

LINE DRIVERS AND RECEIVERS

Many types of line drivers and receivers are available today. Each device has been designed to meet specific criteria. For instance, the device may be extremely wide band or be intended for use in party line systems. Some include built in hysteresis in the receiver while others do not.

The EIA Standard

The Electronic Industries Association has produced a set of specifications dealing with the transmission of data between data terminal and communications equipment. This is EIA Standard RS-232-C and delineates much information about signal levels and hardware configurations in data systems.

MC1488/1489

As line driver and receiver the MC1488 and MC1489 meet or exceed the RS-232 specification.

Standard RS-232 defines the voltage level as being from 5 to 15 volts with positive voltage representing a logic 0. The MC1488 meets these requirements when loaded with resistors from 3k to 7k ohms.

Output slew rates are limited by RS-232 to 30 volts per microsecond. To accomplish this specification the MC1488 is loaded at its output by capacitance as shown by the typical hookup diagram of Figure 1. A graph of slew rate vs output capacitance is given in Figure 2. For the standard 30V/ μ s a capacitance of 400pF is selected.

The short circuit current charges the capacitance with the relationship.

$$C = \frac{I_{SC}\Delta T}{\Delta V}$$

Where C is the required capacitor, I_{SC} is the short circuit current value, and $\Delta V/\Delta T$ is the slew rate.

Using the worst case output short circuit current of 12mA in the above equation, calculations result in a required capacitor of 400pF connected to each output to limit the output slew rate to 30V/ μ s in accordance with the EIA standard.

The EIA standard also states that output shorts to any other conductor of the cable must not damage the driver. Thus the MC1488 is designed such that the output will withstand shorts to other conductors indefinitely even if these conductors are at worst case voltage levels. In addition to output protection, the MC1488 includes a 300 ohm resistor to ensure that the output impedance of the driver will be at least 300 ohms even if the power supply is turned off. In cases where power supply malfunction produces a low impedance to ground, the 300 ohm resistors are shorted to ground also. Output shorts then can cause excessive power dissipation. To prevent this, series diodes should be included in both supply lines as pictured in Figure 3.

The companion receiver, MC1489, is also designed to meet RS-232 specifications for receivers. It must detect a voltage from ± 3 to ± 25 volts as logic signals but cannot generate an input differential voltage of greater

than 2 volts should its inputs become open circuited. Noise and spurious signals are rejected by incorporating positive feedback internally to produce hysteresis. Featured also in the receiver is an external response node so that the threshold may be externally varied to fit the application. Figure 4 shows the shift in high and low trip points as a function of the programming resistance.

APPLICATIONS

The design of the MC1488 and MC1489 makes them very versatile with many possible applications. The MC1488 output current limiting enables the user to define the output voltage levels independent of supply voltages. Figure 5 shows the MC1488 as a TTL to MOS Translator, while Figures 6 and 7 illustrate TTL to HTL and TTL to MOS Translator.

The MC1489 response control node allows the user to modify the input threshold voltage levels. This is accomplished by adding a resistor between the response control pin and an external power supply. Figure 4 shows the shift thus provided. This feature and the fact that the inputs are designed to withstand ± 30 volts permit the use of the MC1489 for level translation as shown in the MOS to TTL translator of Figure 8. This feature is also useful for level shifting, as illustrated in Figure 9.

The response control node can also be used to filter out high frequency, high energy noise pulses. Figures 10 and 11 give typical noise pulse rejection curves for various sized external capacitors.

TYPICAL LINE DRIVER-RECEIVER APPLICATION

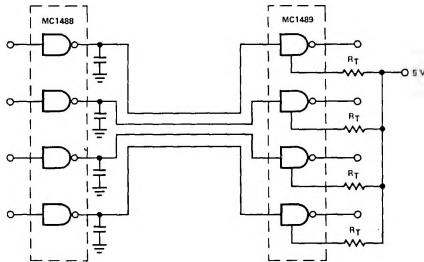


Figure 1

OUTPUT SLEW RATE vs. LOAD CAPACITANCE

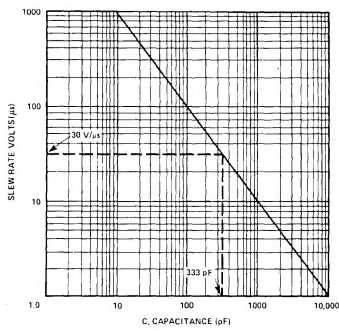


Figure 2

PROTECTION FROM POWER SUPPLY MALFUNCTION

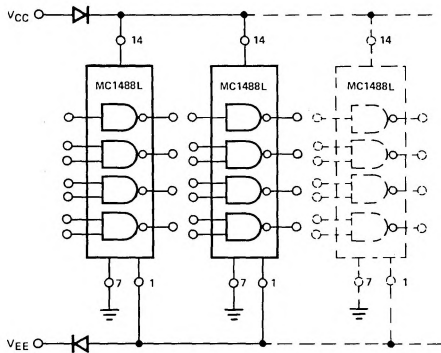


Figure 3

HYSTERESIS AS A FUNCTION OF PROGRAMMING RESISTANCE

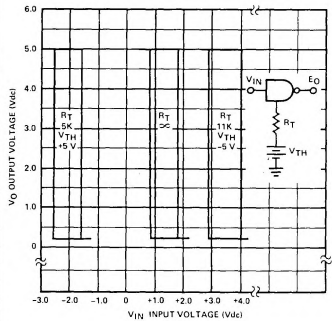
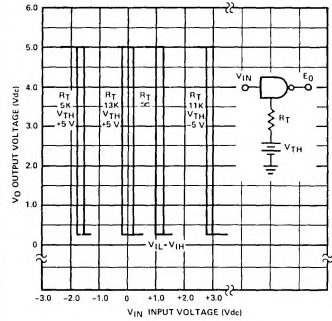
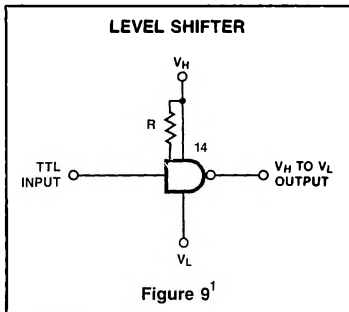
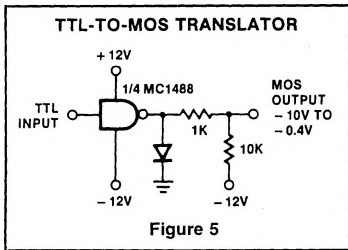


Figure 4



NOTE:
1. $V_2 \leq 5V$; $3V \leq V_H - V_L \leq 10V$.

