

Applications for Low Input Current, High Gain Optocouplers

Optically coupled isolators are useful in applications where large common mode signals are encountered. Examples are: line receivers, logic isolation, power lines, medical equipment and telephone lines. This application note has at least one example in each of these areas for the 6N138/9 series high CTR couplers.

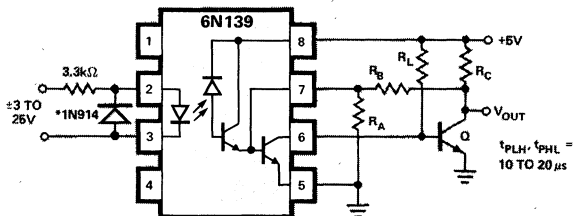
HP's 6N138/9 series couplers contain a high gain, high speed photodetector that provides a minimum current trans-

fer ratio (CTR) of 300% at input currents of 1.6 mA for the 6N138 and 400% at 0.5 mA for the 6N139. The excellent low input current CTR enables these devices to be used in applications where low power consumption is required and those applications that do not provide sufficient input current for other couplers. Separate pin connections for the photodiode and output transistor permit high speed operation and TTL compatible output. A base access terminal allows a gain bandwidth adjustment to be made.

RS-232C COMPATIBLE LINE RECEIVER

- 2500V 60Hz Common Mode Rejection
- Allows use of Low Cost Line
- Full 40kbs Data Rate for Line Lengths up to 5000'
- Hysteresis for Increased Noise Immunity

*ANTIPARALLEL DIODE IS NEEDED ONLY IF REVERSE LINE VOLTAGE EXCEEDS 15V (TO PREVENT HIGH REVERSE VOLTAGE FROM CAUSING POWER DISSIPATION IN EXCESS OF INPUT DIODE MAXIMUM RATING).

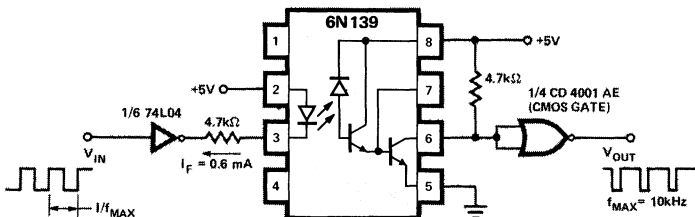


REMOVE R_A AND R_B FOR NO HYSTERESIS

R_A	R_B	R_C	R_L	Q
680k Ω	1.5M Ω	1.8k Ω	15k Ω	2N3904

LOW POWER INTERFACE

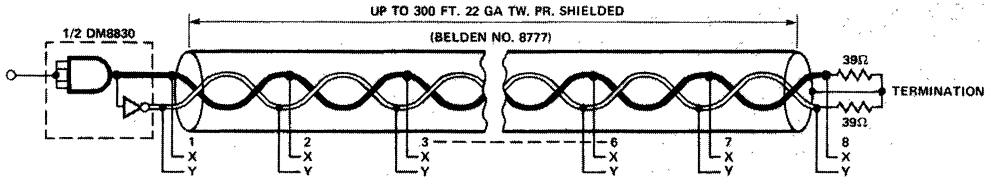
- Operation at $I_F \geq 0.5\text{mA}$
- 10kHz f_{MAX}
- Low Power Consumption



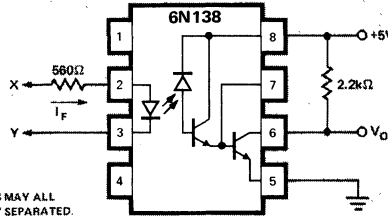
f_{MAX} IS THE FREQUENCY AT WHICH A 50% DUTY FACTOR AT THE INPUT IS DEGENERATED TO 10% OR 90% DUTY FACTOR AT THE OUTPUT.

LINE RECEIVER FOR PARTY LINE

- 1-8 Receivers can be used with circuit shown
- Uses conventional IC Line Driver
- Total Line Length 1-300'
- Typical Data Rate —180kbs
($t_{PHL}, t_{PLH} = 3 \mu\text{sec}$)
- Allows use of Low Cost Line



ISOLATOR LOADS MAY BE DISTRIBUTED RANDOMLY ALONG THE LENGTH OF THE LINE, OR ALL MAY BE LUMPED AT THE END. I_F FOR 1 AND 8 ISOLATOR LOADS WOULD BE 2.7 AND 1.8mA RESPECTIVELY.

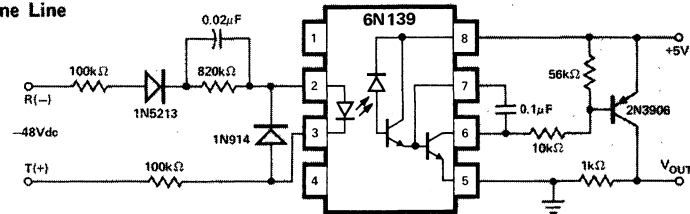


PROPAGATION DELAY: $t_{PHL}, t_{PLH} = 0.5$ to $5 \mu\text{s}$

OUTPUT GROUNDS MAY ALL BE ELECTRICALLY SEPARATED.

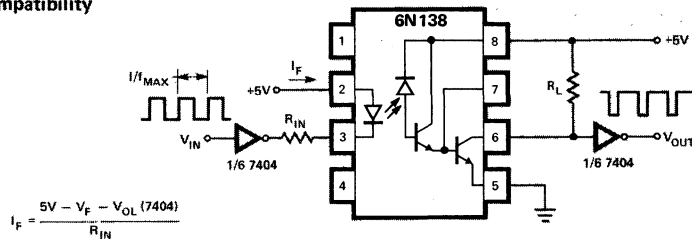
TELEPHONE RING DETECTOR

- Discriminates between Ring and Dial Signals
- Minimal Line Loading ($1\text{M}\Omega$ dc, $450\text{k}\Omega$ at 20Hz)
- 2500V Insulation from Telephone Line
- Small Size
- Integrator Included



TTL TO TTL INTERFACE

- Direct Input and Output Compatibility
- Adjustable Data Rate
- High Fan-Out



$$I_F = \frac{5V - V_F - V_{OL}(7404)}{R_{IN}}$$

FOR HIGHER FANOUT WITH COMPARABLE DATA RATES USE SMALLER VALUES OF R_{IN} .

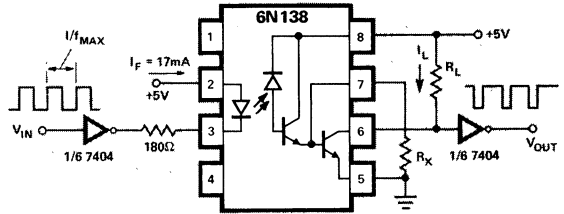
f_{MAX} IS THE FREQUENCY AT WHICH A 50% DUTY FACTOR AT THE INPUT IS DEGENERATED TO 10% OR 90% DUTY FACTOR AT THE OUTPUT.

$R_L (\Omega)$	$R_{IN} (\Omega)$	I_F (mA)	f_{MAX} (kHz)
2200	1800	1.7	40
270	390	8	125
100	180	17	250

APPLICATION NOTES

GAIN/SPEED TRADE OFF

- Obtain Maximum Speed at Required Gain
- Single Resistor Required
- Use same device for Multiple Applications

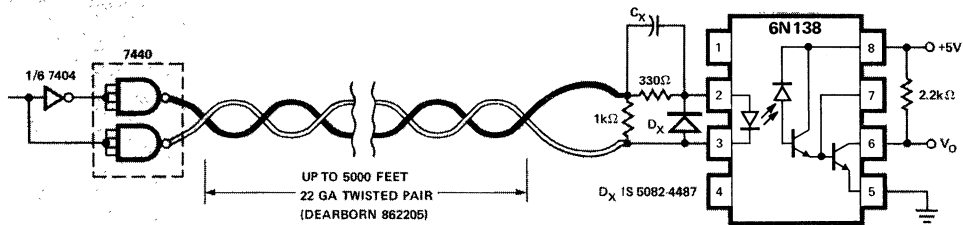


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R_X (Ω)	R_L (Ω)	I_L (mA)	f_{MAX} (kHz)
NONE	100	46	250
820	1000	4.6	650

1-5000 FT. LINE RECEIVER

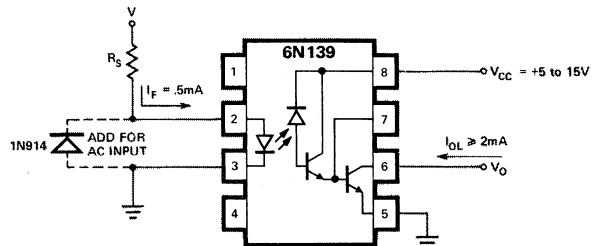
- Drive with Standard TTL Buffer Gate
- 2500V 60Hz Common Mode Rejection
- Allows use of Low Cost Line
- 40kbs Data Rate
- TTL Compatible Output



PROPAGATION DELAY: WITHOUT C_X, D_X , $t_{PLH} = 2$ to $5 \mu s$; $t_{PHL} = 25 \mu s$
WITH $D_X, C_X \geq 0.002 \mu F$, $t_{PLH} = 2 \mu s$; $t_{PHL} = 7 \mu s$

HIGH VOLTAGE STATUS INDICATOR

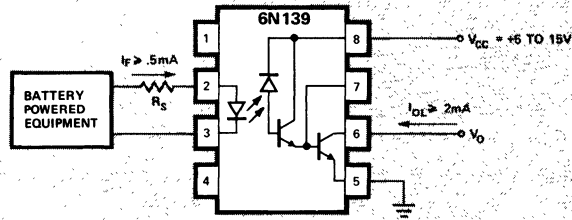
- Low Power Consumption
- TTL Compatible Output
- High Speed
- Use for Power Turn On Anticipation Circuit, 117V Line Monitor or Other High Voltage Sensing



V (Vdc or Vrms)	R_S	$V \cdot I_F$ (mW)
24	47k Ω	11
48	100k Ω	22
117	220k Ω	62
230	470k Ω	113

MEDICAL EQUIPMENT ISOLATION

- Low Power Consumption
- 2500V 60Hz Isolation
- Digital or Analog Operation



CONVENTIONAL DARLINGTON

- No Bias Supply Required
- Base Lead available for Gain/Bandwidth Adjust
- Data Rates of 2kbs

