



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.

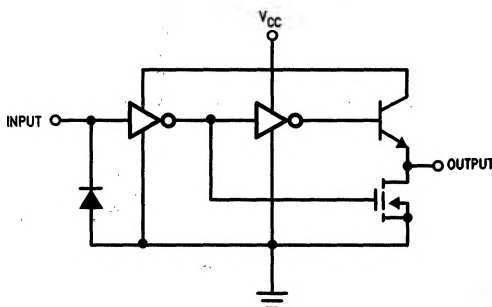
The MM78C29/MM88C29 is a non-inverting single-wire transmission line driver. Since the output ON resistance is a low 20Ω typ., the device can be used to drive lamps, relays, solenoids, and clock lines, besides driving data lines.

Features

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

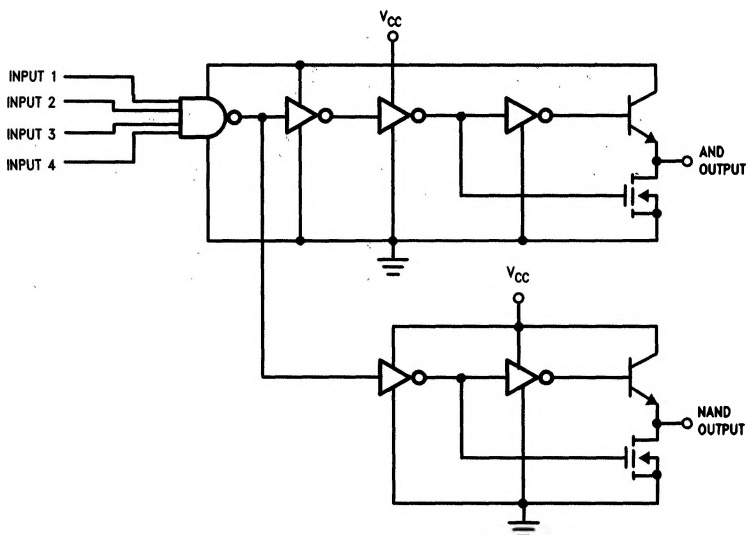
Logic Diagrams

1/4 MM78C29/MM88C29



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1/2 MM78C30/MM88C30



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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 $-55^{\circ}C$ to $+125^{\circ}C$

MM88C29/MM88C30 $-40^{\circ}C$ to $+85^{\circ}C$

Storage Temperature $-65^{\circ}C$ to $+150^{\circ}C$

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

$150^{\circ}C$

Lead Temperature

(Soldering, 10 seconds)

$260^{\circ}C$

DC Electrical Characteristics Min/Max limits apply across temperature range unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
CMOS TO CMOS						
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$	3.5 8			V V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$			1.5 2	V V
$I_{IN(1)}$	Logical "1" Input Current	$V_{CC} = 15V, V_{IN} = 15V$		0.005	1	μA
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC} = 15V, V_{IN} = 0V$	-1	-0.005		μA
I_{CC}	Supply Current	$V_{CC} = 5V$		0.05	100	mA
OUTPUT DRIVE						
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
	MM88C29/MM88C30	$V_{OUT} = V_{CC} - 1.6V$, $V_{CC} \geq 4.75V, T_j = 25^{\circ}C$ $T_j = 85^{\circ}C$	-47 -32	-80 -60		mA mA
	MM78C29/MM88C29 MM78C30/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
	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	Ω Ω
I_{SOURCE}	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	Ω Ω

DC Electrical Characteristics

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
OUTPUT DRIVE (Continued)						
I_{SINK}	Output Sink Resistance MM78C29/MM78C30	$V_{OUT} = 0.4V, V_{CC} = 4.50V,$ $T_J = 25^\circ C$		20	36	Ω
		$T_J = 125^\circ C$		28	50	Ω
	MM88C29/MM88C30	$V_{OUT} = 0.4V, V_{CC} = 10V,$ $T_J = 25^\circ C$		10	18	Ω
		$T_J = 125^\circ C$		14	25	Ω
	Output Resistance Temperature Coefficient Source Sink	$V_{OUT} = 0.4V, V_{CC} = 4.75V,$ $T_J = 25^\circ C$		18	41	Ω
		$T_J = 85^\circ C$		22	50	Ω
		$V_{OUT} = 0.4V, V_{CC} = 10V,$ $T_J = 25^\circ C$		10	21	Ω
		$T_J = 85^\circ C$		12	26	Ω
θ_{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
	MM78C30/MM88C30	$V_{CC} = 10V$		35	100	ns
				110	350	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
C_{IN}	Input Capacitance MM78C29/MM88C29 MM78C30/MM88C30	$V_{CC} = 10V$			150	ns
C_{PD}	Power Dissipation Capacitance MM78C29/MM88C29 MM78C30/MM88C30	(Note 3)		5.0		pF
		(Note 3)		5.0		pF
		(Note 3)		150		pF
		(Note 3)		200		pF

*AC Parameters are guaranteed by DC correlated testing.

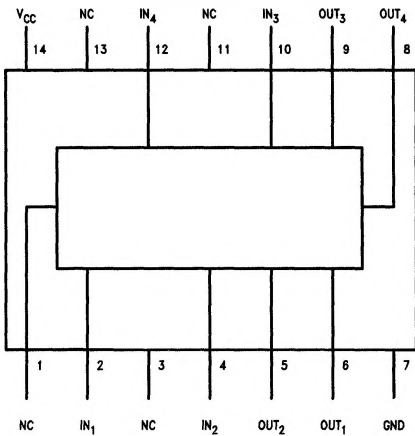
Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual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

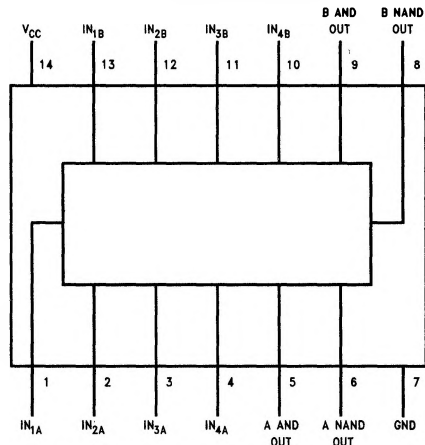
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Order Number MM88C29M or MM88C29N

For Complete Military 883 Specifications, see RETS Data Sheet.

Order Number MM78C29J/883, MM78C29W/883, MM78C30J/883 or MM78C30W/883

Dual-In-Line Package
MM78C30/MM88C30



Top View

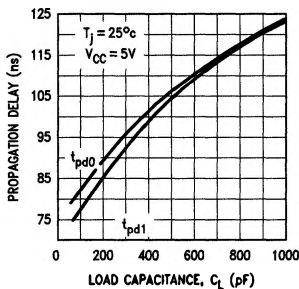
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Order Number MM88C30M or MM88C30N

Typical Performance Characteristics

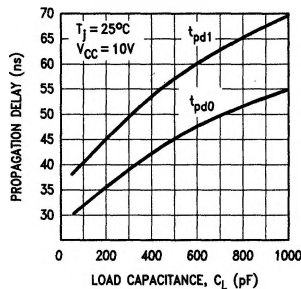
MM78C29/MM88C29

Typical Propagation Delay vs
Load Capacitance



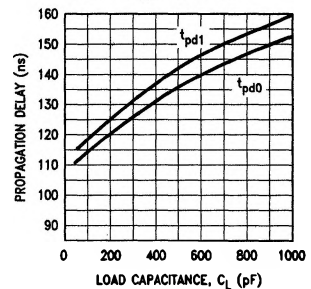
MM78C29/MM88C29

Typical Propagation Delay vs
Load Capacitance



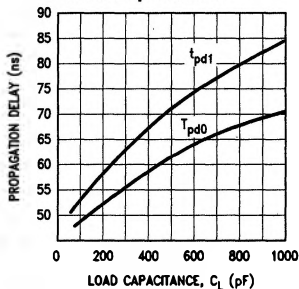
MM78C30/MM88C30

Typical Propagation Delay vs
Load Capacitance

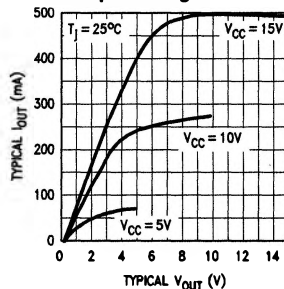


MM78C30/MM88C30

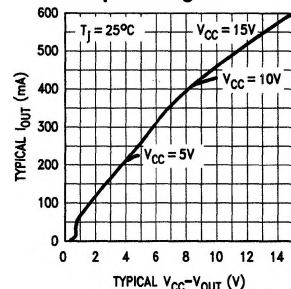
Typical Propagation Delay vs
Load Capacitance



Typical Sink Current vs
Output Voltage

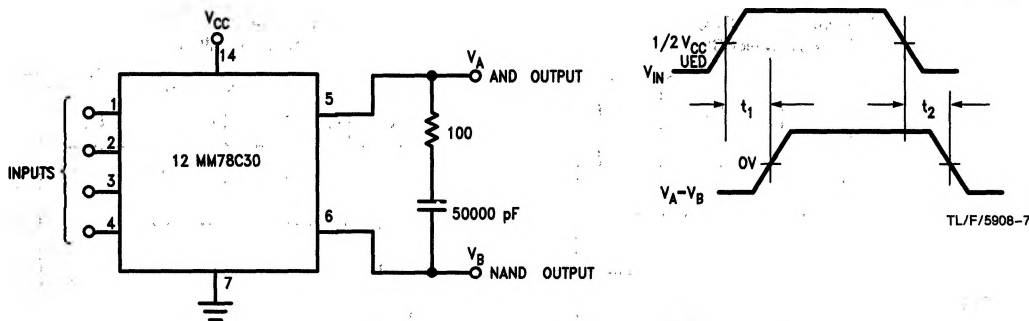


Typical Source Current vs
Output Voltage



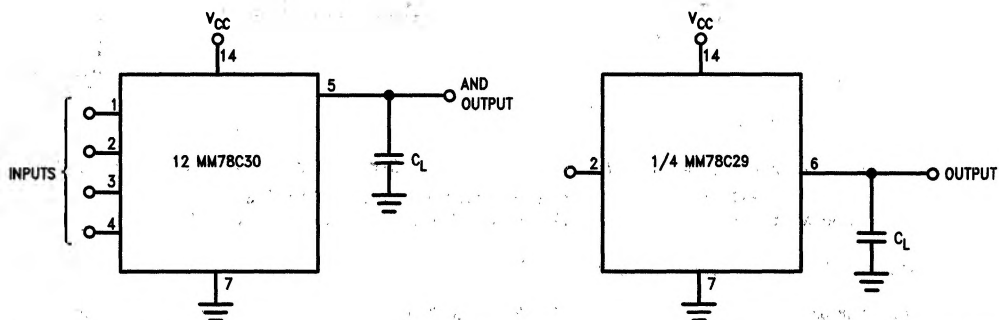
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AC Test Circuits



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FIGURE 1



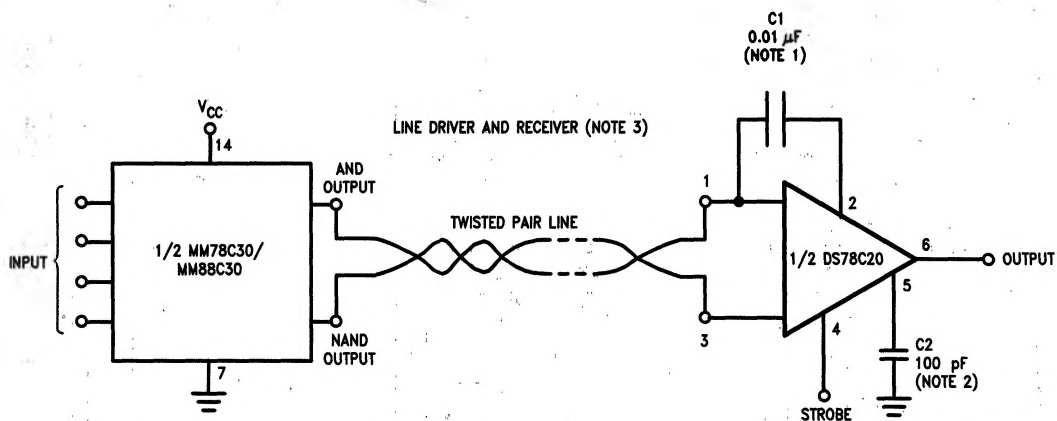
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FIGURE 2

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Typical Applications

Digital Data Transmission



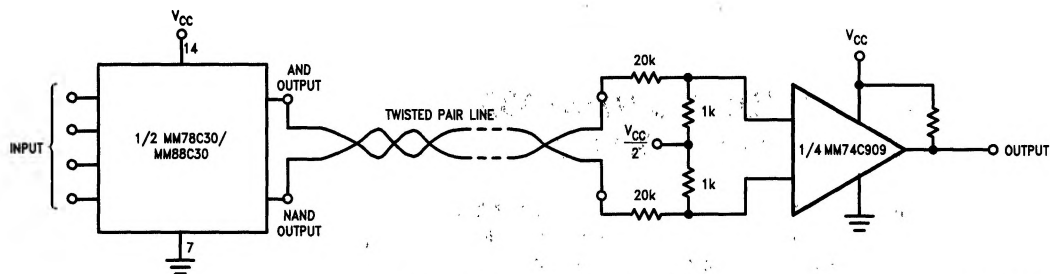
Note 1: Exact value depends on line length.

Note 2: Optional to control response time.

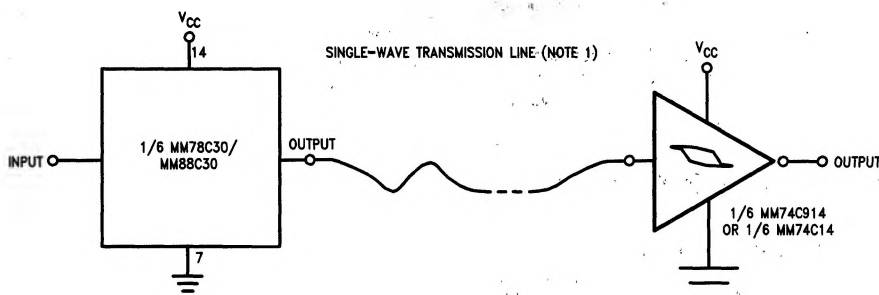
Note 3: $V_{CC} = 4.5V$ to $5.5V$ for the DS7820, $V_{CC} = 4.5V$ to $15V$ for the DS78C20.

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Typical Applications (Continued)

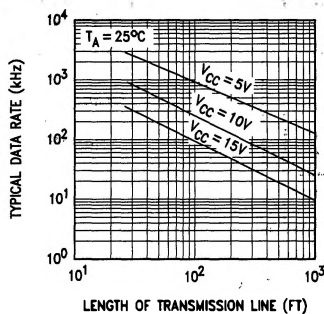


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Note 1: V_{CC} is 3V to 15V

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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.