DS1488 Quad Line Driver

Check for Samples: DS1488

FEATURES

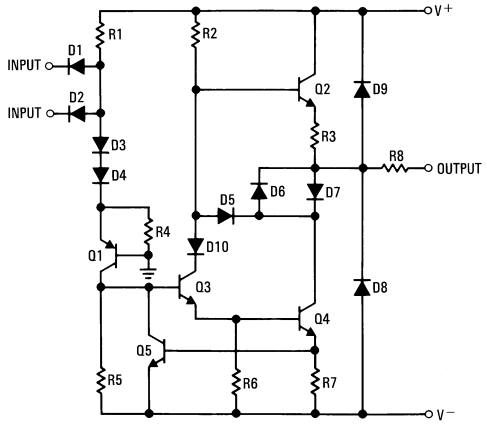
- **Current limited output: ±10 mA typ**
- **Power-off source impedance: 300Ω min**
- **Simple slew rate control with external capacitor**
- **Flexible operating supply range**
- **Inputs are TTL/LS compatible**

DESCRIPTION

The DS1488 is a quad line driver which converts standard TTL input logic levels through one stage of inversion to output levels which meet EIA Standard RS-232D and CCITT Recommendation V.24.

Schematic and Connection Diagrams

Figure 1. 1/4 Circuit



Small-Outline or Dual-In-Line Package

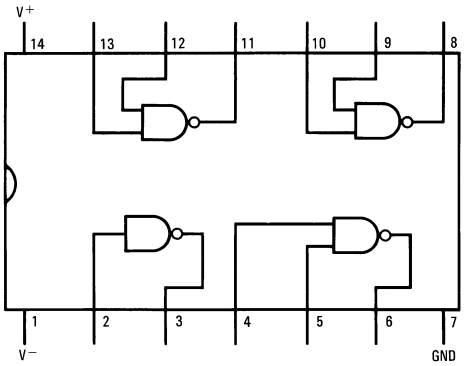


Figure 2. Top View

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings (1)

Supply Voltage	
V^+	+15V
V^-	−15V
Input Voltage (V_{IN})	$-15V \le V_{IN} \le 7.0V$
Output Voltage	±15V
Operating Temperature Range	0°C to +75°C
Storage Temperature Range	−65°C to +150°C
Maximum Power Dissipation (2) at 25°C	
Molded DIP Package	1280 mW
SO Package	974 mW
Lead Temperature (Soldering, 4 sec.)	260°C

(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.

(2) Derate molded DIP package 10.2 mW/°C above 25°C; derate SO package 7.8 mW/°C above 25°C.

Electrical Characteristics (1) (2)

V_{CC}+ = 9V, V_{CC}− = −9V unless otherwise specified

Symbol	Parameter	Conditions		Min	Typ	Max	Units
I_{IL}	Logical “0” Input Current	V_{IN} = 0V			−0.8	−1.3	mA
I_{IH}	Logical “1” Input Current	V_{IN} = +5.0V			0.005	10.0	µA
V_{OH}	High Level Output Voltage	R_L = 3.0 kΩ,	V^+ = 9.0V, V^- = −9.0V	6.0	7.1		V
		V_{IN} = 0.8V	V^+ = 13.2V, V^- = −13.2V	9.0	10.7		V
V_{OL}	Low Level Output Voltage	R_L = 3.0 kΩ,	V^+ = 9.0V, V^- = −9.0V	−6.0	7.0		V
		V_{IN} = 1.9V	V^+ = 13.2V, V^- = −13.2V	−9.0	−10.6		V
I_{OS}+	High Level Output	V_{OUT} = 0V, V_{IN} = 0.8V		−6.0	−10.0	−12.0	mA
	Short-Circuit Current						
I_{OS}−	Low Level Output	V_{OUT} = 0V, V_{IN} = 1.9V		6.0	10.0	12.0	mA
	Short-Circuit Current						
R_{OUT}	Output Resistance	V^+ = V^- = 0V, V_{OUT} = ±2V		300			Ω
I_{CC}+	Positive Supply Current	V_{IN} = 1.9V	V^+ = 9.0V, V^- = −9.0V		11.6	20.0	mA
	(Output Open)		V^+ = 12V, V^- = −12V		15.7	25.0	mA
			V^+ = 15V, V^- = −15V		19.4	34.0	mA
		V_{IN} = 0.8V	V^+ = 9.0V, V^- = −9.0V		3.4	6.0	mA
			V^+ = 12V, V^- = −12V		4.1	7.0	mA
			V^+ = 15V, V^- = −15V		9.1	12.0	mA
I_{CC}−	Negative Supply Current	V_{IN} = 1.9V	V^+ = 9.0V, V^- = −9.0V		−10.8	−17.0	mA
	(Output Open)		V^+ = 12V, V^- = −12V		−14.6	−23.0	mA
			V^+ = 15V, V^- = −15V		−18.3	−34.0	mA
		V_{IN} = 0.8V	V^+ = 9.0V, V^- = −9.0V		−0.001	−0.100	mA
			V^+ = 12V, V^- = −12V		−0.001	−0.100	mA
			V^+ = 15V, V^- = −15V		−0.01	−2.5	mA
P_d	Power Dissipation	V^+ = 9.0V, V^- = −9.0V			252	333	mW
		V^+ = 12V, V^- = −12V			444	576	mW

(1) Unless otherwise specified min/max limits apply across the 0°C to +75°C temperature range for the DS1488.
(2) 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.

Switching Characteristics

(V_{CC} = 9V, V_{EE} = −9V, T_A = 25°C)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{pd1}	Propagation Delay to a Logical “1”	R_L = 3.0 kΩ, C_L = 15 pF, T_A = 25°C		187	350	ns
t_{pd0}	Propagation Delay to a Logical “0”	R_L = 3.0 kΩ, C_L = 15 pF, T_A = 25°C		45	175	ns
t_r	Rise Time	R_L = 3.0 kΩ, C_L = 15 pF, T_A = 25°C		63	100	ns
t_f	Fall Time	R_L = 3.0 kΩ, C_L = 15 pF, T_A = 25°C		33	75	ns

Applications

By connecting a capacitor to each driver output the slew rate can be controlled utilizing the output current limiting characteristics of the DS1488. For a set slew rate the appropriate capacitor value may be calculated using the following relationship

$$C = I_{SC} (\Delta T/\Delta V) \quad (1)$$

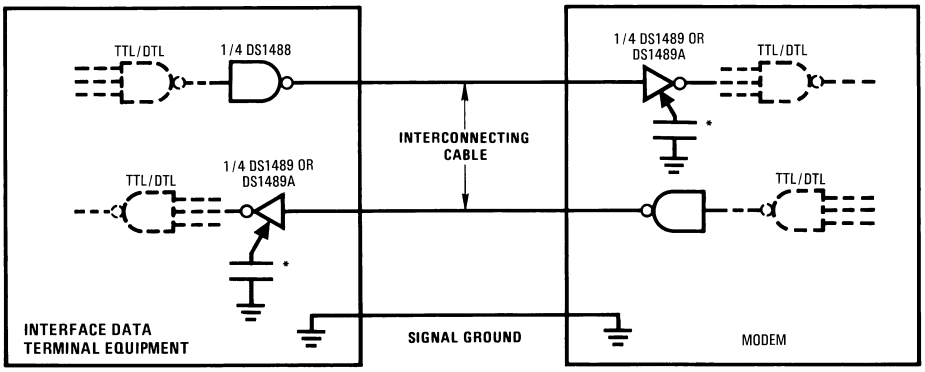
where C is the required capacitor, I_{SC} is the short circuit current value, and ΔV/ΔT is the slew rate.

RS-232C specifies that the output slew rate must not exceed 30V per microsecond. Using the worst case output short circuit current of 12 mA in the above equation, calculations result in a required capacitor of 400 pF connected to each output.

See Typical Performance Characteristics.

Typical Applications

Figure 3. RS-232C Data Transmission



Optional for noise filtering

Figure 4. DTL/TTL-to-MOS Translator

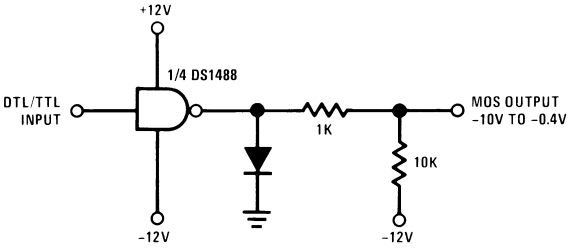


Figure 5. DTL/TTL-to-HTL Translator

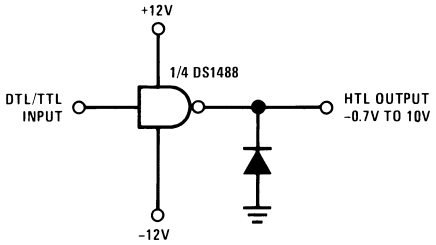
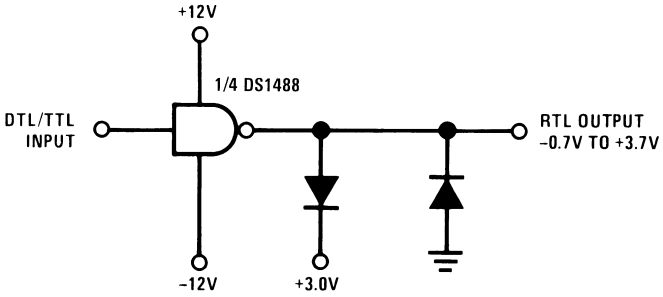
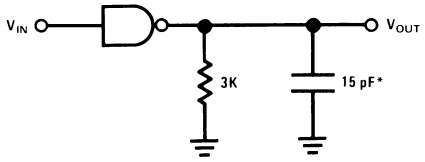


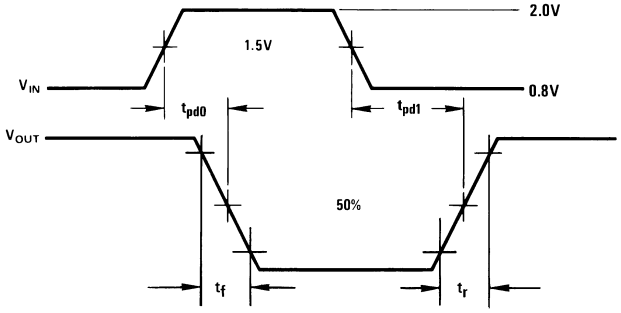
Figure 6. DTL/TTL-to-RTL Translator



AC Load Circuit and Switching Time Waveforms



*C_L includes probe and jig capacitance.



t_r and t_f are measured between 10% and 90% of the output waveform.

Typical Performance Characteristics

T_A=+25°C unless otherwise noted

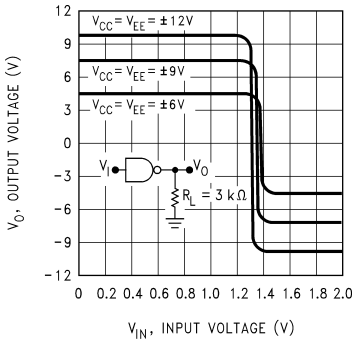


Figure 7. Transfer Characteristics vs Power Supply Voltage

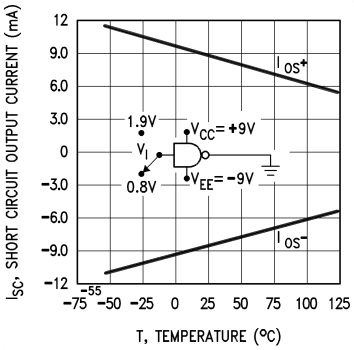


Figure 8. Short-Circuit Output Current vs Temperature

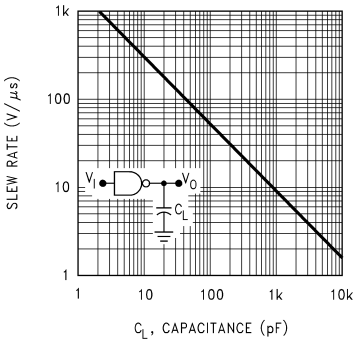


Figure 9. Output Slew Rate vs Load Capacitance

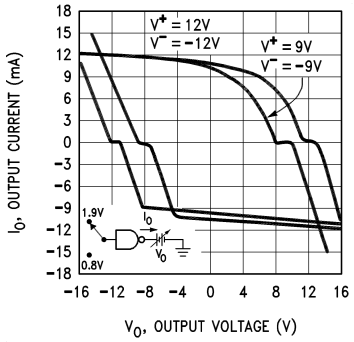


Figure 10. Output Voltage and Current-Limiting Characteristics

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