Am78/8820·Am78/8820A

Dual Differential Line Receivers

Distinctive Characteristics:

- Dual differential receiver pin-for-pin equivalent to the National 78/8820 and 78/8820A
- 500mV sensitivity at ±3V common mode
  1V sensitivity at ±15V common mode
- Single 5-volt supply
- Frequency response control, strobe and internal terminating resistor
- 100% reliability assurance testing in compliance with MIL-STD-883

FUNCTIONAL DESCRIPTION

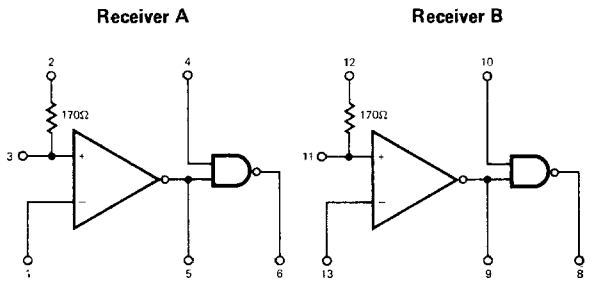
The Am78/8820 and Am78/8820A are dual differential line receivers designed to receive digital data from transmission lines and provide up to 15 volts of common mode rejection with a single 5-volt supply.

The device would normally be used in systems using twisted pair lines for connection, with each receiver having a terminating resistor included. The receivers respond to small differential signals and reject considerable amounts of common mode noise.

Each receiver has a strobe that enables the output and a response control that allows the time constant of the output circuit to be controlled by an external capacitor and give noise rejection of high frequency noise and short logic spikes.

Companion differential line drivers are the Am78/8830, Am78/8831 and Am78/8832.

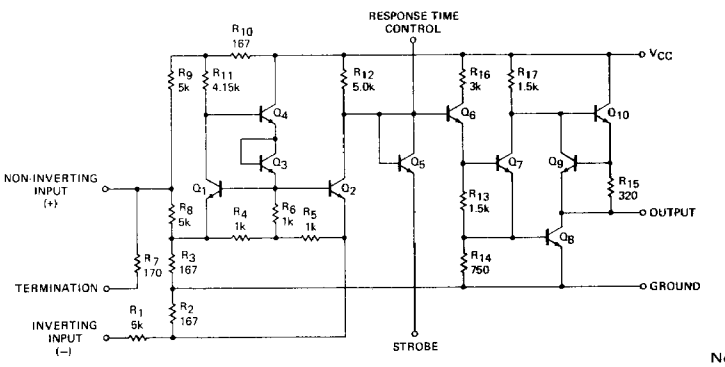
LOGIC DIAGRAM



LIC-517

V_{CC} = Pin 14
GND = Pin 7

CIRCUIT DIAGRAM



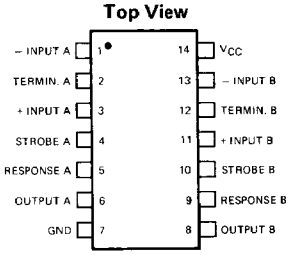
LIC-518

Note: Only one receiver shown.

ORDERING INFORMATION

Package Type	Temperature Range	Am78/8820 Order Number	Am78/8820A Order Number
Molded DIP	0°C to +75°C	DM8820N	DM8820AN
Hermetic DIP	0°C to +75°C	DM8820J	DM8820AJ
Dice	0°C to +75°C	AM8820X	AM8820AX
Hermetic DIP	−55°C to +125°C	DM7820J	DM7820AJ
Hermetic Flat Pak	−55°C to +125°C	DM7820W	DM7820AW
Dice	−55°C to +125°C	AM7820X	AM7820AX

CONNECTION DIAGRAM
Top View



Note: Pin 1 is marked for orientation.

LIC-519

Am7820 • Am8820

ELECTRICAL CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (Unless Otherwise Noted)

Am8820A	$T_A = 0°C$ to $+75°C$	$V_{CC} = 5.0V \pm 5\%$	$V_{CM} = -15V$ to $+15V$
Am7820A	$T_A = -55°C$ to $+125°C$	$V_{CC} = 5.0V \pm 10\%$	$V_{CM} = -15V$ to $+15V$

Parameters	Description	Test Conditions	Min.	Typ.(Note 1)	Max.	Units
V_{OH}	Output HIGH Voltage	$I_{OH} \leq 0.2mA$	2.5	4.0	5.5	Volts
V_{OL}	Output LOW Voltage	$I_{OL} \leq 3.5mA$	0		0.4	Volts
V_{TH}	Differential Threshold Voltage	$V_{CM} = 0V$		+0.06	+0.5	Volts
		$-15V \leq V_{CM} \leq +15V$		+0.06	+1.0	
		$V_{CM} = 0V$	−0.5	−0.08		
		$-15V \leq V_{CM} \leq +15V$	−1.0	−0.08		
I_{IH}	Strobe Input HIGH Current	$V_{STROBE} = 5.5V$		0.01	5.0	μA
I_{IL}	Strobe Input LOW Current	$V_{STROBE} = 0.4V$	−1.4	−1.0		mA
$I_{IN\ INV}$	Inverting Input Current	$V_{CM} = +15V$		+3.0	+4.2	mA
		$V_{CM} = 0V$	−0.5	0		
		$V_{CM} = -15V$	−4.2	−3.0		
$I_{IN\ NINV}$	Non-Inverting Input Current	$V_{CM} = +15V$		+5.0	+7.0	mA
		$V_{CM} = 0V$	−1.6	−1.0		
		$V_{CM} = -15V$	−9.8	−7.0		
I_{CC}	Power Supply Current (Each Receiver)	$V_{CM} = +15V$		+3.9	+7.0	mA
		$V_{CM} = 0V$		+6.5	+10.2	
		$V_{CM} = -15V$		+8.3	+15.0	
$R_{IN\ INV}$	Inverting Input Resistance		3.6	5.0		kΩ
$R_{IN\ NINV}$	Non-Inverting Input Resistance		1.8	2.5		kΩ
R_{TERM}	Input Terminating Resistor	$T_A = 25°C$	120	170	250	Ω

Notes: 1. For operating at elevated temperatures, the device must be derated based on a thermal resistance of 100°C/W and a maximum junction temperature of 160°C for the AM7820, or 150°C/W and 115°C maximum junction temperature for the AM8820.
2. Typical values given are for $V_{CC} = 5.0V$, $T_A = 25°C$ and $V_{CM} = 0V$ unless stated differently.

Switching Characteristics ($T_A = 25°C$, $V_{CC} = 5.0V$)

Parameters	Description	Test Conditions	Min.	Typ.	Max.	Units
t_{RESP}	Response Time	$C_{delay} = 0$		40		ns
t_{RESP}	Response Time	$C_{delay} = 100\ pF$		150		ns

MAXIMUM RATINGS (Above which the useful life may be impaired)

Storage Temperature		−65°C to +150°C
Temperature (Ambient) Under Bias		−55°C to +125°C
Supply Voltage to Ground Potential (Pin 14 to Pin 7) Continuous		−0.5V to +8.0V
DC Common Mode Voltage		−20V to +20V
DC Strobe Input Voltage		−0.5V to +8.0V
DC Data Input Voltage		−20V to +20V
Output Current, Into Outputs:	Am78/8820	25mA
	Am78/8820A	50mA
Power Dissipation (Note 1)		600mW

Am7820A • Am8820A

ELECTRICAL CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (Unless Otherwise Noted)

Am8820A $T_A = 0°C$ to $+75°C$ $V_{CC} = 5.0V \pm 5\%$ $V_{CM} = -15V$ to $+15V$
Am7820A $T_A = -55°C$ to $+125°C$ $V_{CC} = 5.0V \pm 10\%$ $V_{CM} = -15V$ to $+15V$

Parameters	Description	Test Conditions	Min.	Typ.(Note 1)	Max.	Units
V_{OH}	Output HIGH Voltage	$V_{DIFF} = +1V$, $I_{OH} = -400\mu A$	2.5	4.0	5.5	Volts
V_{OL}	Output LOW Voltage	$V_{DIFF} = -1V$	0		0.4	Volts
V_{IH}	Strobe Input HIGH Level Voltage	$V_{DIFF} = -3V$ $V_{OUT} \leq 0.4V$, $I_{OUT} = 16mA$	2.1			Volts
V_{IL}	Strobe Input LOW Level Voltage	$V_{DIFF} = -3V$ $V_{OUT} \geq 2.5V$, $I_{OUT} = -400\mu A$			0.9	Volts
V_{TH}	Differential Threshold Voltage	$-3V \leq V_{CM} \leq +3V$, $I_{OUT} = -400\mu A$		+0.06	+0.5	Volts
		$-15V \leq V_{CM} \leq +15V$, $I_{OUT} = -400\mu A$		+0.06	+1.0	
		$-3V \leq V_{CM} \leq +3V$, $I_{OUT} = 16mA$	−0.5	−0.08		
		$-15V \leq V_{CM} \leq +15V$, $I_{OUT} = 16mA$	−1.0	−0.08		
I_{IH}	Strobe Input HIGH Current	$V_{STROBE} = 5.5V$, $V_{DIFF} = +3V$		0.01	5.0	μA
I_{IL}	Strobe Input LOW Current	$V_{STROBE} = 0.4V$, $V_{DIFF} = -3V$	−1.4	−1.0		mA
$I_{IN\ INV}$	Inverting Input Current	$V_{CM} = +15V$		+3.0	+4.2	mA
		$V_{CM} = 0V$	−0.5	0		
		$V_{CM} = -15V$	−4.2	−3.0		
$I_{IN\ NINV}$	Non-Inverting Input Current	$V_{CM} = +15V$		+5.0	+7.0	mA
		$V_{CM} = 0V$	−1.6	−1.0		
		$V_{CM} = -15V$	−9.8	−7.0		
I_{SC}	Output Short Circuit Current	$V_{OUT} = 0V$, $V_{STROBE} = 0V$, $V_{CC} = 5.5V$	−6.7	−4.5	−2.8	mA
I_{CC}	Power Supply Current (Each Receiver)	$V_{CM} = +15V$, $V_{DIFF} = -1V$		+3.9	+6.0	mA
		$V_{CM} = 0V$, $V_{DIFF} = -0.5V$		+6.5	+10.2	
		$V_{CM} = -15V$, $V_{DIFF} = -1V$		+9.2	+14.0	
$R_{IN\ INV}$	Inverting Input Resistance		3.6	5.0		kΩ
$R_{IN\ NINV}$	Non-Inverting Input Resistance		1.8	2.5		kΩ
R_{TERM}	Input Terminating Resistor	$T_A = 25°C$	120	170	250	Ω

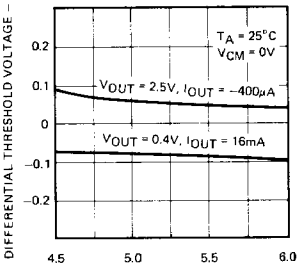
Notes: 1. For operating at elevated temperatures, the device must be derated based on a thermal resistance of 100°C/W and a maximum junction temperature of 160°C for the AM7820A, or 150°C/W and 115°C maximum junction temperature for the AM8820A.
2. Typical values given are for $V_{CC} = 5.0V$, $T_A = 25°C$ and $V_{CM} = 0V$ unless stated differently.

Switching Characteristics ($T_A = 25°C$)

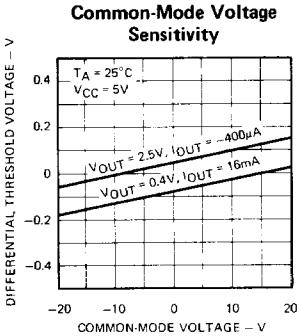
Parameters	Description	Test Conditions	Min.	Typ.	Max.	Units
t_{PHL}	Differential Input to Output LOW	$V_{CC} = 5.0$ V See Switching Waveforms		25	45	ns
t_{PLH}	Differential Input to Output HIGH			22	40	ns
t_{PHL}	Strobe Input to Output LOW			16	25	ns
t_{PLH}	Strobe Input to Output HIGH			15	30	ns

TYPICAL PERFORMANCE CHARACTERISTICS

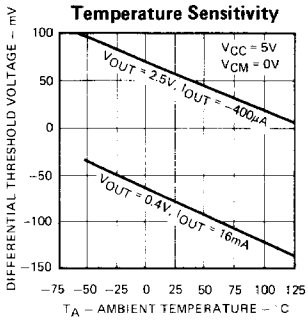
Supply Voltage Sensitivity



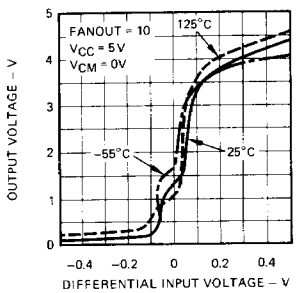
Common-Mode Voltage Sensitivity



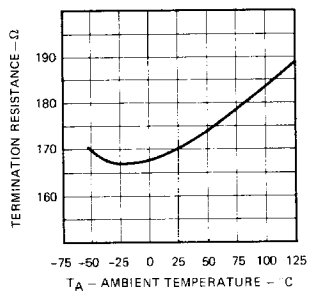
Temperature Sensitivity



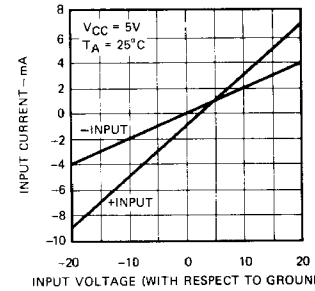
Transfer Function



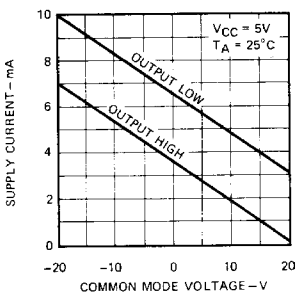
Termination Resistance



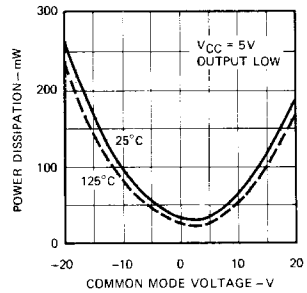
Input Characteristics



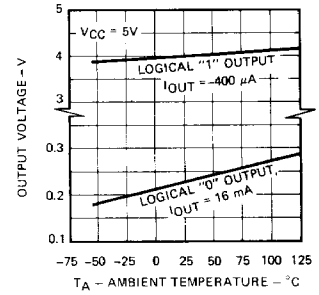
Power Supply Current (Each Receiver)



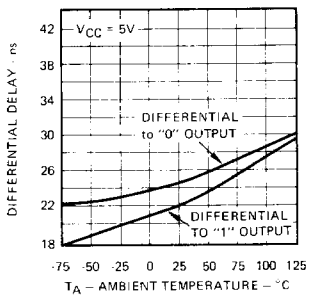
Internal Power Dissipation (Each Receiver)



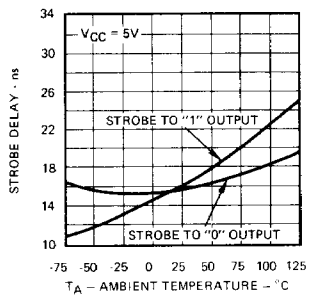
Output Voltage Levels



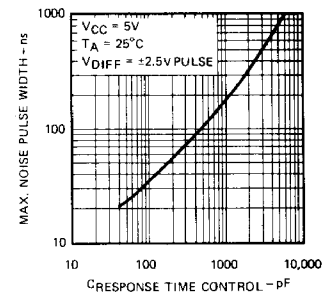
Differential Input Delays



Strobe Delays

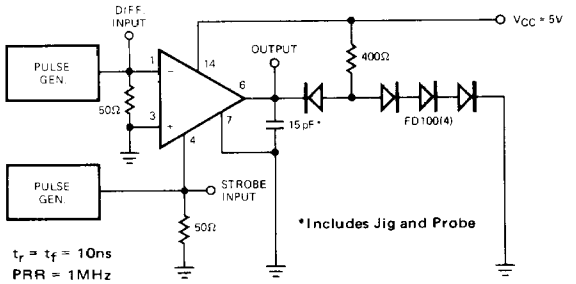


Noise Rejection

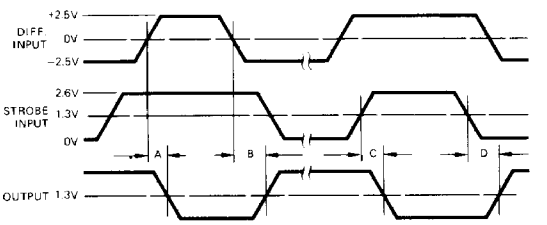


LIC-520

AC TEST CIRCUIT AND WAVEFORMS



LIC-521

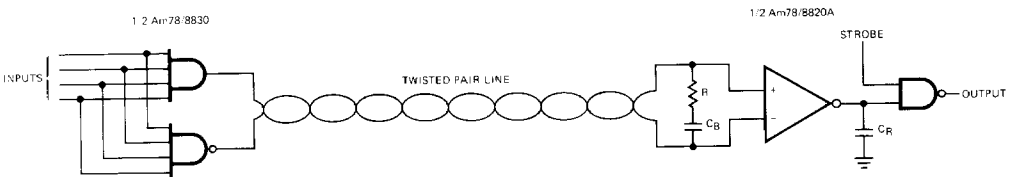


A = Differential Input to "0" Output
B = Differential Input to "1" Output
C = Strobe Input to "0" Output
D = Strobe Input to "1" Output

LIC-522

TYPICAL APPLICATION

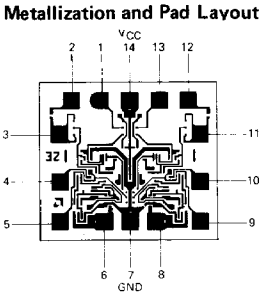
TYPICAL TWISTED PAIR DIFFERENTIAL COMMUNICATION SYSTEM



LIC-523

The Am78/8830 drives a twisted pair line which is terminated at the receiving end by an RC network. The R is approximately equal to the line impedance (170Ω) and is part of the Am78/8820A differential receiver. The C_B is a blocking capacitor which stops DC current flow, and for low duty cycles reduces power consumption. The value of this capacitor depends upon the data rate, C_B must be large compared to $\frac{1}{fd \cdot R}$ where fd is the data rate. The capacitor C_R is used to control the response time of the receiver and limit high frequency noise. $C_R \sim 4 \times 10^3 \frac{1}{fn}$ where C is in pF and fn is the lowest noise frequency expected in MHz.

Metallization and Pad Layout



DIE SIZE 0.045" X 0.050"