

## MM78C29/MM88C29 Quad Single-Ended Line Driver MM78C30/MM88C30 Dual Differential Line Driver

### General Description

The MM78C30/MM88C30 is a dual differential line driver that also performs the dual four-input NAND or dual four-input AND function. The absence of a clamp diode to  $V_{CC}$  in the input protection circuitry of the MM78C30/MM88C30 allows a CMOS user to interface systems operating at different voltage levels. Thus, a CMOS digital signal source can operate at a  $V_{CC}$  voltage greater than the  $V_{CC}$  voltage of the MM78C30 line driver. The differential output of the MM78C30/MM88C30 eliminates ground-loop errors.

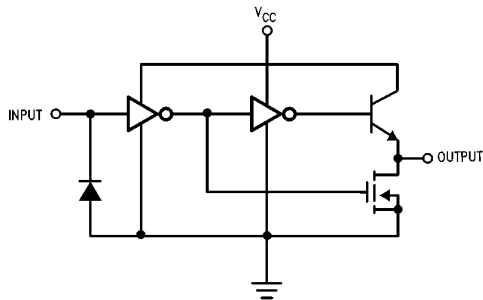
The MM78C29/MM88C29 is a non-inverting single-wire transmission line driver. Since the output ON resistance is a low  $20\Omega$  typ., the device can be used to drive lamps, relays, solenoids, and clock lines, besides driving data lines.

### Features

- Wide supply voltage range 3V to 15V
- High noise immunity  $0.45 V_{CC}$  (typ.)
- Low output ON resistance  $20\Omega$  (typ.)

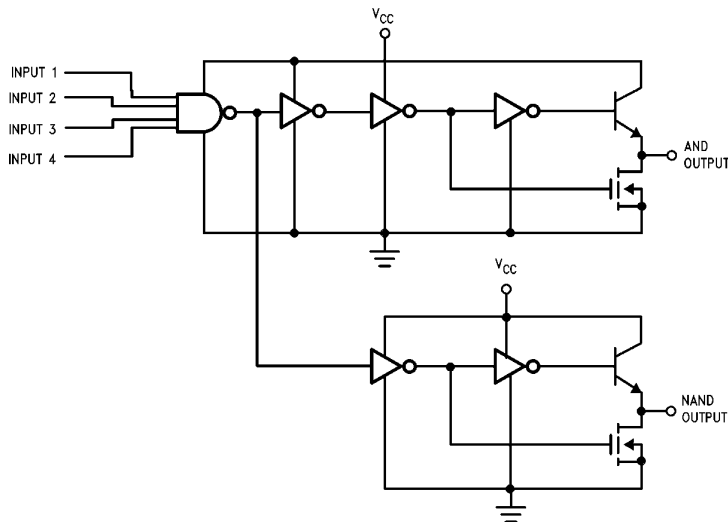
### Logic Diagrams

1/4 MM78C29/MM88C29



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1/2 MM78C30/MM88C30



TL/F/5908-2

## Absolute Maximum Ratings (Note 1)

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

Voltage at Any Pin (Note 1)	-0.3V to $V_{CC} + 16V$
Operating Temperature Range	
MM78C29/MM78C30	-55°C to +125°C
MM88C29/MM88C30	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Power Dissipation ( $P_D$ )	
Dual-In-Line	700 mW
Small Outline	500 mW

Operating $V_{CC}$ Range	3V to 15V
Absolute Maximum $V_{CC}$	18V
Average Current at Output	
MM78C30/MM88C30	50 mA
MM78C29/MM88C29	25 mA
Maximum Junction Temperature, $T_j$	150°C
Lead Temperature (Soldering, 10 seconds)	260°C

## DC Electrical Characteristics

Min/Max limits apply across temperature range unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>CMOS TO CMOS</b>						
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 5V$	3.5			V
		$V_{CC} = 10V$	8			V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5V$			1.5	V
		$V_{CC} = 10V$			2	V
$I_{IN(1)}$	Logical "1" Input Current	$V_{CC} = 15V, V_{IN} = 15V$		0.005	1	$\mu A$
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC} = 15V, V_{IN} = 0V$	-1	-0.005		$\mu A$
$I_{CC}$	Supply Current	$V_{CC} = 5V$		0.05	100	mA
<b>OUTPUT DRIVE</b>						
$I_{SOURCE}$	Output Source Current MM78C29/MM78C30	$V_{OUT} = V_{CC} - 1.6V,$ $V_{CC} \geq 4.5V, T_j = 25^\circ C$ $T_j = 125^\circ C$	-57 -32	-80 -50		mA mA
		$V_{OUT} = V_{CC} - 1.6V,$ $V_{CC} \geq 4.75V, T_j = 25^\circ C$ $T_j = 85^\circ C$	-47 -32	-80 -60		mA mA
	MM88C29/MM88C30	$V_{OUT} = V_{CC} - 0.8V$ $V_{CC} \geq 4.5V$	-2	-20		mA
$I_{SINK}$	Output Sink Current MM78C29/MM78C30	$V_{OUT} = 0.4V, V_{CC} = 4.5V,$ $T_j = 25^\circ C$ $T_j = 125^\circ C$	11 8	20 14		mA mA
		$V_{OUT} = 0.4V, V_{CC} = 10V,$ $T_j = 25^\circ C$ $T_j = 125^\circ C$	22 16	40 28		mA mA
	MM88C29/MM88C30	$V_{OUT} = 0.4V, V_{CC} = 4.75V,$ $T_j = 25^\circ C$ $T_j = 85^\circ C$	9.5 8	22 18		mA mA
		$V_{OUT} = 0.4V, V_{CC} = 10V,$ $T_j = 25^\circ C$ $T_j = 125^\circ C$	19 15.5	40 33		mA mA
$I_{SOURCE}$	Output Source Resistance MM78C29/MM78C30	$V_{OUT} = V_{CC} - 1.6V,$ $V_{CC} \geq 4.5V, T_j = 25^\circ C$ $T_j = 125^\circ C$		20 32	28 50	$\Omega$ $\Omega$
		MM88C29/MM88C30	$V_{OUT} = V_{CC} - 1.6V,$ $V_{CC} \geq 4.75V, T_j = 25^\circ C$ $T_j = 85^\circ C$		20 27	34 50

## DC Electrical Characteristics

Min/Max limits apply across temperature range, unless otherwise noted (Continued)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>OUTPUT DRIVE (Continued)</b>						
$I_{SINK}$	Output Sink Resistance MM78C29/MM78C30	$V_{OUT} = 0.4V, V_{CC} = 4.50V,$ $T_j = 25^\circ C$		20	36	$\Omega$
		$T_j = 125^\circ C$		28	50	$\Omega$
	MM88C29/MM88C30	$V_{OUT} = 0.4V, V_{CC} = 10V,$ $T_j = 25^\circ C$		10	18	$\Omega$
		$T_j = 125^\circ C$		14	25	$\Omega$
		$V_{OUT} = 0.4V, V_{CC} = 4.75V,$ $T_j = 25^\circ C$		18	41	$\Omega$
		$T_j = 85^\circ C$		22	50	$\Omega$
		$V_{OUT} = 0.4V, V_{CC} = 10V,$ $T_j = 25^\circ C$		10	21	$\Omega$
		$T_j = 85^\circ C$		12	26	$\Omega$
	Output Resistance Temperature Coefficient Source Sink			0.55 0.40		%/ $^\circ C$ %/ $^\circ C$
$\theta_{JA}$	Thermal Resistance MM78C29/MM78C30 (D-Package)			100		$^\circ C/W$
	MM88C29/MM88C30 (N-Package)			150		$^\circ C/W$

## AC Electrical Characteristics\* $T_A = 25^\circ C, C_L = 50 pF$

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{pd}$	Propagation Delay Time to Logical "1" or "0" MM78C29/MM88C29	(See Figure 2)				
		$V_{CC} = 5V$		80	200	ns
	$V_{CC} = 10V$		35	100	ns	
	MM78C30/MM88C30	$V_{CC} = 5V$		110	350	ns
		$V_{CC} = 10V$		50	150	ns
$t_{pd}$	Differential Propagation Delay Time to Logical "1" or "0" MM78C30/MM88C30	$R_L = 100\Omega, C_L = 5000 pF$ (See Figure 1)				
		$V_{CC} = 5V$			400	ns
		$V_{CC} = 10V$			150	ns
$C_{IN}$	Input Capacitance MM78C29/MM88C29 MM78C30/MM88C30	(Note 3)		5.0		pF
		(Note 3)		5.0		pF
$C_{PD}$	Power Dissipation Capacitance MM78C29/MM88C29 MM78C30/MM88C30	(Note 3)		150		pF
		(Note 3)		200		pF

\*AC Parameters are guaranteed by DC correlated testing.

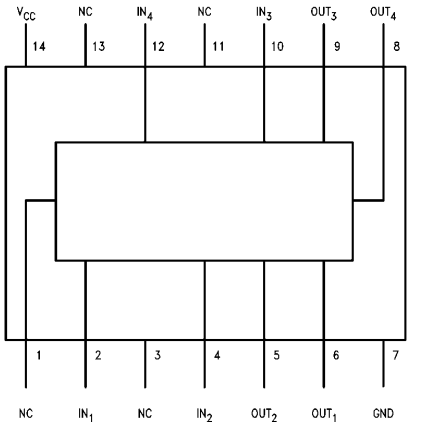
**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

**Note 2:** Capacitance is guaranteed by periodic testing.

**Note 3:**  $C_{PD}$  determines the no load AC power consumption of any CMOS device. For complete explanation see 54C/74C Family Characteristics application note AN-90 (CMOS Logic Databook).

## Connection Diagrams

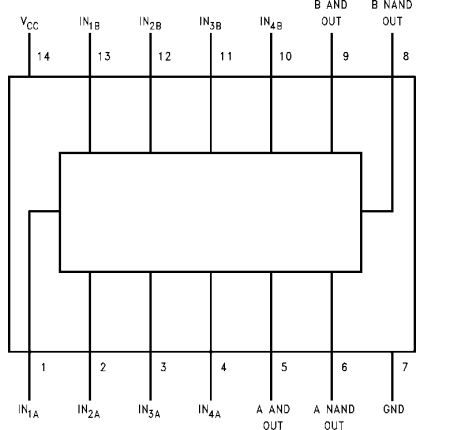
**Dual-In-Line Package  
MM78C29/MM88C29**



Top View

Order Number MM88C29M or MM88C29N

**Dual-In-Line Package  
MM78C30/MM88C30**



Top View

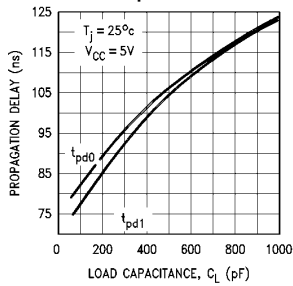
Order Number MM88C30M or MM88C30N

For Complete Military 883 Specifications, see RETS Data Sheet.  
Order Number MM78C29J/883, MM78C29W/883, MM78C30J/883 or MM78C30W/883

## Typical Performance Characteristics

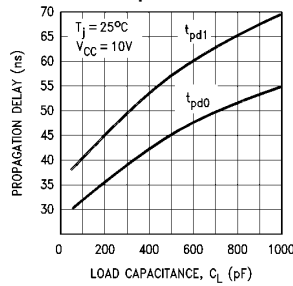
**MM78C29/MM88C29**

**Typical Propagation Delay vs Load Capacitance**



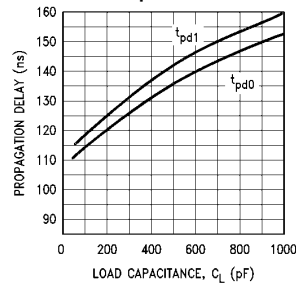
**MM78C29/MM88C29**

**Typical Propagation Delay vs Load Capacitance**



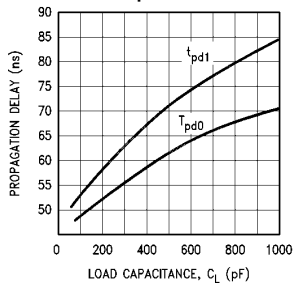
**MM78C30/MM88C30**

**Typical Propagation Delay vs Load Capacitance**

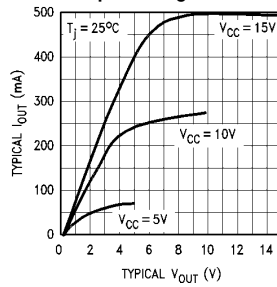


**MM78C30/MM88C30**

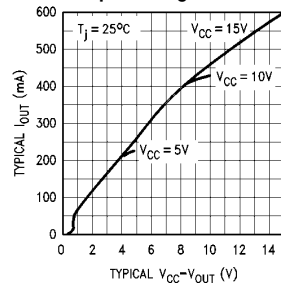
**Typical Propagation Delay vs Load Capacitance**



**Typical Sink Current vs Output Voltage**

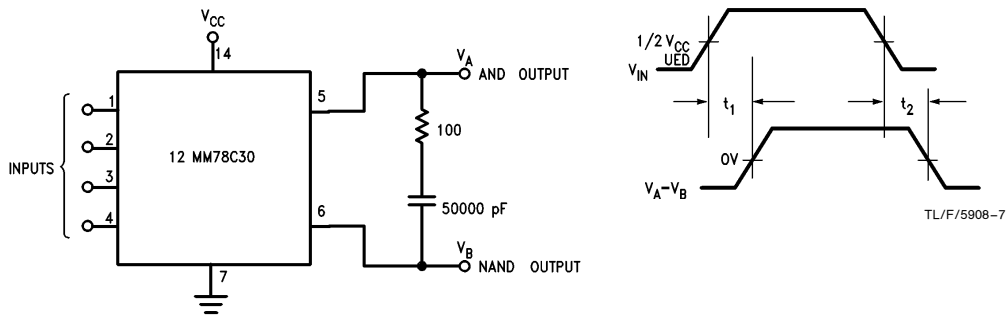


**Typical Source Current vs Output Voltage**

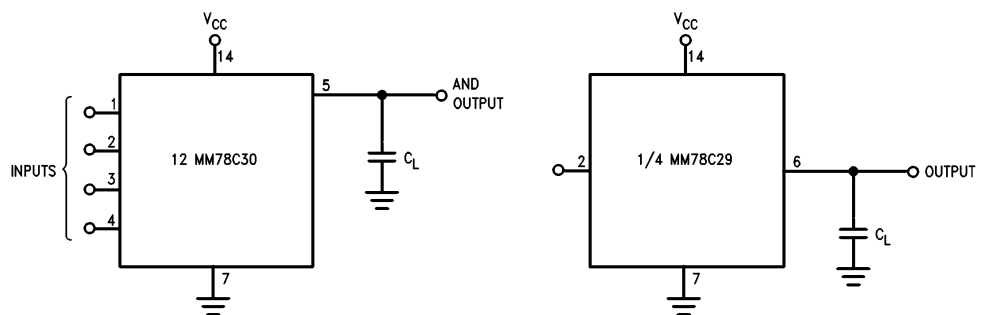


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## AC Test Circuits



TL/F/5908-6  
FIGURE 1

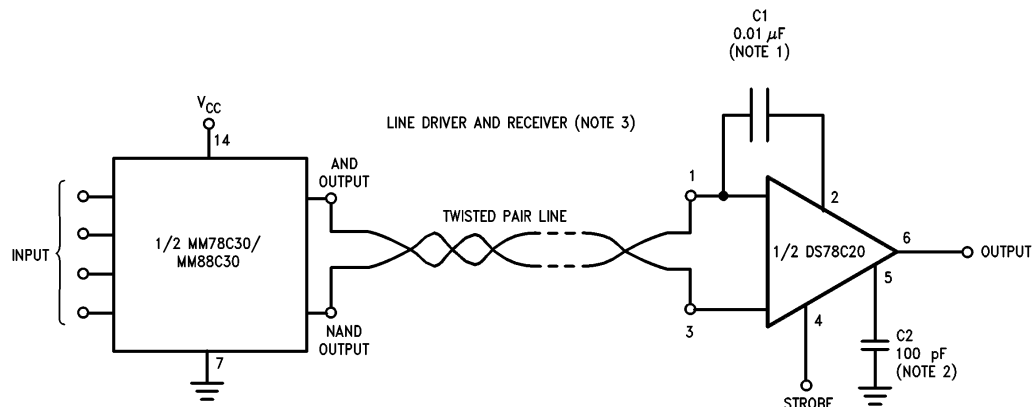


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FIGURE 2

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## Typical Applications

### Digital Data Transmission



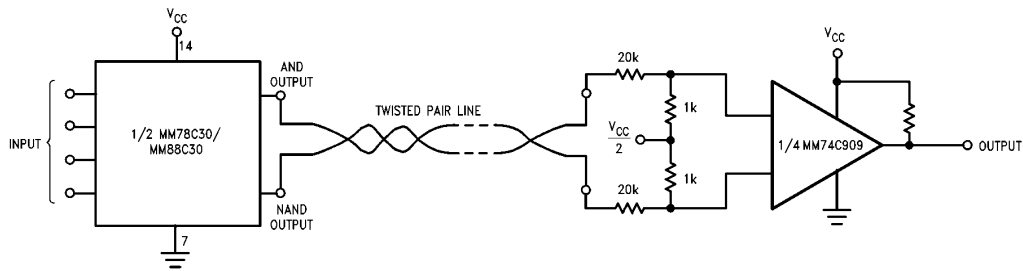
Note 1: Exact value depends on line length.

Note 2: Optional to control response time.

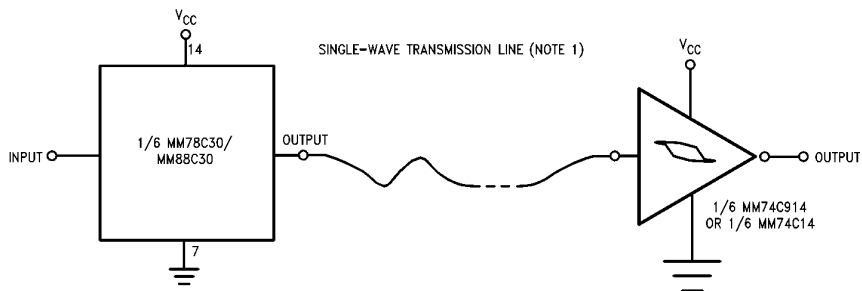
Note 3:  $V_{CC} = 4.5V$  to  $5.5V$  for the DS7820,  $V_{CC} = 4.5V$  to  $15V$  for the DS78C20.

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## Typical Applications (Continued)



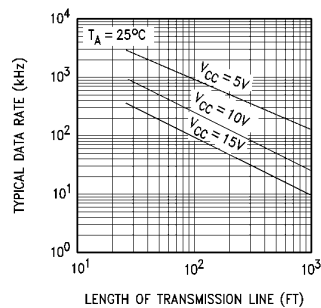
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Note 1:  $V_{CC}$  is 3V to 15V

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### Typical Data Rate vs Transmission Line Length

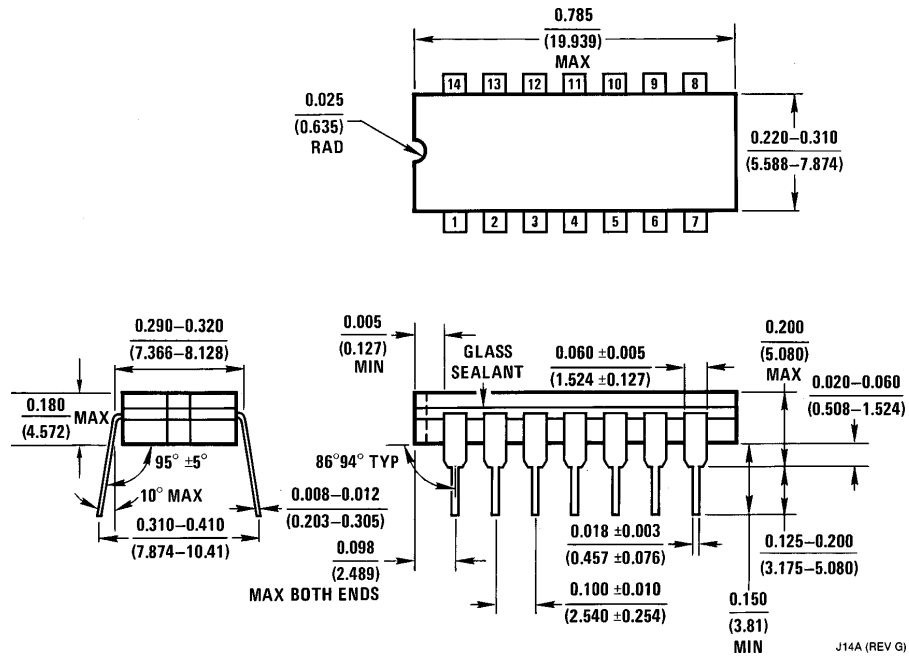


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Note 1: The transmission line used was #22 gauge unshielded twisted pair (40k termination).

Note 2: The curves generated assume that both drivers are driving equal lines, and that the maximum power is 500 mW/package.

**Physical Dimensions** inches (millimeters)

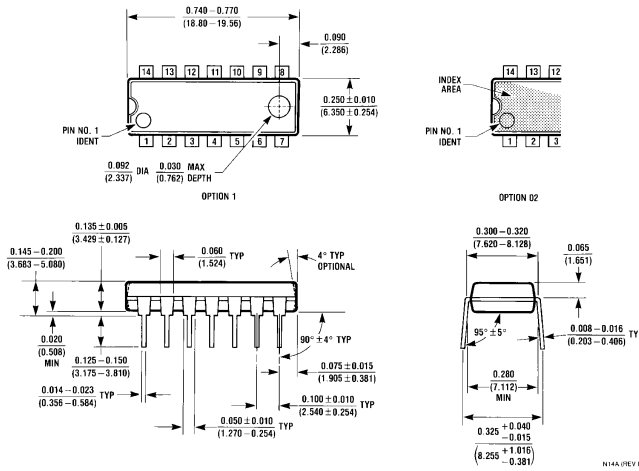


**Ceramic Dual-In-Line Package (J)**  
**Order Number MM78C29J, MM78C30J, MM88C29J or MM88C30J**  
**NS Package Number J14A**

J14A (REV G)

**MM78C29/MM88C29 Quad Single-Ended Line Driver  
MM78C30/MM88C30 Dual Differential Line Driver**

**Physical Dimensions** inches (millimeters) (Continued)



**Molded Dual-In-Line Package (N)**  
Order Number MM78C29N, MM78C30N, MM88C29N or MM88C30N  
NS Package Number N14A

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