line Package



Note 1: Pin 7 connected to bottom of cavity package.

Top View
Order Number DS7820AJ or DS8820AN See NS Package Number J14A or N14A
For Complete Military 883 Specificatons, See RETS Data Sheet.
Order Number DS7820AJ/883 or DS7820AW/883
See NS Package Number J14A or W14B

Absolute Maximum Ratings (Note 3)

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

Supply Voltage	8.0V
Common-Mode Voltage	±20V
Differential Input Voltage	±20V
Strobe Voltage	8.0V
Output Sink Current	50 mA
Storage Temperature Range	−65˚C to 150˚C
Maximum Power Dissipation (Note 2) at 25˚C	
Cavity Package	1308 mW
Molded Package	1207 mW
Lead Temperature (Soldering, 4 sec.)	260˚C

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})			
DS7820A	4.5	5.5	V
DS8820A	4.75	5.25	V
Temperature (T_A)			
DS7820A	−55	+125	˚C
DS8820A	0	+70	˚C

Note 2: Derate cavity package 8.7 mW/˚C above 25˚C; derate molded package 9.7 mW/˚C above 25˚C.

Electrical Characteristics (Notes 4, 5, 6)

Symbol	Parameter	Conditions			Min	Typ	Max	Units
V_{TH}	Differential Threshold Voltage	I_{OUT} = −400 µA, $V_{OUT} \geq 2.5V$	−3V ≤ V_{CM} ≤ +3V			0.06	0.5	V
			−15V ≤ V_{CM} ≤ +15V			0.06	1.0	V
		I_{OUT} = +16 mA, $V_{OUT} \leq 0.4V$	−3V ≤ V_{CM} ≤ +3V			−0.08	−0.5	V
			−15V ≤ V_{CM} ≤ +15V			−0.08	−1.0	V
R_{I-}	Inverting Input Resistance	−15V ≤ V_{CM} ≤ +15V			3.6	5		kΩ
R_{I+}	Non-Inverting Input Resistance	−15V ≤ V_{CM} ≤ +15V			1.8	2.5		kΩ
R_T	Line Termination Resistance	T_A = 25˚C			120	170	250	Ω
I_{I-}	Inverting Input Current	V_{CM} = 15V				3.0	4.2	mA
		V_{CM} = 0V				0	−0.5	mA
		V_{CM} = −15V				−3.0	−4.2	mA
I_{I+}	Non-Inverting Input Current	V_{CM} = 15V				5.0	7.0	mA
		V_{CM} = 0V				−1.0	−1.6	mA
		V_{CM} = −15V				−7.0	−9.8	mA
I_{CC}	Power Supply Current One Side Only	I_{OUT} = Logical “0”	V_{DIFF} = −1V	V_{CM} = 15V		3.9	6.0	mA
				V_{CM} = −15V		9.2	14.0	mA
			V_{DIFF} = −0.5V, V_{CM} = 0V			6.5	10.2	mA
V_{OH}	Logical “1” Output Voltage	I_{OUT} = −400 µA, V_{DIFF} = 1V			2.5	4.0	5.5	V
V_{OL}	Logical “0” Output Voltage	I_{OUT} = +16 mA, V_{DIFF} = −1V			0	0.22	0.4	V
V_{SH}	Logical “1” Strobe Input Voltage	I_{OUT} = +16 mA, $V_{OUT} \leq 0.4V$, V_{DIFF} = −3V			2.1			V
V_{SL}	Logical “0” Strobe Input Voltage	I_{OUT} = −400 µA, $V_{OUT} \geq 2.5V$, V_{DIFF} = −3V					0.9	V
I_{SH}	Logical “1” Strobe Input Current	V_{STROBE} = 5.5V, V_{DIFF} = 3V				0.01	5.0	µA
I_{SL}	Logical “0” Strobe Input Current	V_{STROBE} = 0.4V, V_{DIFF} = −3V				−1.0	−1.4	mA
I_{SC}	Output Short Circuit Current	V_O = 0V, V_{CC} = 5.5V, V_{STROBE} = 0V			−2.8	−4.5	−6.7	mA

Note 3: “Absolute Maximum Ratings” are those values beyond which the safety of the device cannot be guaranteed. Except for “Operating Temperature Range” they are not meant to imply that the devices should be operated at these limits. The table of “Electrical Characteristics” provides conditions for actual device operation.

Note 4: These specifications apply for 4.5V ≤ V_{CC} ≤ 5.5V, −15V ≤ V_{CM} ≤ 15V and −55˚C ≤ T_A ≤ +125˚C for the DS7820A or 4.75V ≤ V_{CC} ≤ 5.25V, 0˚C ≤ T_A ≤ +70˚C for the DS8820A unless otherwise specified. Typical values given are for V_{CC} = 5.0V, T_A = 25˚C and V_{CM} = 0V unless stated differently.

Note 5: All currents into device pins shown as positive, out of device pins as negative, all voltages referenced to ground unless otherwise noted. All values shown as max or min on absolute value basis.

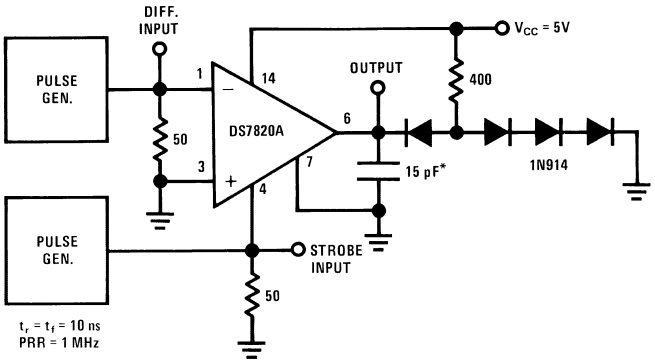
Note 6: Only one output at a time should be shorted.

Switching Characteristics

T_A = 25˚C, V_{CC} = 5V, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{pd0}	Propagation Delay, Differential Input to “0” Output	R_L = 400 Ω, C_L = 15 pF, see *Figure 1*		30	45	ns
t_{pd1}	Propagation Delay, Differential Input to “1” Output			27	40	ns
t_{pd0}	Propagation Delay, Strobe Input to “0” Output			16	25	ns
t_{pd1}	Propagation Delay, Strobe Input to “1” Output			18	30	ns

AC Test Circuit and Waveforms



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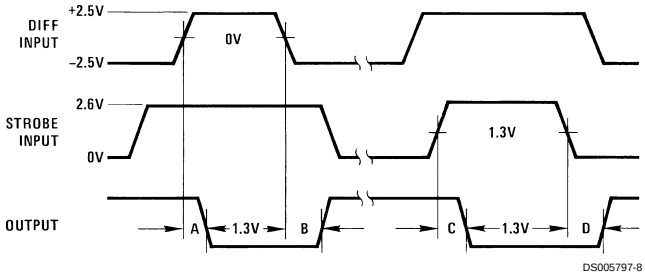
Note 7: *Includes Jig and Probe Capacitance



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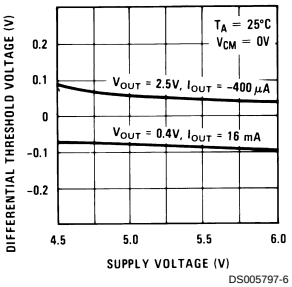
A = Differential Input to “0” Output
B = Differential Input to “1” Output
C = Strobe Input to “0” Output
D = Strobe Input to “1” Output

FIGURE 1.

Typical Performance Characteristics

Supply Voltage Sensitivity



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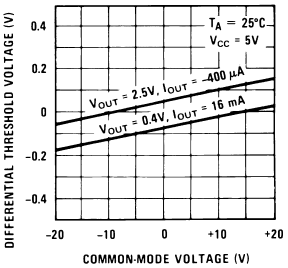
Common-Mode Voltage Sensitivity



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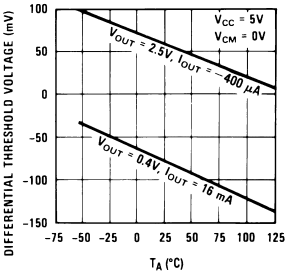
Temperature Sensitivity



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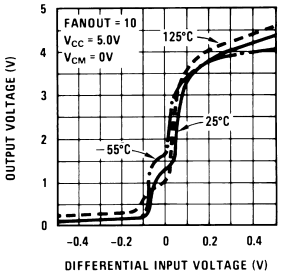
Transfer Function



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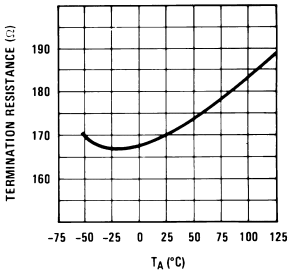
Termination Resistance



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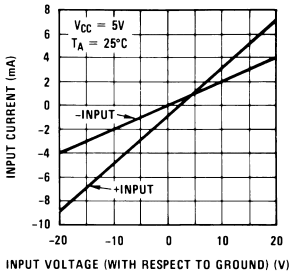
Input Characteristics



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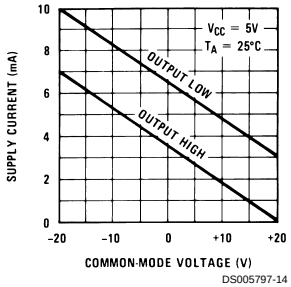
Power Supply Current



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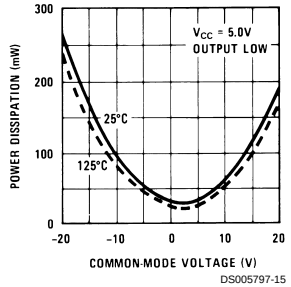
Internal Power Dissipation



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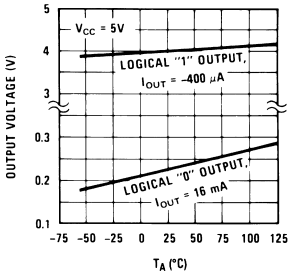
Output Voltage Levels



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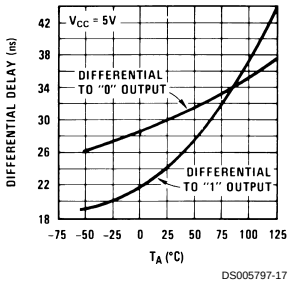
Differential Input Delays



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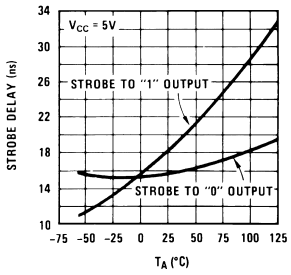
Strobe Delays



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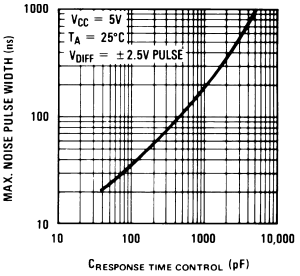
Noise Rejection



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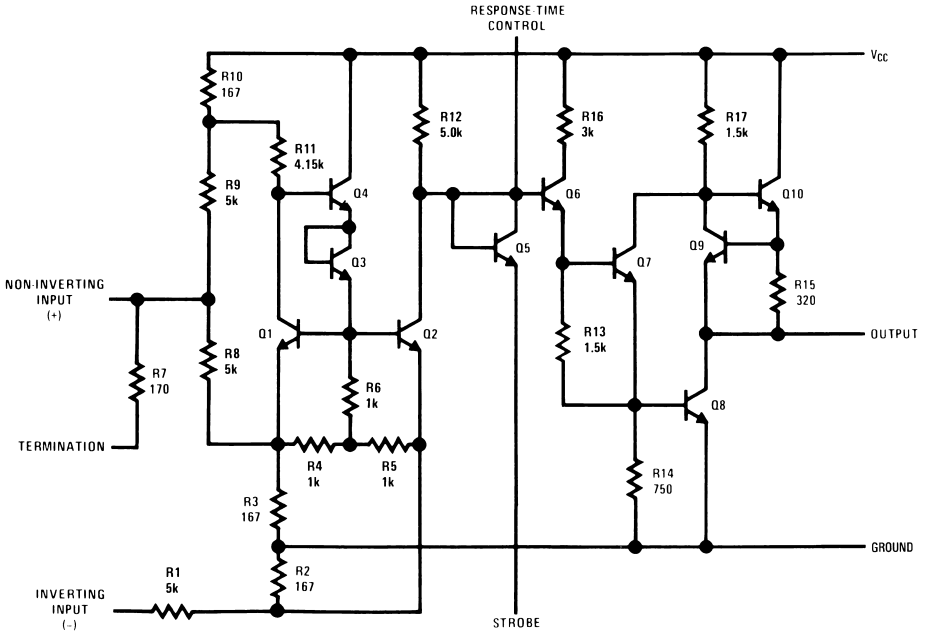
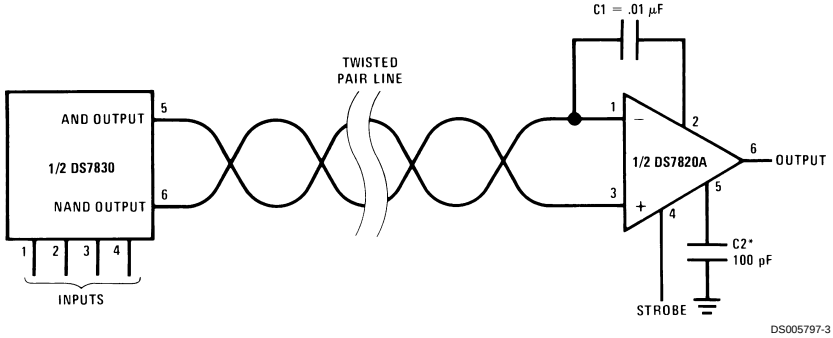
Schematic Diagram



Note 8: Schematic shows one-half of unit.

Typical Applications

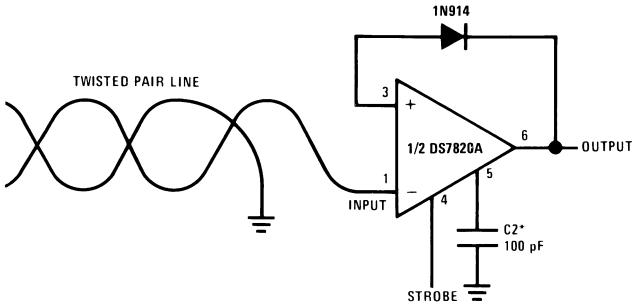
Differential Line Driver and Receiver



Note 9: Optional to control response time.

Single Ended (EIA-RS232C) Receiver with Hysteresis

Typical Applications (Continued)



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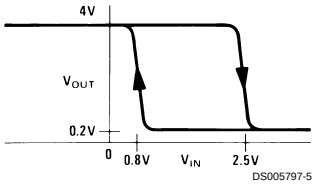

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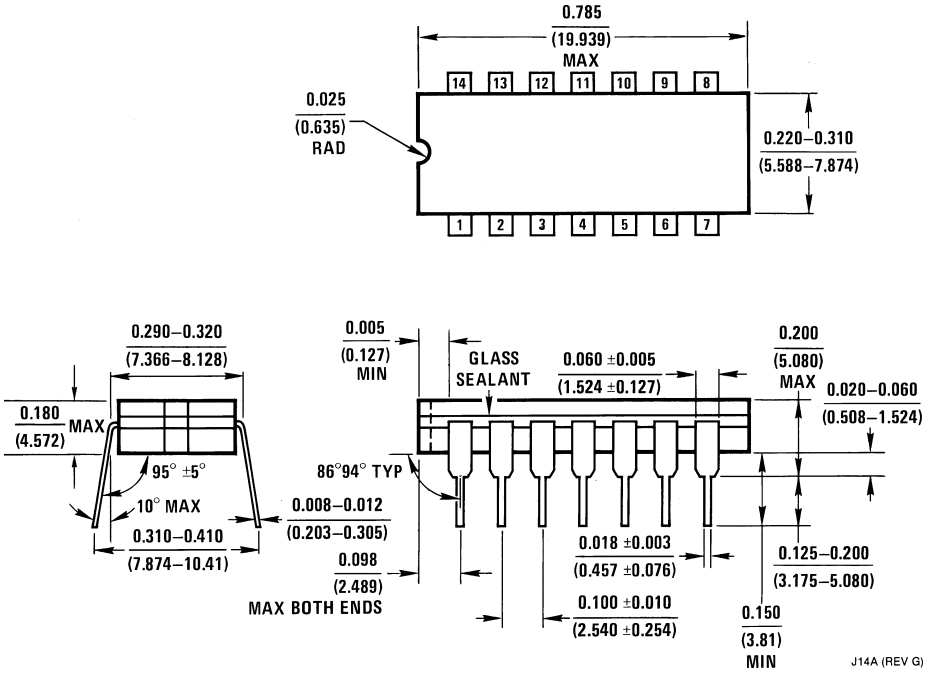
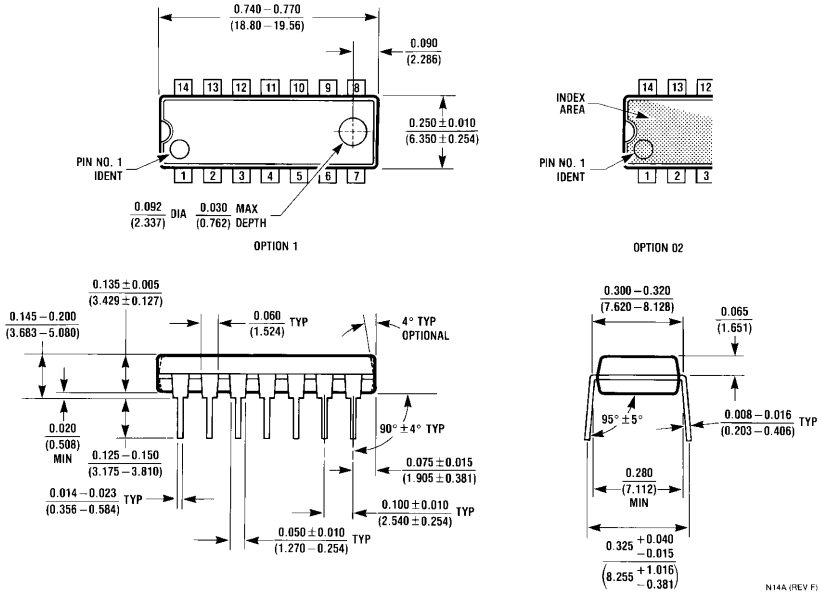
(Output = "1" for Open Input)

Physical Dimensions inches (millimeters) unless otherwise noted

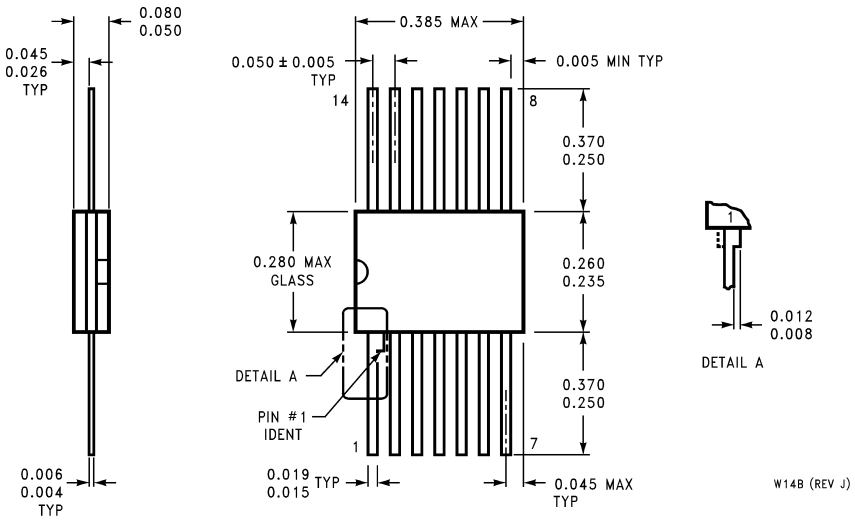


Ceramic Dual-In-Line Package (J)
Order Number DS7820AJ or DS7820AJ/883
NS Package Number J14A



Molded Dual-In-Line Package (N)
Order Number DS8820AN
NS Package Number N14A

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



Dual-In-Line Package (W)
Order Number DS7820AW/883
NS Package Number W14B

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