National Semiconductor

July 1999

DS1488 Quad Line Driver

General Description

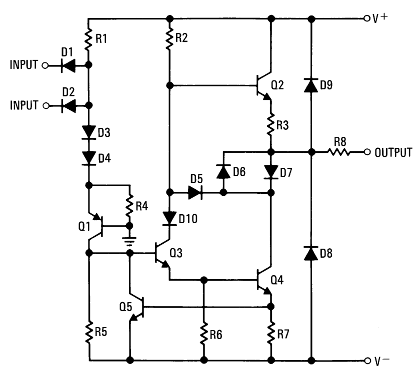
The DS1488 is a quad line driver which converts standard TTL input logic levels through one stage of inversion to output levels which meet EIA Standard RS-232D and CCITT Recommendation V.24.

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

Schematic and Connection Diagrams

1/4 Circuit



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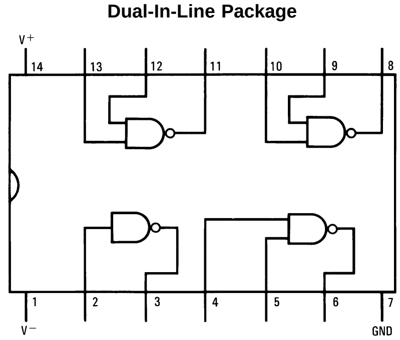
Dual-In-Line Package



DS005776-2

Top View
Order Number DS1488M or DS1488N
See NS Package Number M14A or N14A

Absolute Maximum Ratings (Note 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/ Distributors for availability and specifications.

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 (Note 1) at 25˚C	
Molded DIP Package	1280 mW
SO Package	974 mW
Lead Temperature (Soldering, 4 sec.)	260˚C

Note 1: Derate molded DIP package 10.2 mW/˚C above 25˚C; derate SO package 7.8 mW/˚C above 25˚C.

Electrical Characteristics (Notes 3, 4)

$V_{CC}+ = 9V$, $V_{CC}- = -9V$ 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	$R_L = 3.0\ k\Omega$, $V_{IN} = 0.8V$	$V^+ = 9.0V, V^- = -9.0V$	6.0	7.1		V
			$V^+ = 13.2V, V^- = -13.2V$	9.0	10.7		V
V_{OL}	Low Level Output Voltage	$R_L = 3.0\ k\Omega$, $V_{IN} = 1.9V$	$V^+ = 9.0V, V^- = -9.0V$	−6.0	7.0		V
			$V^+ = 13.2V, V^- = -13.2V$	−9.0	−10.6		V
$I_{OS}+$	High Level Output Short-Circuit Current	$V_{OUT} = 0V, V_{IN} = 0.8V$		−6.0	−10.0	−12.0	mA
$I_{OS}-$	Low Level Output Short-Circuit Current	$V_{OUT} = 0V, V_{IN} = 1.9V$		6.0	10.0	12.0	mA
R_{OUT}	Output Resistance	$V^+ = V^- = 0V, V_{OUT} = \pm 2V$		300			Ω
$I_{CC}+$	Positive Supply Current (Output Open)	$V_{IN} = 1.9V$	$V^+ = 9.0V, V^- = -9.0V$		11.6	20.0	mA
			$V^+ = 12V, V^- = -12V$		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 (Output Open)	$V_{IN} = 1.9V$	$V^+ = 9.0V, V^- = -9.0V$		−10.8	−17.0	mA
			$V^+ = 12V, V^- = -12V$		−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

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"	$R_L = 3.0\ k\Omega$, $C_L = 15\ pF$, $T_A = 25˚C$		187	350	ns
t_{pd0}	Propagation Delay to a Logical "0"	$R_L = 3.0\ k\Omega$, $C_L = 15\ pF$, $T_A = 25˚C$		45	175	ns
t_r	Rise Time	$R_L = 3.0\ k\Omega$, $C_L = 15\ pF$, $T_A = 25˚C$		63	100	ns
t_f	Fall Time	$R_L = 3.0\ k\Omega$, $C_L = 15\ pF$, $T_A = 25˚C$		33	75	ns

Note 2: "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.

Note 3: Unless otherwise specified min/max limits apply across the 0˚C to +75˚C temperature range for the DS1488.

Note 4: 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.

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

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

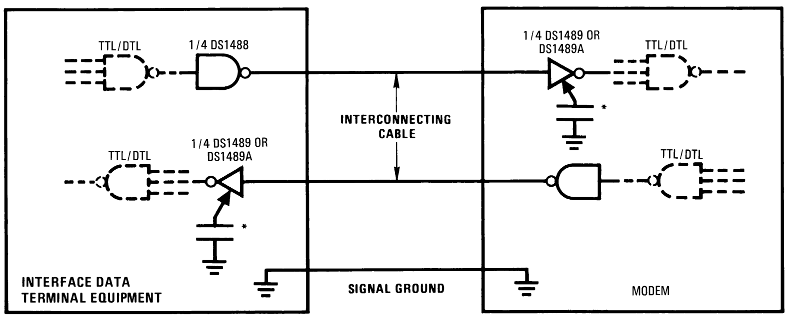
where C is the required capacitor, I_{SC} is the short circuit current value, and $\Delta V/\Delta T$ is the slew rate.

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

RS-232C Data Transmission



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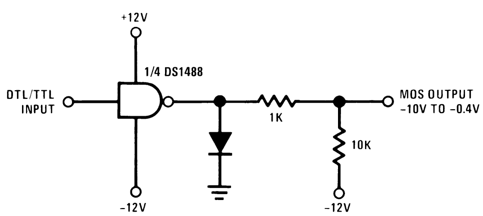
Note 5: Optional for noise filtering

DTL/TTL-to-MOS Translator



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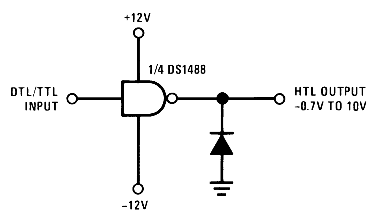
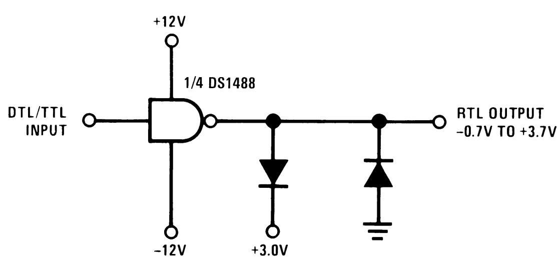
DTL/TTL-to-HTL Translator



DS005776-5

DTL/TTL-to-RTL Translator



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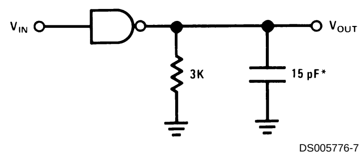
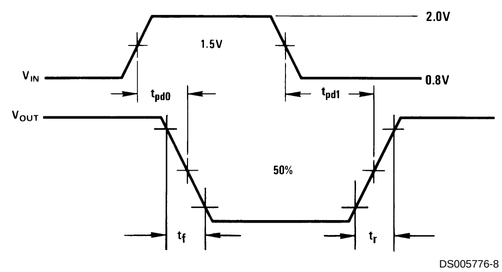
AC Load Circuit and Switching Time Waveforms



*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

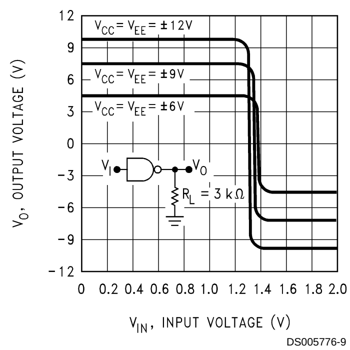


FIGURE 1. Transfer Characteristics vs Power Supply Voltage

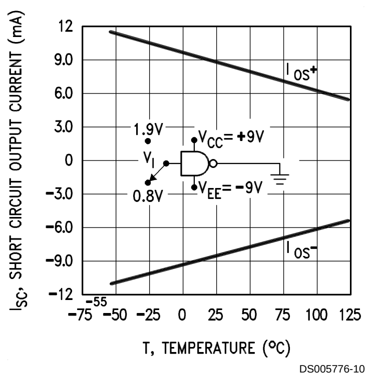


FIGURE 2. Short-Circuit Output Current vs Temperature

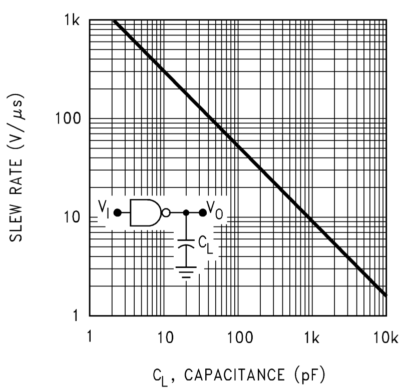


FIGURE 3. Output Slew Rate vs Load Capacitance

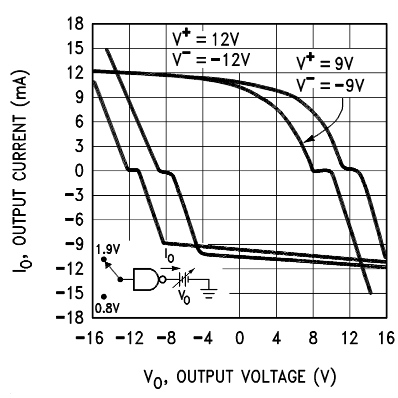
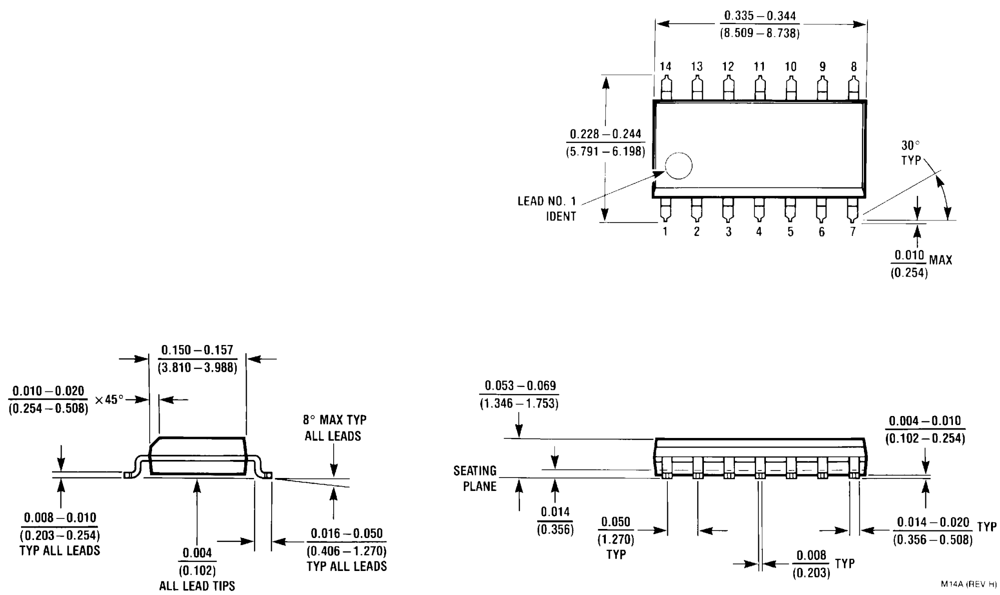
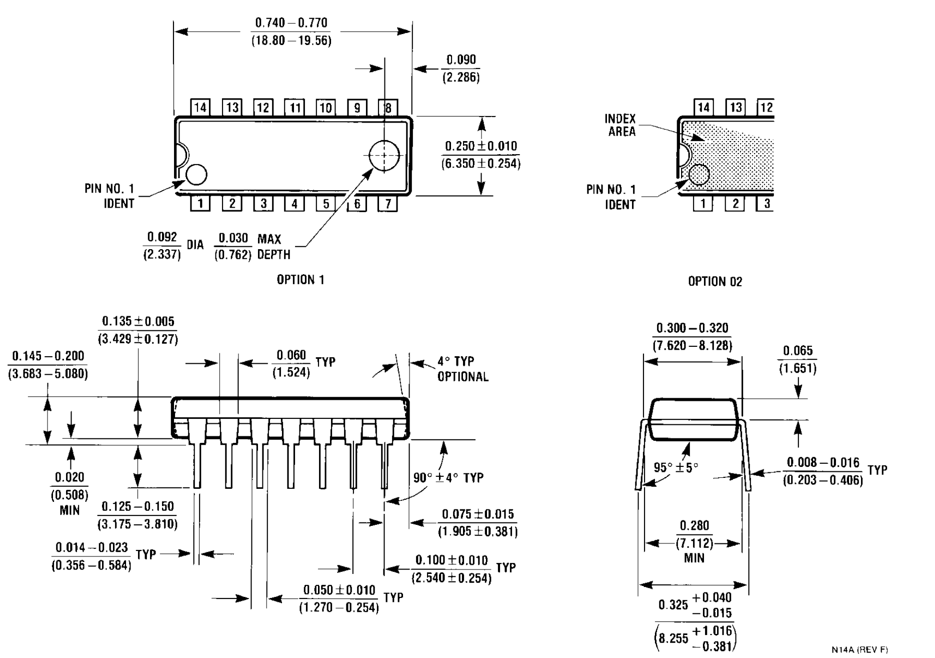


FIGURE 4. Output Voltage and Current-Limiting Characteristics

Physical Dimensions inches (millimeters) unless otherwise noted



SO Package (M)
Order Number DS1488M
NS Package Number M14A



Molded Dual-In-Line Package (N)
Order Number DS1488N
NS Package Number N14A

Notes

National Semiconductor Corporation
Americas
Tel: 1-800-272-9959
Fax: 1-800-737-7018
Email: support@nsc.com

www.national.com

National Semiconductor Europe
Fax: +49 (0) 1 80-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 1 80-530 85 85
English Tel: +49 (0) 1 80-532 78 32
Français Tel: +49 (0) 1 80-532 93 58
Italiano Tel: +49 (0) 1 80-534 16 80

National Semiconductor Asia Pacific Customer Response Group
Tel: 65-2544466
Fax: 65-2504466
Email: sea.support@nsc.com

National Semiconductor Japan Ltd.
Tel: 81-3-5639-7560
Fax: 81-3-5639-7507