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## 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

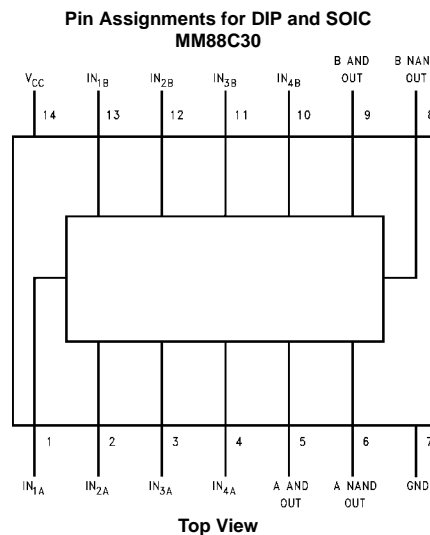
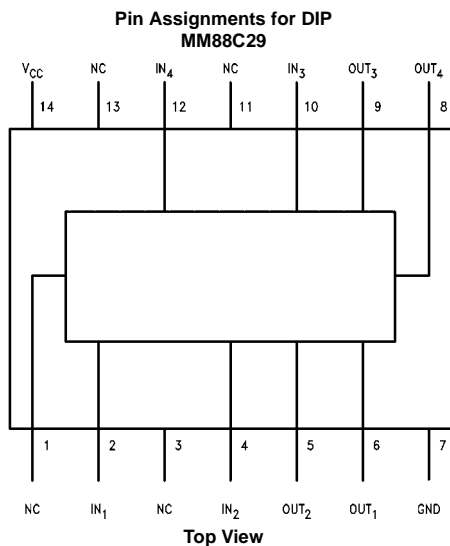
- Wide supply voltage range: 3V to 15V
- High noise immunity:  $0.45 V_{CC}$  (typ.)
- Low output ON resistance:  $20\Omega$  (typ.)

#### Ordering Code:

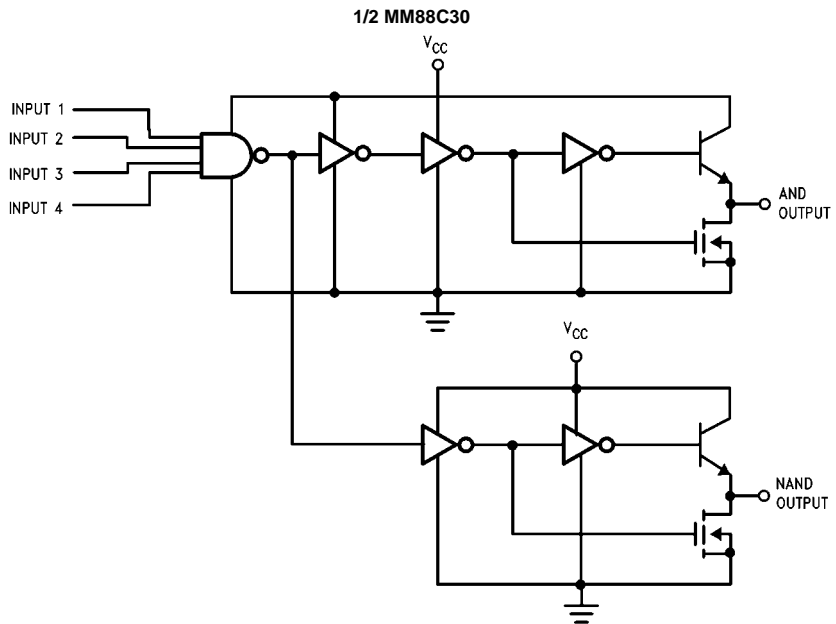
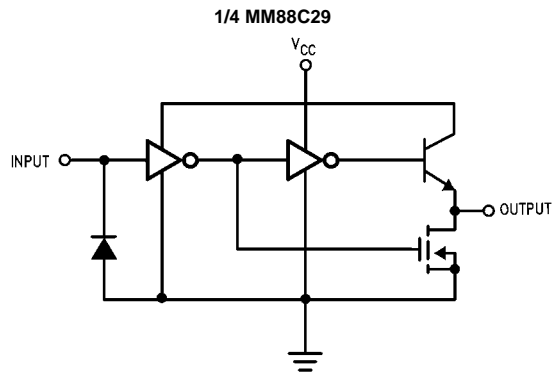
Order Number	Package Number	Package Description
MM88C29N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
MM88C30M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM88C30N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" 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)		Average Current at Output	
Voltage at Any Pin (Note 2)	-0.3V to $V_{CC} + 16V$	MM88C30	50 mA
Operating Temperature Range	-40°C to +85°C	MM88C29	25 mA
Storage Temperature	-65°C to +150°C	Maximum Junction Temperature, $T_j$	150°C
Power Dissipation ( $P_D$ )		Lead Temperature	
Dual-In-Line	700 mW	(Soldering, 10 seconds)	260°C
Small Outline	500 mW		
Operating $V_{CC}$ Range	3V to 15V		
Absolute Maximum $V_{CC}$	18V		

**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	$V_{OUT} = V_{CC} - 0.8V$ $V_{CC} \geq 4.5V$	-2	-20	
$I_{SINK}$	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
$I_{SOURCE}$	Output Source Resistance	$V_{OUT} = V_{CC} - 1.6V,$ $V_{CC} \geq 4.75V, T_j = 25^\circ C$ $T_j = 85^\circ C$		20 27	34 50	$\Omega$ $\Omega$
$I_{SINK}$	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 0.40		%/°C %/°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" MM88C29	(See Figure 1) $V_{CC} = 5\text{V}$		80	200	ns
		$V_{CC} = 10\text{V}$		35	100	ns
	MM88C30	$V_{CC} = 5\text{V}$		110	350	ns
		$V_{CC} = 10\text{V}$		50	150	ns
$t_{pd}$	Differential Propagation Delay Time to Logical "1" or "0" MM88C30	$R_L = 100\Omega$ , $C_L = 5000\text{ pF}$ (See Figure 2)			400	ns
		$V_{CC} = 10\text{V}$			150	ns
$C_{IN}$	Input Capacitance MM88C29 MM88C30	(Note 3)		5.0		pF
		(Note 3)		5.0		pF
$C_{PD}$	Power Dissipation Capacitance MM88C29 MM88C30	(Note 3)		150		pF
		(Note 3)		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 (top left) shows a 12 MM88C30 chip. Pin 14 is VCC, pin 7 is ground. Inputs 1, 2, 3, and 4 are labeled. Output 5 is connected to an AND output terminal and a load capacitor CL.

Figure 1 (top right) shows a 1/4 MM88C29 chip. Pin 14 is VCC, pin 7 is ground. Input 2 is shown. Output 6 is connected to an output terminal and a load capacitor CL.

**FIGURE 1.**

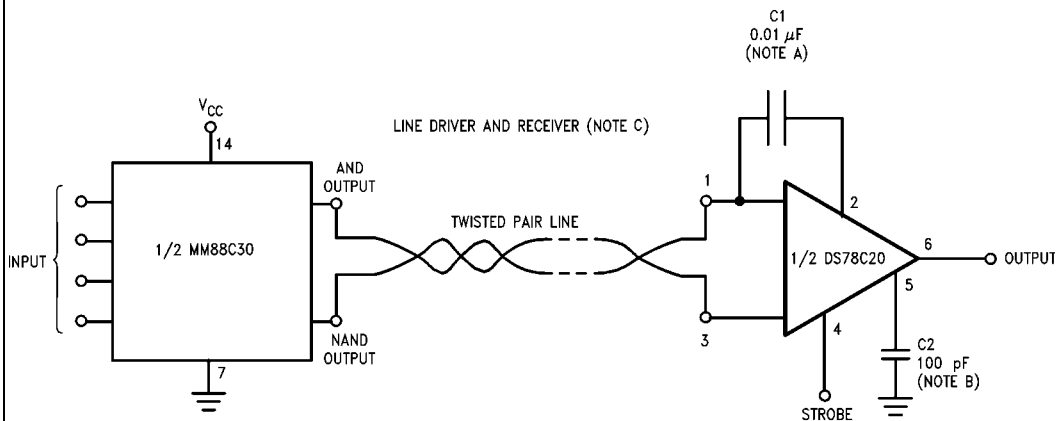
Figure 2 (bottom left) shows a 12 MM88C30 chip. Pin 14 is VCC, pin 7 is ground. Inputs 1, 2, 3, and 4 are labeled. Output 5 is connected to an AND output terminal (VA) through a 100 ohm resistor. Output 6 is connected to a NAND output terminal (VB) through a 50000 pF capacitor.

Figure 2 (bottom right) shows a timing diagram. The input voltage VIN is a square wave with a high level of  $\frac{1}{2} V_{CC} U_{ED}$ . The output voltages VA and VB are square waves with a high level of 0V. Propagation delays t1 and t2 are indicated.

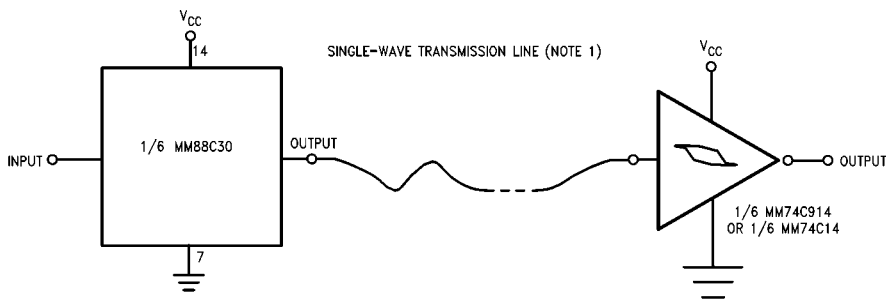
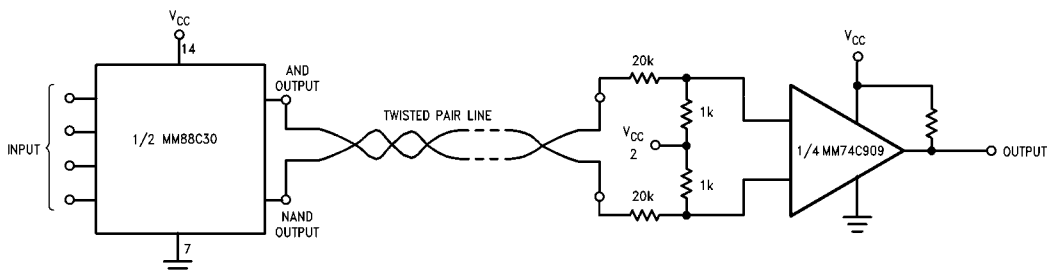
**FIGURE 2.**

## Typical Applications

### Digital Data Transmission

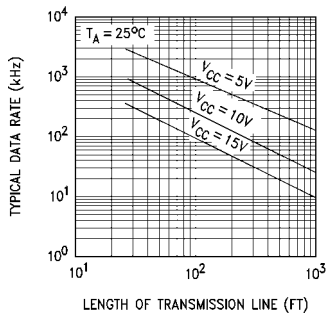


Note A: Exact value depends on line length.  
 Note B: Optional to control response time.  
 Note C:  $V_{CC}$  = 4.5V to 5.5V for the DS7820,  $V_{CC}$  = 4.5V to 15V for the DS78C20.



$V_{CC}$  is 3V to 15V.

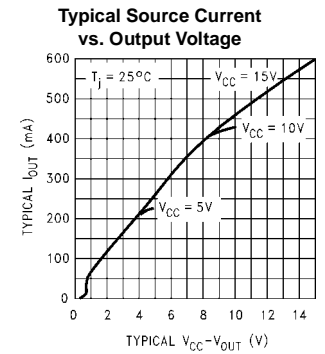
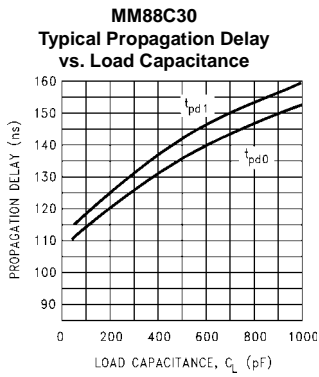
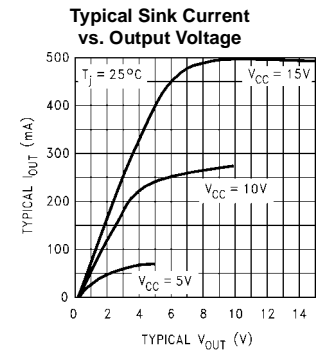
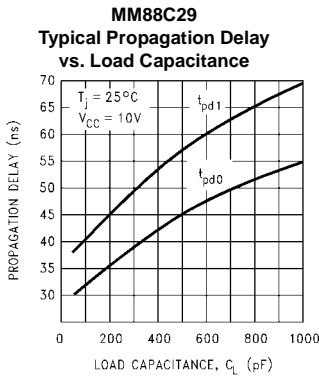
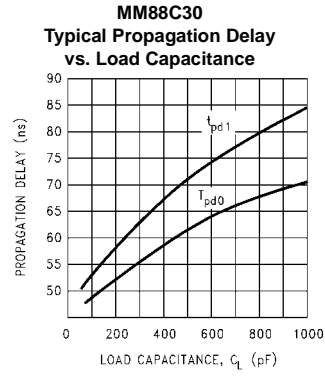
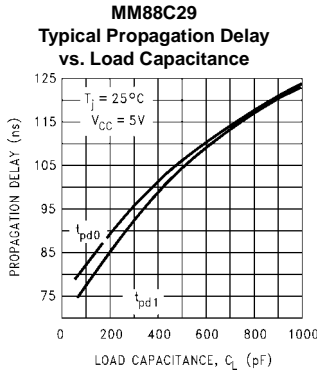
### Typical Data Rate vs Transmission Line Length



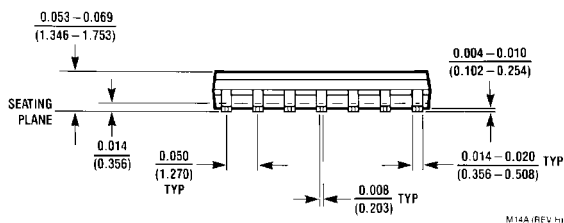
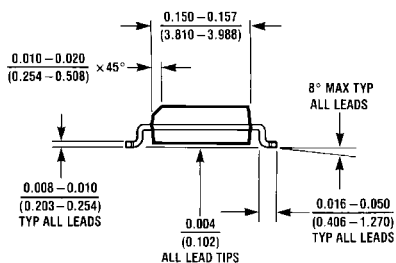
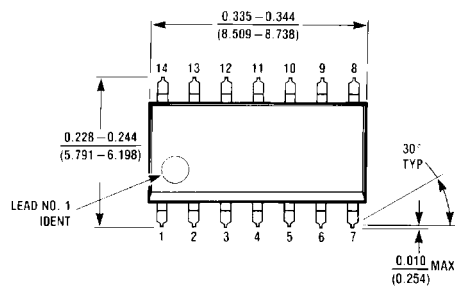
Note: The transmission line used was #22 gauge unshielded twisted pair (40k termination).

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

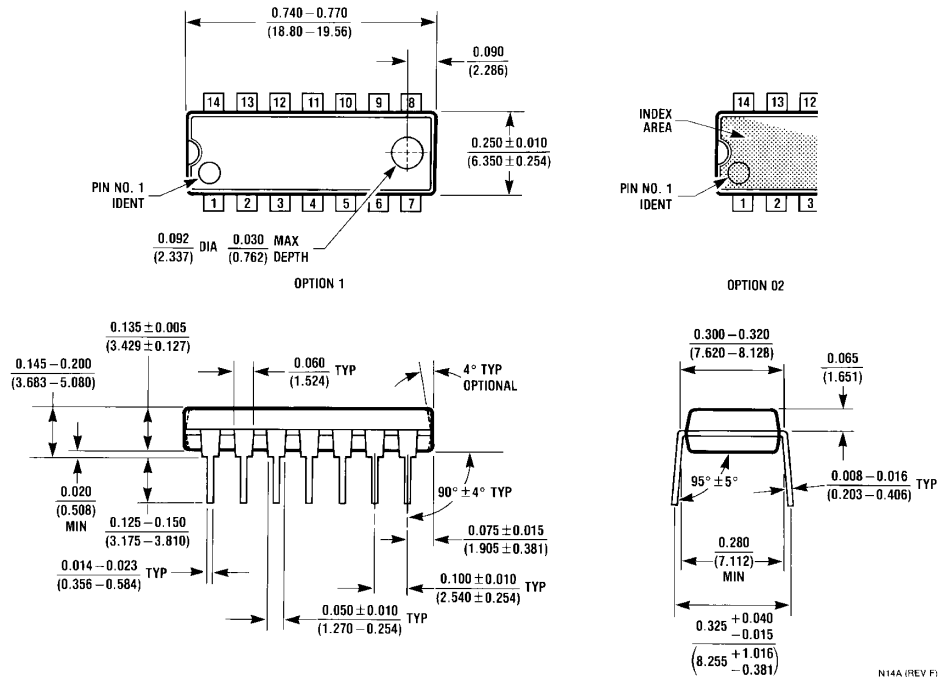


**14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow  
Package Number M14A**

M14A (REV. H)



**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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