

## MM88C29 • MM88C30

### Quad Single-Ended Line Driver • Dual Differential Line Driver

#### General Description

The 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 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 MM88C30 line driver. The differential output of the MM88C30 eliminates ground-loop errors.

The 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

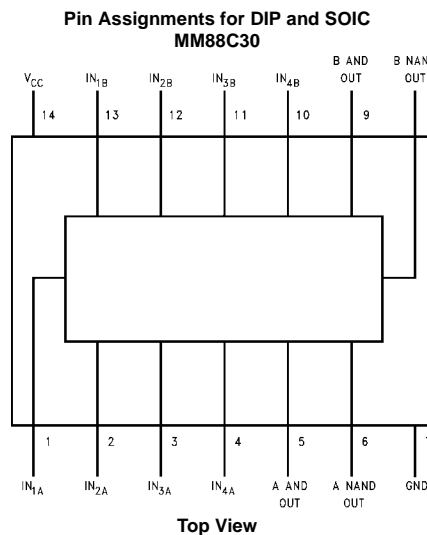
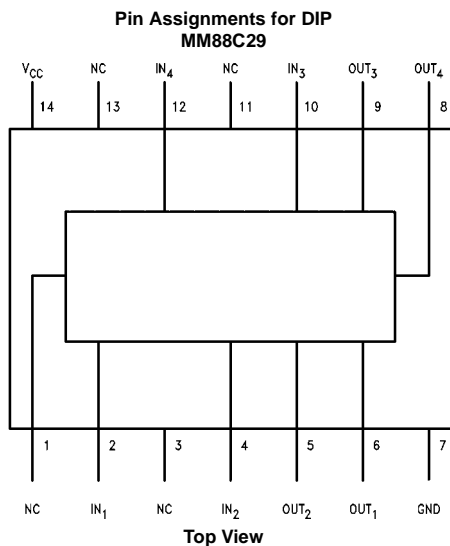
- Wide supply voltage range: 3V to 15V
- High noise immunity:  $0.45 V_{CC}$  (typ.)
- Low output ON resistance:  $20\Omega$  (typ.)

#### Ordering Code:

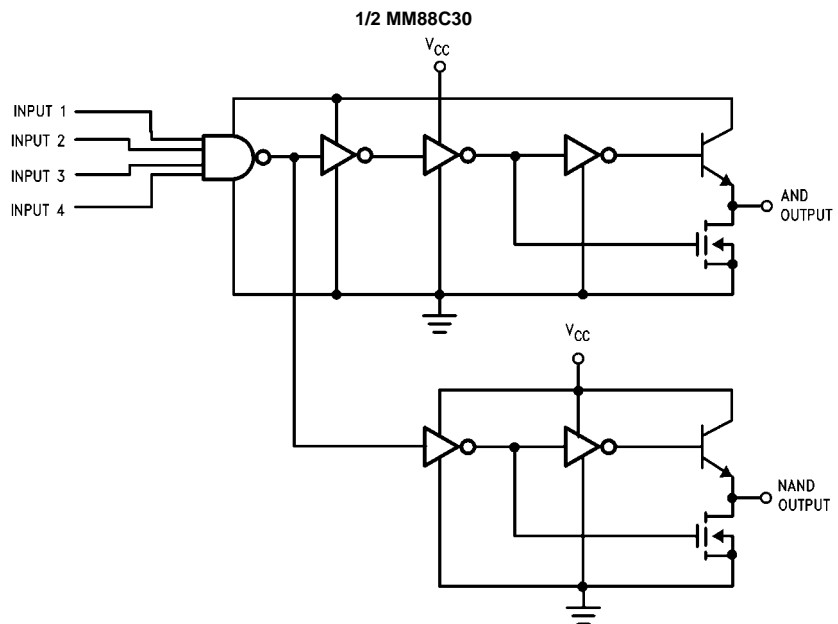
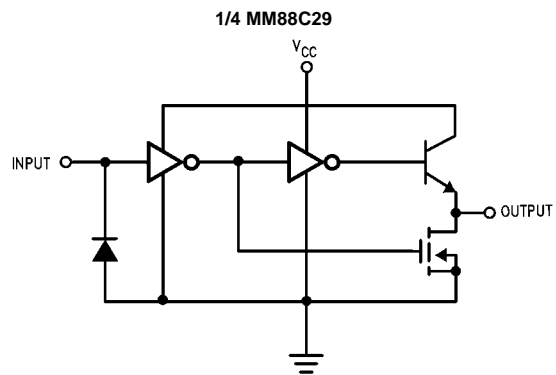
Order Number	Package Number	Package Description
MM88C29N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
MM88C30M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM88C30N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Devices also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

#### Connection Diagrams



## Logic Diagrams



**Absolute Maximum Ratings**(Note 1)

Voltage at Any Pin (Note 2)	−0.3V to $V_{CC} + 16V$
Operating Temperature Range	−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

MM88C30	50 mA
MM88C29	25 mA
Maximum Junction Temperature, $T_j$	150°C
Lead Temperature	
(Soldering, 10 seconds)	260°C

**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 Electrical Characteristics tables provide conditions for actual device operation.

**Note 2:** AC Parameters are guaranteed by DC correlated testing.

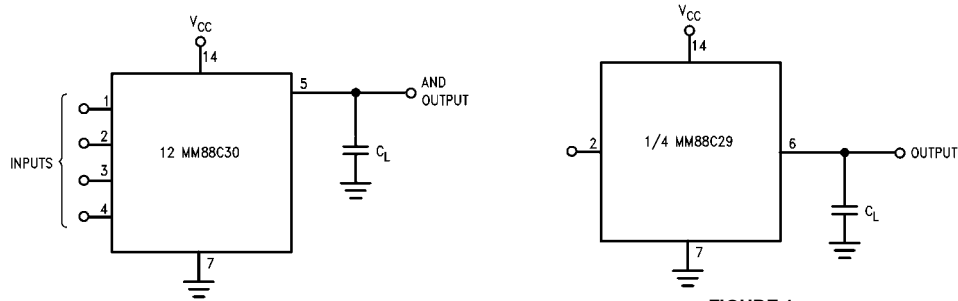
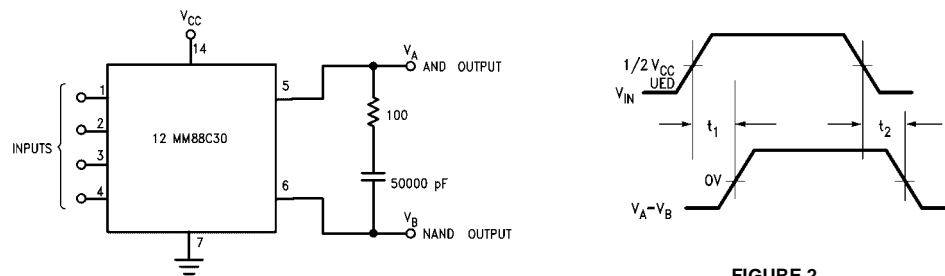
**DC Electrical Characteristics**

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	$V_{CC} = 5V$ $V_{CC} = 10V$	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	$\mu A$
$I_{IN(0)}$	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	$V_{OUT} = V_{CC} - 1.6V,$ $V_{CC} \geq 4.75V, T_j = 25^\circ C$ $T_j = 85^\circ C$	−47 −32	−80 −60		mA mA
		MM88C29 MM88C30	−2	−20		mA
$I_{SINK}$	Output Sink Current	$V_{OUT} = 0.4V, V_{CC} = 4.75V,$ $T_j = 25^\circ C$ $T_j = 85^\circ C$	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 Sink Resistance	$V_{OUT} = 0.4V, V_{CC} = 4.75V,$ $T_j = 25^\circ C$ $T_j = 85^\circ C$		18 22	41 50	$\Omega$ $\Omega$
		$V_{OUT} = 0.4V, V_{CC} = 10V,$ $T_j = 25^\circ C$ $T_j = 85^\circ C$		10 12	21 26	$\Omega$ $\Omega$
	Output Resistance Temperature Coefficient			0.55		%/°C
				0.40		%/°C
$\theta_{JA}$	Thermal Resistance (N-Package)			150		°C/W

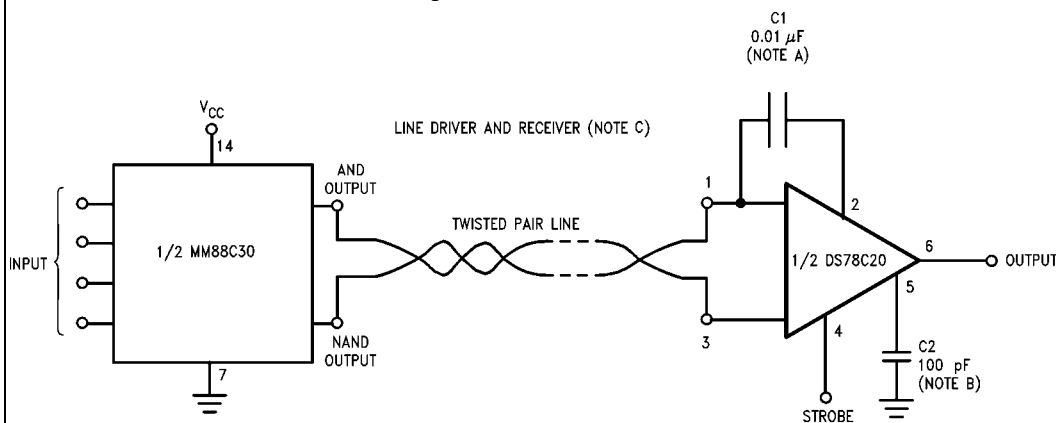
**AC Electrical Characteristics** (Note 2) $T_A = 25^\circ\text{C}$ ,  $C_L = 50\text{ pF}$ 

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

**Note 3:** Capacitance is guaranteed by periodic testing.**Note 4:**  $C_{PD}$  determines the no load AC power consumption of any CMOS device. For complete explanation see Family Characteristics application note AN-90 (CMOS Logic Databook).**AC Test Circuits****FIGURE 1.****FIGURE 2.**

## Typical Applications

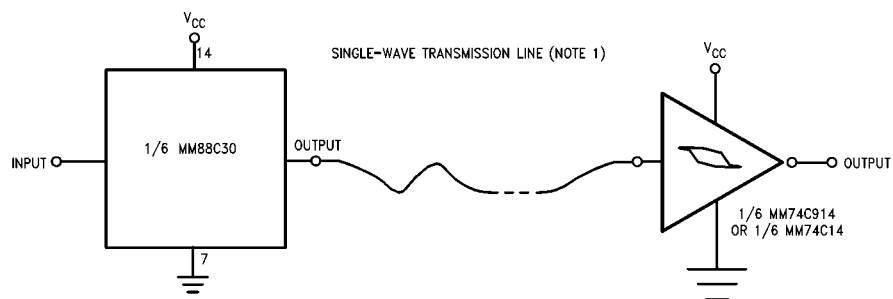
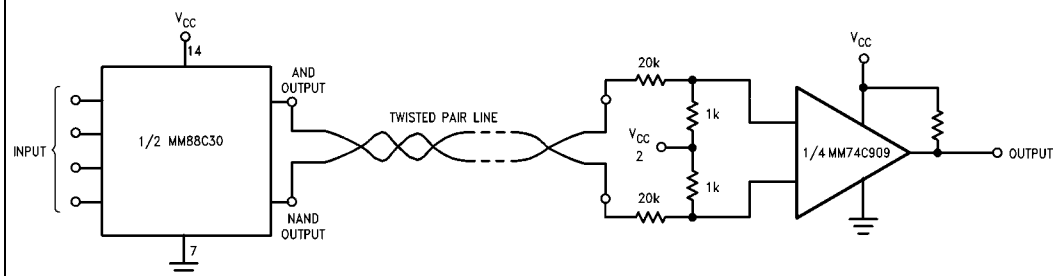
### Digital Data Transmission



Note A: Exact value depends on line length.

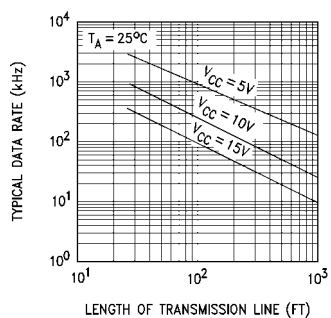
Note B: Optional to control response time.

Note C: V<sub>CC</sub> = 4.5V to 5.5V for the DS7820, V<sub>CC</sub> = 4.5V to 15V for the DS78C20.



V<sub>CC</sub> is 3V to 15V.

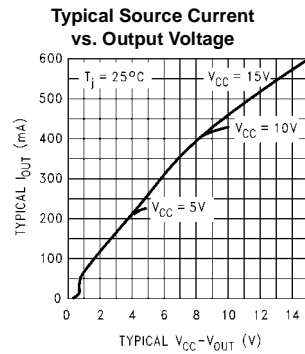
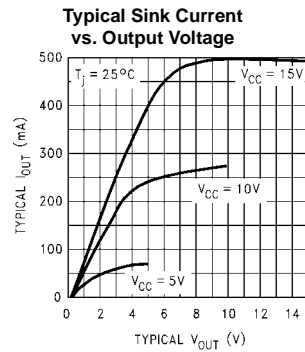
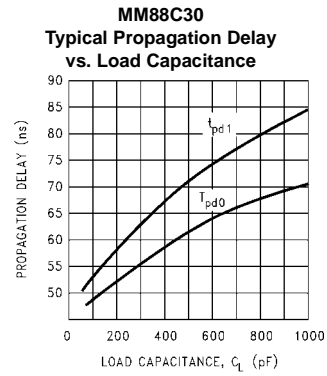
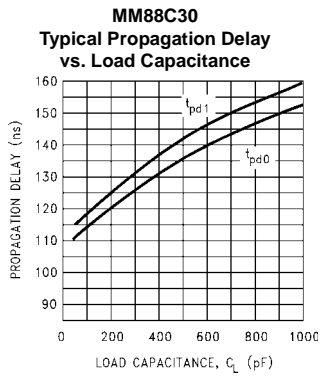
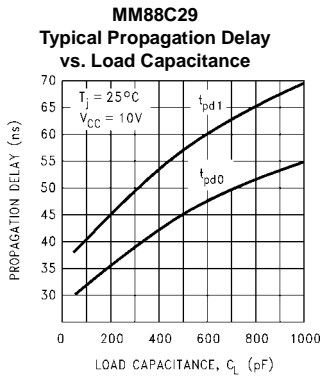
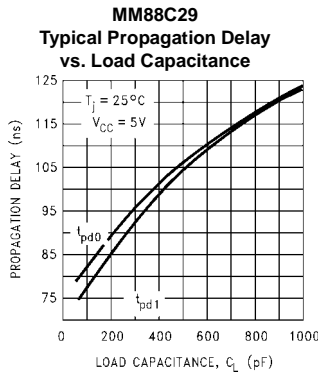
### Typical Data Rate vs Transmission Line Length



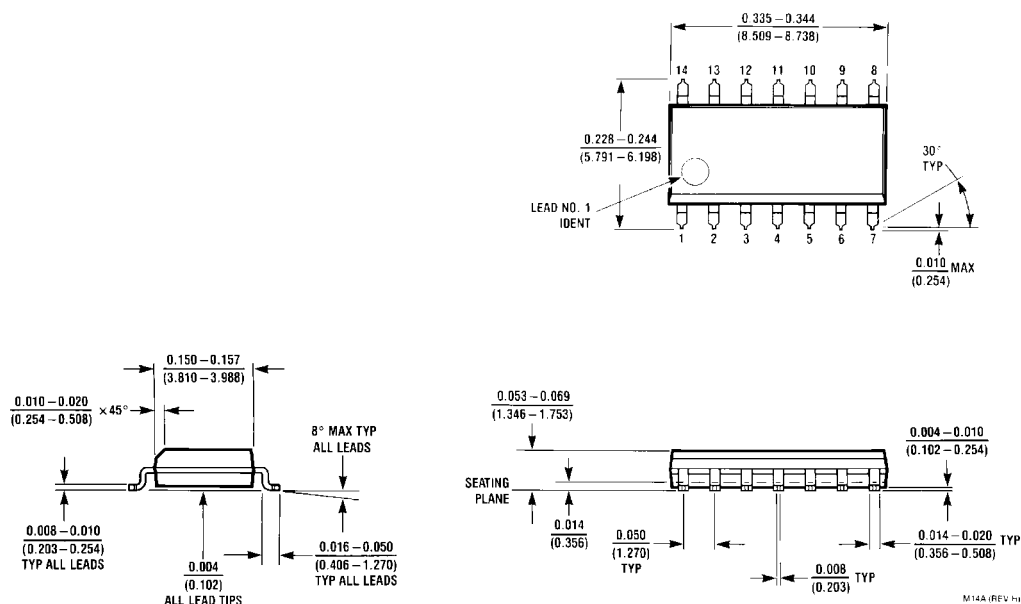
**Note:** The transmission line used was #22 gauge unshielded twisted pair (40k termination).

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

## Typical Performance Characteristics

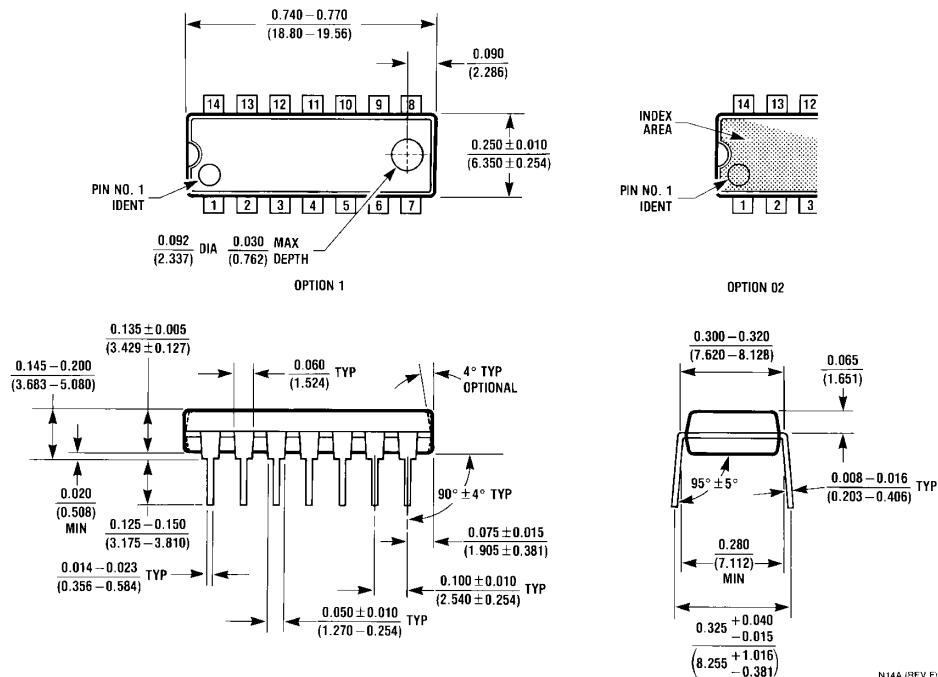


**Physical Dimensions** inches (millimeters) unless otherwise noted



**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow  
Package Number M14A**

## Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide  
Package Number N14A

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