DS78C20,DS88C20

DS78C20/DS88C20 Dual CMOS Compatible Differential Line Receiver

Literature Number: SNLS359A

National Semiconductor

May 1998

DS78C20/DS88C20
Dual CMOS Compatible Differential Line Receiver

General Description

The DS78C20 and DS88C20 are high performance, dual differential, CMOS compatible line receivers for both balanced and unbalanced digital data transmission. The inputs are compatible with EIA and Federal Standards.

Input specifications meet or exceed those of the popular DS7820/DS8820 line receiver, and the pinout is identical.

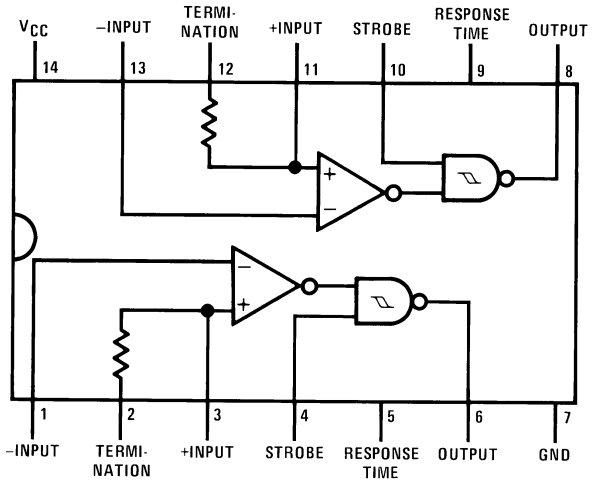
A response pin is provided for controlling sensitivity to input noise spikes with an external capacitor. Each receiver includes a 180Ω terminating resistor, which may be used optionally on twisted pair lines. The DS78C20 is specified over a −55˚C to +125˚C operating temperature range, and the DS88C20 over a 0˚C to +70˚C range.

Features

- Meets requirements of EIA Standards RS-232-C RS-422 and RS-423, and Federal Standards 1020 and 1030
- Input voltage range of ±15V (differential or common-mode)
- Separate strobe input for each receiver
- ½ V_{CC} strobe threshold for CMOS compatibility
- 5k typical input impedance
- 50 mV input hysteresis
- 200 mV input threshold
- Operation voltage range = 4.5V to 15V
- DS7830/DS8830 recommended driver

Connection Diagram

Dual-In-Line Package



Top View
Order Number DS88C20N
See NS Package Numbers N14A
For Complete Military Product Specifications, refer to the appropriate SMD or MDS.
Order Number DS78C20J/883
See NS Package Number J14A

© 2001 National Semiconductor Corporation

Absolute Maximum Ratings (Note 2)

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

Supply Voltage	18V
Common-Mode Voltage	±25V
Differential Input Voltage	±25V
Strobe Voltage	18V
Output Sink Current	50 mA
Maximum Power Dissipation (Note 1) at 25˚C	
Cavity Package	1364 mW
Molded Package	1280 mW
Storage Temperature Range	−65˚C to +150˚C
Lead Temperature (Soldering, 4 seconds)	260˚C

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})	4.5	15	V
Temperature (T_A)			
DS78C20	−55	+125	˚C
DS88C20	0	+70	˚C
Common-Mode Voltage (V_{CM})	−15	+15	V

Note 1: Derate cavity package 9.1 mW/˚C; derate molded package 10.2 mW/˚C above 25˚C.

Electrical Characteristics (Notes 3, 4)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
V_{TH}	Differential Threshold Voltage	I_{OUT} = −200 µA, $V_{OUT} \geq V_{CC}$ −1.2V	−10V ≤ V_{CM} ≤ 10V		0.06	0.2	V
			−15V ≤ V_{CM} ≤ 15V		0.06	0.3	V
		I_{OUT} = 1.6 mA, $V_{OUT} \leq$ 0.5V	−10V ≤ V_{CM} ≤ 10V		−0.08	−0.2	V
			−15V ≤ V_{CM} ≤ 15V		−0.08	−0.3	V
R_{IN}	Input Resistance	−15V ≤ V_{CM} ≤ 15V			5		kΩ
R_T	Line Termination Resistance	T_A = 25˚C		100	180	300	Ω
I_{IND}	Data Input Current (Unterminated)	V_{CM} = 10V			2	3.1	mA
		V_{CM} = 0V			0	−0.5	mA
		V_{CM} = −10V			−2	−3.1	mA
V_{THB}	Input Balance	I_{OUT} = 200 µA, $V_{OUT} \geq V_{CC}$ −1.2V, R_S = 500Ω, (Note 6)	−7V ≤ V_{CM} ≤ 7V		0.1	0.4	V
		I_{OUT} = 1.6 mA, $V_{OUT} \leq$ 0.5V, R_S = 500Ω, (Note 6)	−7V ≤ V_{CM} ≤ 7V		−0.1	−0.4	V
V_{OH}	Logical “1” Output Voltage	I_{OUT} = −200 µA, V_{DIFF} = 1V		V_{CC}−1.2	V_{CC}−0.75		V
V_{OL}	Logical “0” Output Voltage	I_{OUT} = 1.6 mA, V_{DIFF} = −1V			0.25	0.5	V
I_{CC}	Power Supply Current	15V ≤ V_{CM} ≤ −15V, V_{DIFF} = −0.5V (Both Receivers)	V_{CC} = 5.5V		8	15	mA
			V_{CC} = 15V		15	30	mA
$I_{IN(1)}$	Logical “1” Strobe Input Current	V_{STROBE} = 15V, V_{DIFF} = 3V	V_{CC} = 15V		15	100	µA
$I_{IN(0)}$	Logical “0” Strobe Input Current	V_{STROBE} = 0V, V_{DIFF} = −3V	V_{CC} = 15V		−0.5	−100	µA
V_{IH}	Logical “1” Strobe Input Voltage	I_{OUT} = 1.6 mA, $V_{OL} \leq$ 0.5V	V_{CC} = 5V	3.5	2.5		V
			V_{CC} = 10V	8.0	5.0		V
			V_{CC} = 15V	12.5	7.5		V
V_{IL}	Logical “0” Strobe Input Voltage	I_{OUT} = −200 µA, $V_{OH} = V_{CC}$ −1.2V	V_{CC} = 5V		2.5	1.5	V
			V_{CC} = 10V		5.0	2.0	V
			V_{CC} = 15V		7.5	2.5	V
I_{OS}	Output Short-Circuit Current	V_{OUT} = 0V, V_{CC} = 15V, V_{STROBE} = 0V, (Note 5)		−5	−20	−40	mA

Switching Characteristics

V_{CC} = 5V, T_A = 25˚C

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{pd0(D)}$	Differential Input to “0” Output	C_L = 50 pF		60	100	ns
$t_{pd1(D)}$	Differential Input to “1” Output	C_L = 50 pF		100	150	ns
$t_{pd0(S)}$	Strobe Input to “0” Output	C_L = 50 pF		30	70	ns
$t_{pd1(S)}$	Strobe Input to “1” Output	C_L = 50 pF		100	150	ns

Note 2: “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 3: Unless otherwise specified min/max limits apply across the −55˚C to +125˚C temperature range for the DS78C20 and across the 0˚C to +70˚C range for the DS88C20. All typical values are for T_A = 25˚C, V_{CC} = 5V and V_{CM} = 0V.

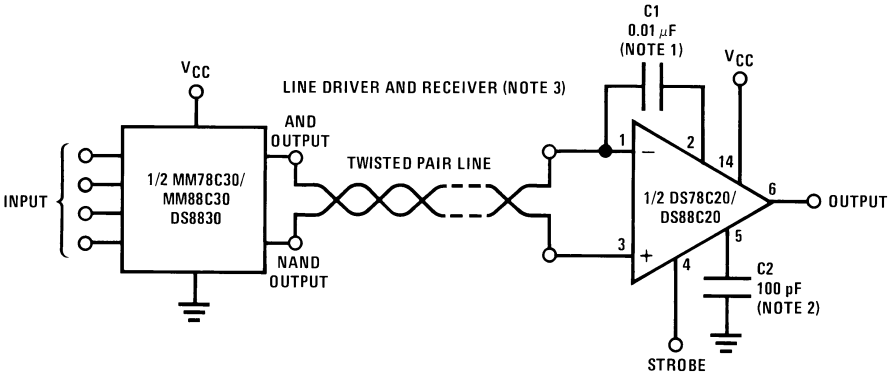
Note 4: All currents into device pins shown as positive, out of device pins as negative, all voltages referenced to ground unless otherwise noted. All values shown as max or min on absolute value basis.

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

Note 6: Refer to EIA-RS-422 for exact conditions.

Typical Applications

RS-422/RS-423 Application



Note 7: (Optional internal termination resistor.)

a) Capacitor in series with internal line termination resistor, terminates the line and saves termination power. Exact value depends on line length.

b) Pin 1 connected to pin 2; terminates the line.

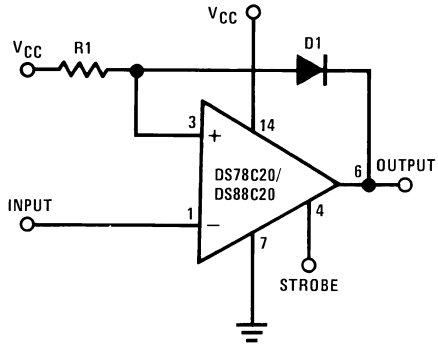
c) Pin 2 open; no internal line termination.

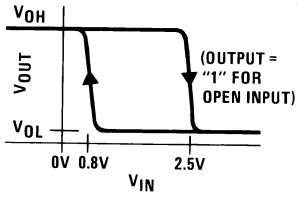
d) Transmission line may be terminated elsewhere or not at all.

Note 8: Optional to control response time.

Note 9: V_{CC} 4.5V to 15V for the DS78C20. For further information on line drivers and line receivers, refer to applicaton notes AN-22, AN-83 and AN-108.

RS-232-C Application with Hysteresis



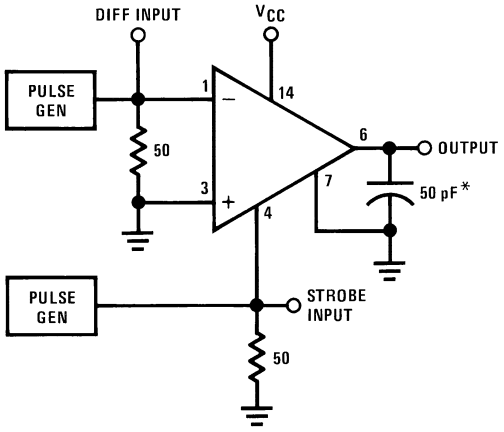


For signals which require fail-safe or have slow rise and fall times, use R1 and D1 as shown above. Otherwise, the positive input (pin 3 or 11) may be connected to ground.

Typical Applications (Continued)

V_{CC}	R1 ±5%
5V	4,3 kΩ
10V	15 kΩ
15V	24 kΩ

AC Test Circuit

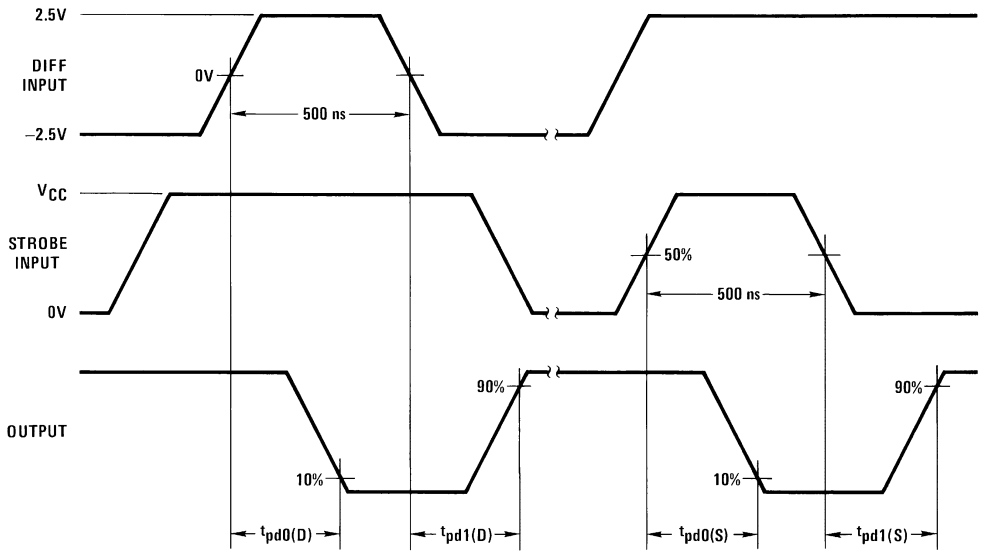


DS005798-5

$t_r = t_f = \leq 10$ ns
PRR = 1 MHz

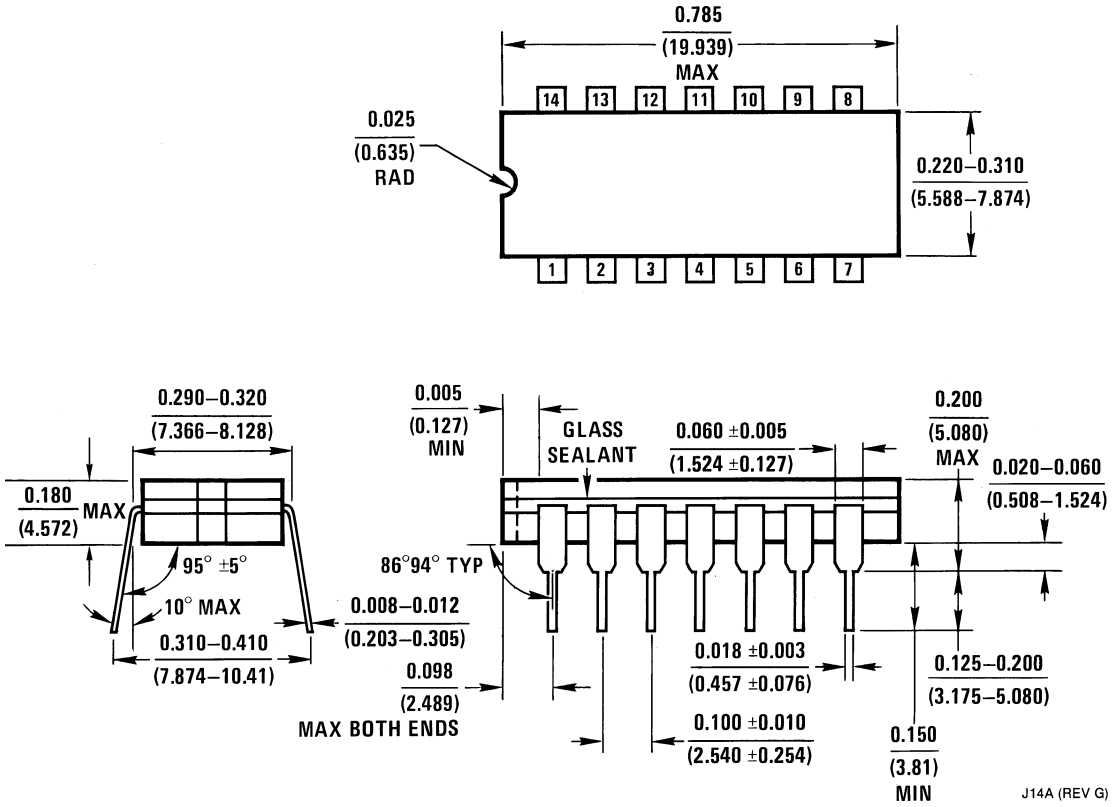
Note 10: Includes probe and jig capacitance

Switching Time Waveforms

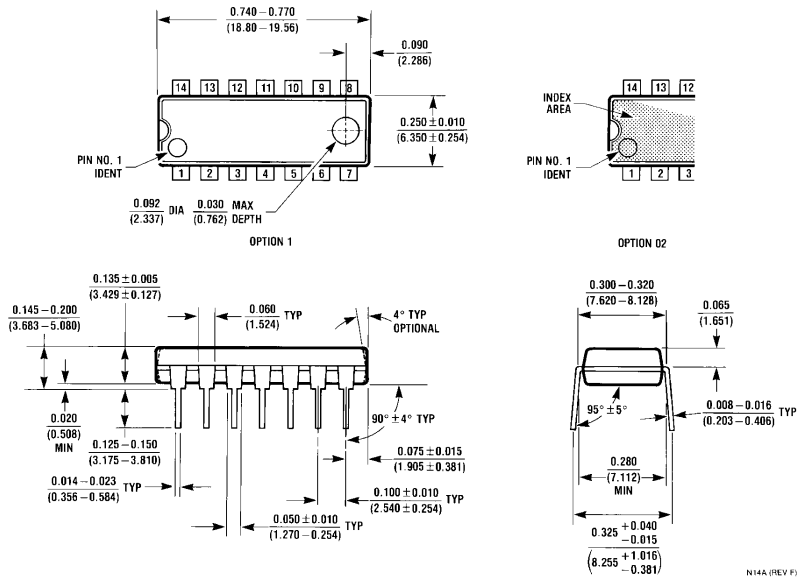


DS005798-6

Physical Dimensions inches (millimeters) unless otherwise noted



Ceramic Dual-In-Line Package (J)
Order Number DS78C20J/883
NS Package Number J14A



Molded Dual-In-Line Package (N)
Order Number DS88C20N
NS Package Number N14A

Notes

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.

National Semiconductor Corporation
Americas
Email: support@nsc.com

www.national.com

National Semiconductor Europe
Fax: +49 (0) 180-530 85 86
Email: europe.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 Response Group
Tel: 65-2544466
Fax: 65-2504466
Email: ap.support@nsc.com

National Semiconductor Japan Ltd.
Tel: 81-3-5639-7560
Fax: 81-3-5639-7507

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.

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		**Applications**	
Audio	www.ti.com/audio	Communications and Telecom	www.ti.com/communications
Amplifiers	amplifier.ti.com	Computers and Peripherals	www.ti.com/computers
Data Converters	dataconverter.ti.com	Consumer Electronics	www.ti.com/consumer-apps
DLP® Products	www.dlp.com	Energy and Lighting	www.ti.com/energy
DSP	dsp.ti.com	Industrial	www.ti.com/industrial
Clocks and Timers	www.ti.com/clocks	Medical	www.ti.com/medical
Interface	interface.ti.com	Security	www.ti.com/security
Logic	logic.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Power Mgmt	power.ti.com	Transportation and Automotive	www.ti.com/automotive
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Mobile Processors	www.ti.com/omap		
Wireless Connectivity	www.ti.com/wirelessconnectivity		
	TI E2E Community Home Page		e2e.ti.com

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