



# 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.

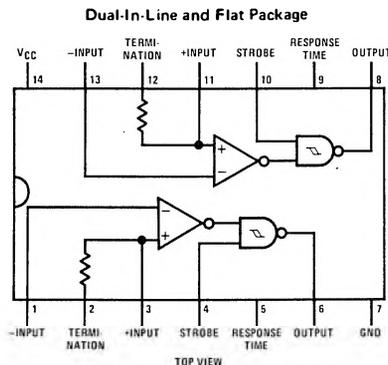
Input specifications meet or exceed those of the popular DS7820/DS8820 line receiver, and the pinout is identical.

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.

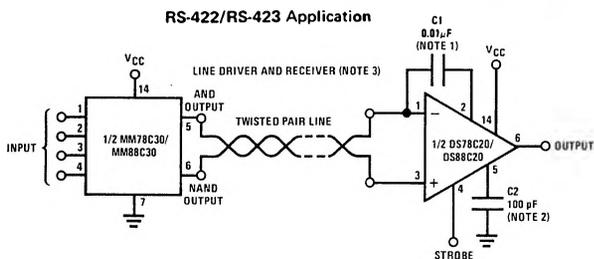
## Features

- Full compatibility with 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<sub>CC</sub> strobe threshold for CMOS compatibility
- 5k input impedance
- 50mV input hysteresis
- 200mV input threshold
- Operation voltage range = 4.5V to 15V

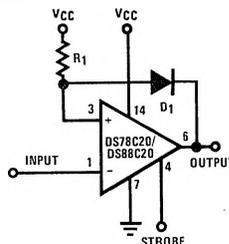
## Connection Diagram



## Typical Application



### RS-232-C Application with Hysteresis



- Note 1:** (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 2:** Optional to control response time.

**Note 3:** V<sub>CC</sub> = 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.

For signals which require fail-safe or have slow rise and fall times, use R<sub>1</sub> and D<sub>1</sub> as shown above; otherwise the positive input (pin 3 or pin 11) may be connected to ground.

V <sub>CC</sub>	R <sub>1</sub> ± 5%
5V	4.3kΩ
10V	15 kΩ
15V	24 kΩ



**Absolute Maximum Ratings** (Note 1)

Supply Voltage	18V
Input Voltage	±25V
Strobe Voltage	18V
Output Sink Current	50 mA
Power Dissipation	600 mW
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10 seconds)	300°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
Differential Input Voltage ( $V_{DIFF}$ )		≤6	V

**Electrical Characteristics** (Notes 2 and 3)

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 $\Omega$	
$R_T$ Line Termination Resistance	$T_A = 25^\circ C$	100	180	300	$\Omega$	
$I_{IND}$ 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 5)	$-7V \leq V_{CM} \leq 7V$		0.1	0.4	V
	$I_{OUT} = 1.6 \text{ mA}$ , $V_{OUT} \leq 0.5V$ , $R_S = 500\Omega$ , (Note 5)	$-7V \leq V_{CM} \leq 7V$		-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	$V_{STROBE} = 15V$ , $V_{DIFF} = 3V$		15	100	$\mu A$	
$I_{IN(0)}$ Logical "0" Strobe Input Current	$V_{STROBE} = 0V$ , $V_{DIFF} = -3V$		-0.5	-100	$\mu A$	
$V_{IH}$ 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	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 4)	-5	-20	-40	mA	

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

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
$t_{pd(D)}$ Differential Input to "0" Output	$C_L = 50 \text{ pF}$		60	100	ns
$t_{pd(1(D))}$ Differential Input to "1" Output	$C_L = 50 \text{ pF}$		100	150	ns
$t_{pd(S)}$ Strobe Input to "0" Output	$C_L = 50 \text{ pF}$		30	70	ns
$t_{pd(1(S))}$ Strobe Input to "1" Output	$C_L = 50 \text{ pF}$		100	150	ns

**Note 1:** "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.

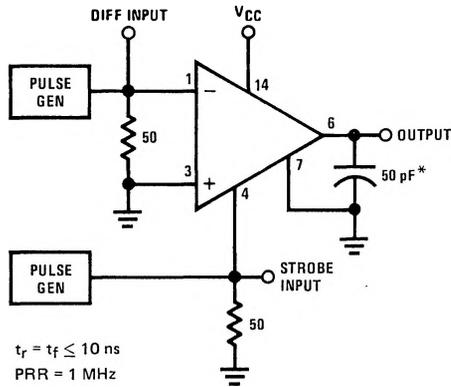
**Note 2:** Unless otherwise specified min/max limits apply across the  $-55^\circ C$  to  $+125^\circ C$  temperature range for the DS78C20 and across the  $0^\circ C$  to  $+70^\circ C$  range for the DS88C20. All typical values are for  $T_A = 25^\circ C$ ,  $V_{CC} = 5V$  and  $V_{CM} = 0V$ .

**Note 3:** 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 4:** Only one output at a time should be shorted.

**Note 5:** Refer to EIA-RS-422 for exact conditions.

# AC Test Circuit and Switching Time Waveforms



\*Includes probe and jig capacitance

