QUAD LINE DRIVER　MC1488
276-2520

GENERAL DESCRIPTION

The 1488 is a monolithic quad line driver designed to interface data terminal equipment with data communications equipment in conformance with the specifications of EIA Standard No. RS-232C.

FEATURES

- Current Limited Output
  ±10 MA typ
- Power-Off Source Impedance
  300 Ohms min
- Simple Slew Rate Control with External Capacitor
- Flexible Operating Supply Range

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) .... 15 V
$\qquad$ (V_{EE}) .... − 15 V
Output Signal Voltage (VO) .... ±15 V
Power (PD) .... 1 W
Input Current-Low Logic State (V_{IL} = 0) (See Fig. 8) .... 1.6 mA
Input Current-High Logic State (V_{IH} = 5.0V) (See Fig. 8) .... 10 μA
Output Resistance (V_{CC} = V_{EE} = 0/Vol = ±2.0V
(See Fig. 11) 300Ω
Operating Temperature Range (TA) .... 0°C To + 75°C
Storage Temperature Range (T_{stg}) .... −65°C To +175°C

PIN CONNECTION
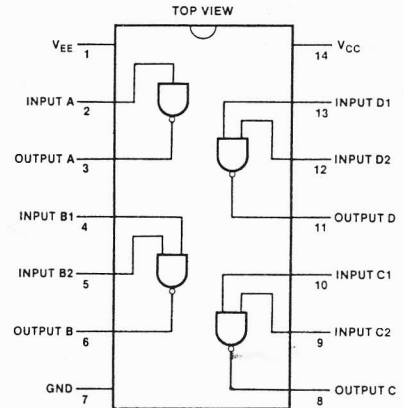
INTERNAL CIRCUIT
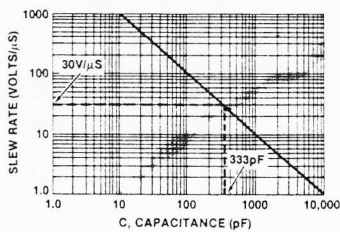### (¼ of Circuit Shown)
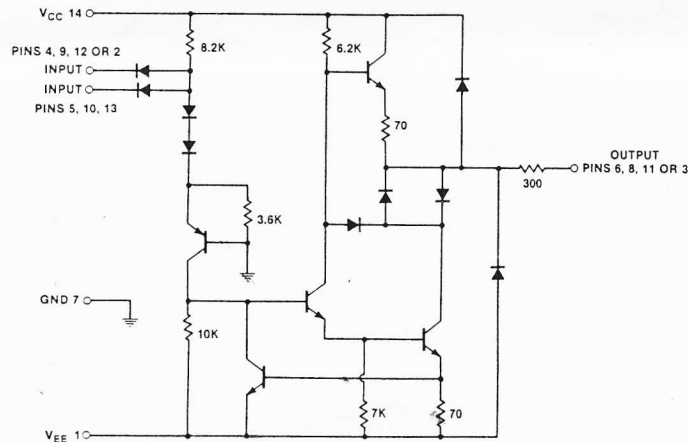
TYPICAL CHARACTERISTICS
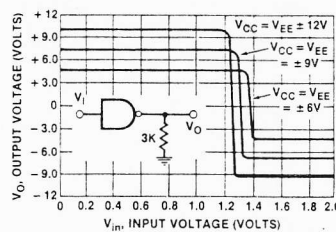

Figure 1—Slew Rate vs Capacitance
for I_{SC} = 10mA

Figure 3—Transfer Characteristics
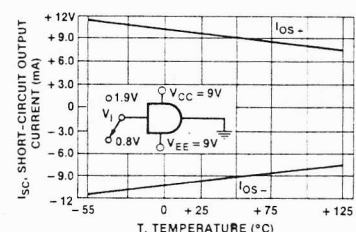vs Power–Supply Voltage

Figure 4—Short-Circuit Output Current
vs Temperature

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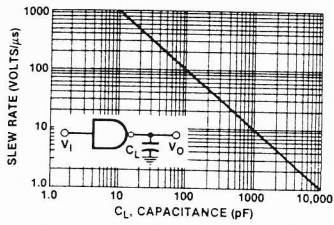## TYPICAL CHARACTERISTICS (Cont'd)
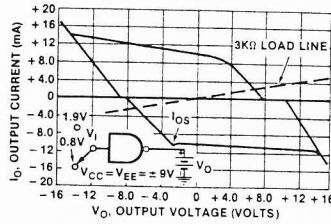
Figure 5—Output Slew Rate vs
Load Capacitance

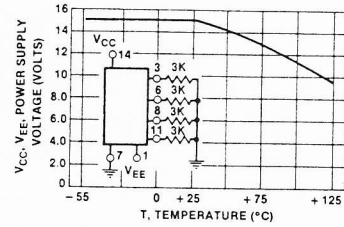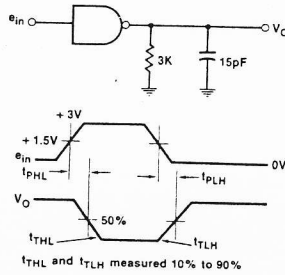Figure 6—Output Voltage and
Current-Limiting Characteristics

Figure 7—Maximum Operating
Temperature vs Power-Supply
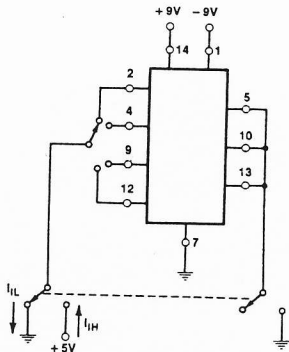Voltage

Switching Response
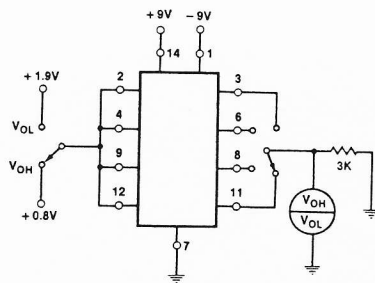
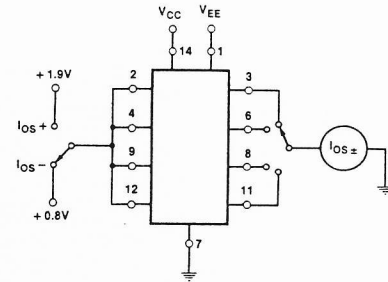## TEST CIRCUITS

Figure 8— Input Current

Figure 9— Output Voltage
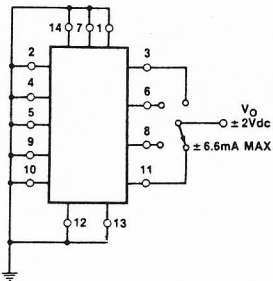
Figure 10— Output Short-Circuit
Current

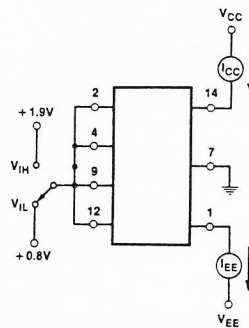Figure 11 — Output Resistance (Power-Off)

Figure 12— Power-Supply Currents

APPLICATIONS INFORMATION

The Electronic Industries Association (EIA) RS232C specification detail the requirements for the interface between data processing equipment and data communications equipment. This standard specifies not only the number and type of interface leads, but also the voltage levels to be used. The 1488 quad driver and its companion circuit, the 1489 quad receiver, provide a complete interface system between DTL or TTL logic levels and the RS232C defined levels. The RS232C requirements as applied to drivers are discussed herein.

The required driver voltages are defined as between 5 and 15-volts in magnitude and are positive for a logic "0" and negative for a logic "1". These voltages are so defined when the drivers are terminated with a 3000 to 7000-ohm resistor. The 1488 meets this voltage requirement by converting a DTL/TTL logic level into RS232C levels with one stage of inversion.

The RS232C specification further requires that during transitions, the driver output slew rate must not exceed 30 volts per microsecond. The inherent slew rate of the 1488 is much too fast for this requirement. The current limited output of the device can be used to control this slew rate by connecting a capacitor to each drive output. The required capacitor can be easily determined by using the relationship $C = I_{OS} \times \Delta T/\Delta V$ from which Figure 1 is derived. Accordingly, a 330-pF capacitor on each output will guarantee a worst case slew rate of 30 volts per microsecond.

The interface driver is also required to withstand an accidental short to any other conductor in an interconnecting cable. The worst possible signal on any conductor would be another driver using a plus or minus 15-volt, 500-mA source. The 1488 is designed to indefinitely withstand such a short to all four outputs in a package as long as the power-supply voltages are greater than 9.0 volts (i.e., $V_{CC} \geq 9.0$ V; $V_{EE} \leq -9.0$ V). In some power-supply designs, a loss of system power causes a low impedance on the power-supply outputs. When this occurs, a low impedance to ground would exist at the power inputs to the 1488 effectively shorting the 300-ohm output resistors to ground. If *all four outputs* were then shorted to plus or minus 15 volts, the power dissipation in these resistors would be excessive. Therefore, if the system is designed to permit low impedances to ground at the power-supplies of the drivers, a diode should be placed in each power-supply lead to prevent overheating in this fault condition. These two diodes, as shown in Figure 2, could be used to decouple all the driver packages in a system. (These same diodes will allow the 1488 to withstand momentary shorts to the ±25-volt limits specified in the earlier Standard RS232B.) The addition of the diodes also permits the 1488 to withstand faults with power-supplies of less than the 9.0 volts stated above.

The maximum short-circuit current allowable under fault conditions is more than guaranteed by the previously mentioned 10 mA output current limiting.

OTHER APPLICATIONS

The 1488 is an extremely versatile line driver with a myriad of possible applications. Several features of the drivers enhance this versatility:

1. Output Current Limiting—this enables the circuit designer to define the output voltage levels independing of power-supplies and can be accomplished by diode clamping of the output pins. Figure 14 shows the 1488 used as a DTL to MOS translator where the high-level voltage output is clamped one diode above ground. The resistor divider shown is used to reduce the output voltage below the 300 mV above ground MOS input level limit.

2. Power-Supply Range—as can be seen from the schematic drawing of the drivers, the postive and negative driving elements of the device are essentially independent and do not require matching power-supplies. In fact, the positive supply can vary from a minimum seven volts (required for driving the negative pulldown section) to the maximum specified 15 volts. The negative supply can vary from approximately -2.5 volts to the minimum specified -15 volts. The 1488 will drive the output to within 2 volts of the postive or negative supplies as long as the current output limits are not exceeded. The combination of the current-limiting and supply-voltage features allow a wide combination of possible outputs within the same quad package. Thus if only a portion of the four drivers are used for driving RS232C lines, the remainder could be used for DTL to MOS or even DTL or DTL translation. Figure 15 shows one such combination.
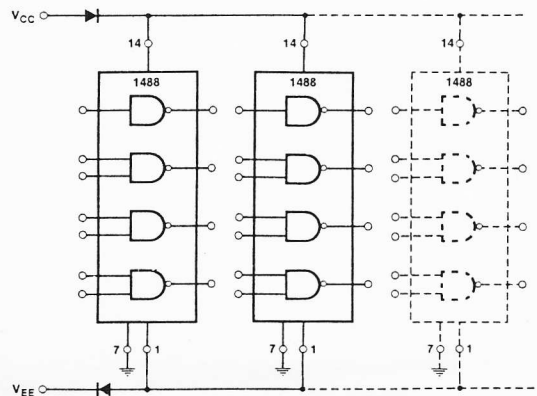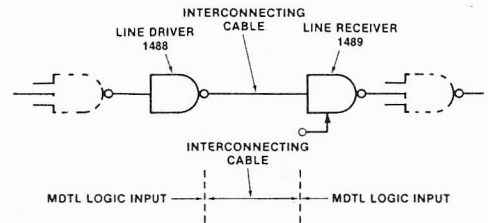
TYPICAL APPLICATIONS

Figure 2—Power Supply Protection
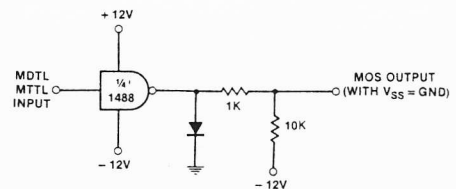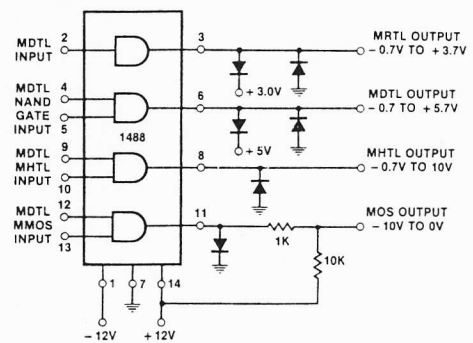to Meet Power-Off Fault Conditions

Figure 14—MDTL/MTTL-to-MOS
Translator

Figure 15—Logic Translator
Applications