



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.

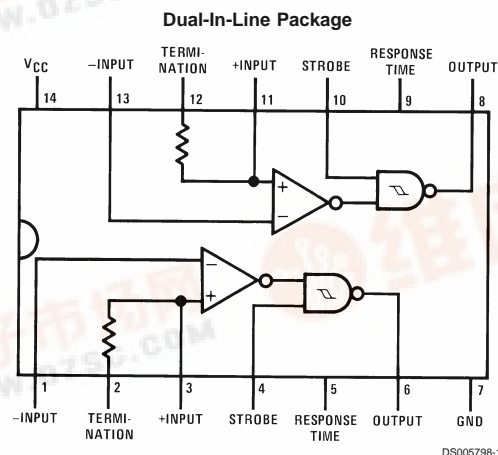
Input specifications meet or exceed those of the popular DS7820/DS8820 line receiver, and the pinout is identical.

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 $\pm 15\text{V}$ (differential or common-mode)
- Separate strobe input for each receiver
- $\frac{1}{2} V_{CC}$ 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



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

DS78C20/DS88C20 Dual CMOS Compatible Differential Line Receiver



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	$I_{OUT} = -200 \mu A$, $V_{OUT} \geq V_{CC} - 1.2V$	$-10V \leq V_{CM} \leq 10V$	0.06	0.2	V
			$-15V \leq V_{CM} \leq 15V$	0.06	0.3	V
		$I_{OUT} = 1.6 \text{ mA}$, $V_{OUT} \leq 0.5V$	$-10V \leq V_{CM} \leq 10V$	–0.08	–0.2	V
			$-15V \leq V_{CM} \leq 15V$	–0.08	–0.3	V
R_{IN}	Input Resistance	$-15V \leq V_{CM} \leq 15V$		5		k Ω
R_T	Line Termination Resistance	$T_A = 25^\circ C$	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	$I_{OUT} = 200 \mu A$, $V_{OUT} \geq V_{CC} - 1.2V$, $R_S = 500\Omega$, (Note 6)	$-7V \leq V_{CM} \leq 7V$	0.1	0.4	V
		$I_{OUT} = 1.6 \text{ mA}$, $V_{OUT} \leq 0.5V$, $R_S = 500\Omega$, (Note 6)	$-7V \leq V_{CM} \leq 7V$	–0.1	–0.4	V
V_{OH}	Logical "1" Output Voltage	$I_{OUT} = -200 \mu A$, $V_{DIFF} = 1V$	$V_{CC} - 1.2$	$V_{CC} - 0.75$		V
V_{OL}	Logical "0" Output Voltage	$I_{OUT} = 1.6 \text{ mA}$, $V_{DIFF} = -1V$		0.25	0.5	V
I_{CC}	Power Supply Current	$15V \leq V_{CM} \leq -15V$, $V_{DIFF} = -0.5V$ (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	$I_{OUT} = 1.6 \text{ mA}$, $V_{OL} \leq 0.5V$	$V_{CC} = 5V$	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	$I_{OUT} = -200 \mu A$, $V_{OH} = V_{CC} - 1.2V$	$V_{CC} = 5V$	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

$V_{CC} = 5V$, $T_A = 25^\circ C$

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{pd0(D)}$	Differential Input to "0" Output	$C_L = 50 \text{ pF}$		60	100	ns
$t_{pd1(D)}$	Differential Input to "1" Output	$C_L = 50 \text{ pF}$		100	150	ns
$t_{pd0(S)}$	Strobe Input to "0" Output	$C_L = 50 \text{ pF}$		30	70	ns
$t_{pd1(S)}$	Strobe Input to "1" Output	$C_L = 50 \text{ pF}$		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 $-55^\circ C$ to $+125^\circ C$ temperature range for the DS78C20 and across the $0^\circ C$ to $+70^\circ C$ range for the DS88C20. All typical values are for $T_A = 25^\circ C$, $V_{CC} = 5V$ and $V_{CM} = 0V$.

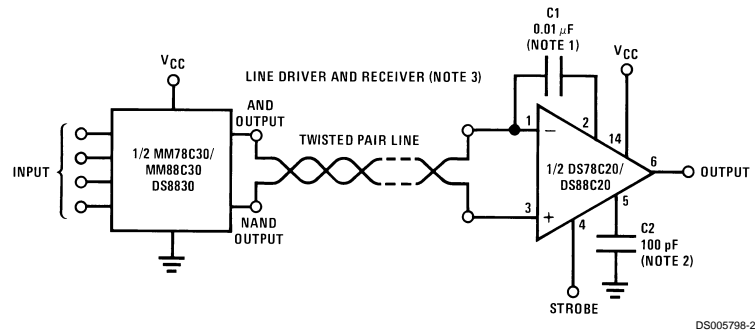
Note 4: All currents into device pins shown as positive, out of device pins as negative, all voltages referenced to ground unless otherwise noted. All values shown as max or min on absolute value basis.

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



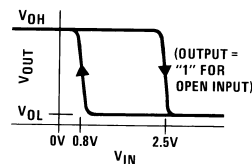
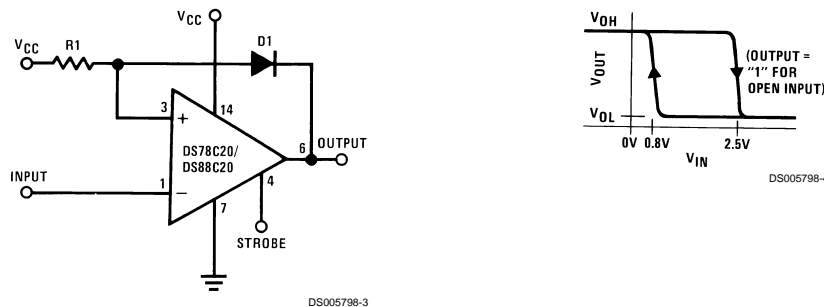
Note 7: (Optional internal termination resistor.)

- 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 application notes AN-22, AN-83 and AN-108.

RS-232-C Application with Hysteresis

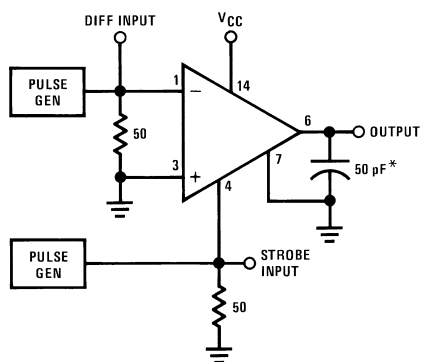


For signals which require fail-safe or have slow rise and fall times, use R1 and D1 as shown above. Otherwise, the positive input (pin 3 or 11) may be connected to ground.

Typical Applications (Continued)

V_{CC}	$R1 \pm 5\%$
5V	4,3 k Ω
10V	15 k Ω
15V	24 k Ω

AC Test Circuit

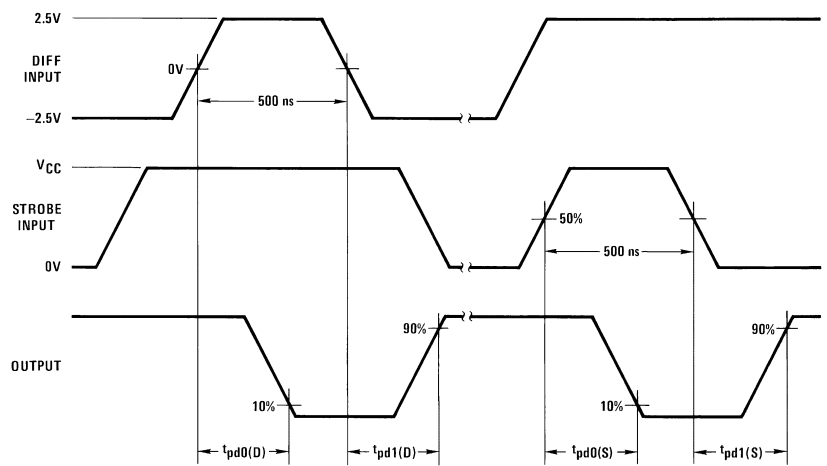


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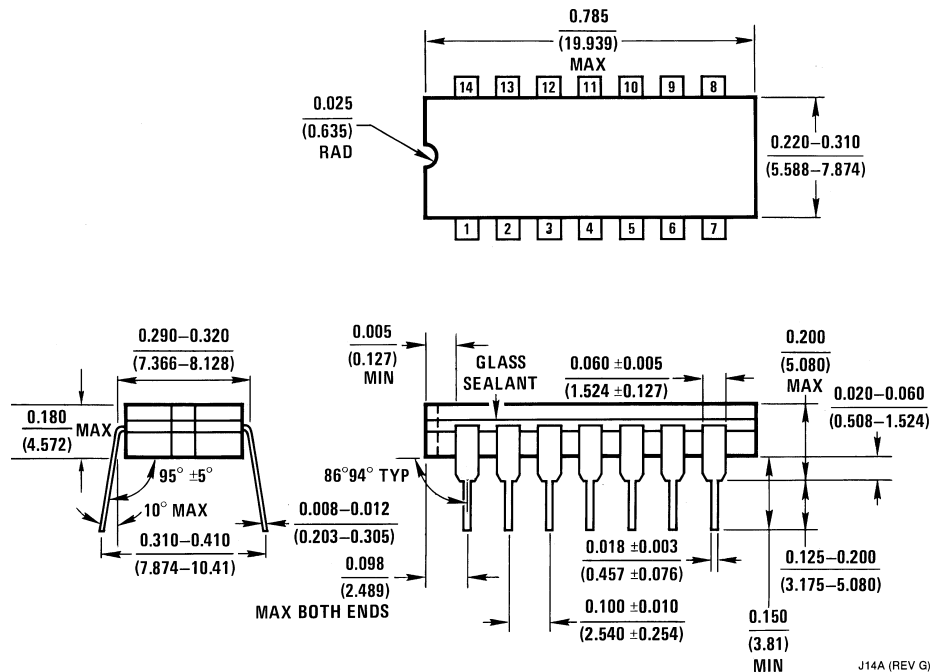
$t_r = t_f = \leq 10$ ns
 PRR = 1 MHz

Note 10: Includes probe and jig capacitance

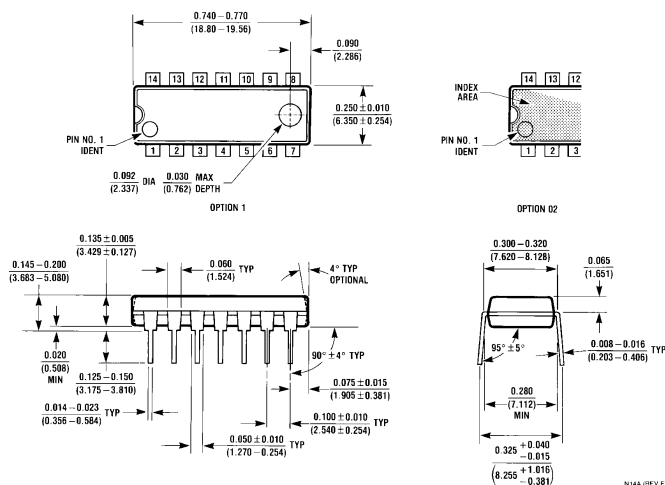
Switching Time Waveforms



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

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