National Semiconductor

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.

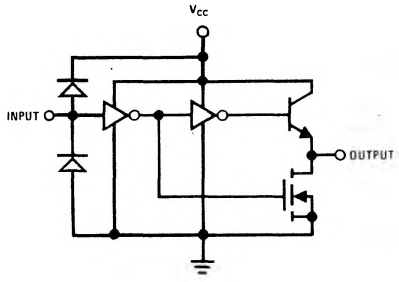
The MM78C29/MM88C29 is a non-inverting single-wire transmission line driver. Since the output ON resistance is a low 20Ω typ., the device can be used to drive lamps, relays, solenoids, and clock lines, besides driving data lines.

Features

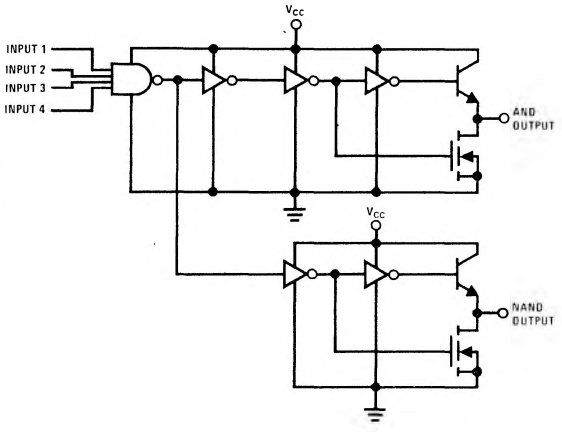
■ Wide supply voltage range	3.0V to 15V
■ High noise immunity	0.45 V_{CC} (typ.)
■ Low output ON resistance	20Ω (typ.)

Logic and Connection Diagrams

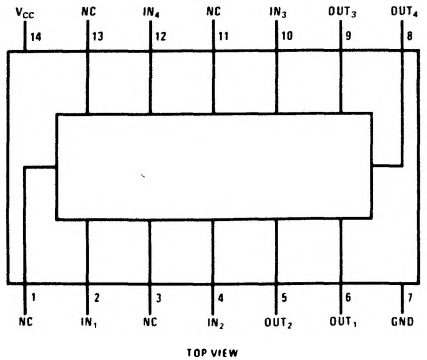
1/4 MM78C29/MM88C29



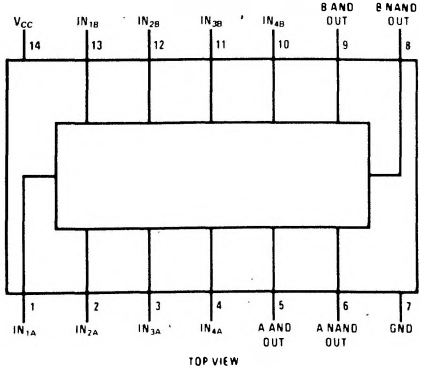
1/2 MM78C30/MM88C30



MM78C29/MM88C29



MM78C30/MM88C30



Absolute Maximum Ratings (Note 1)

Voltage at Any Pin (Note 1)	$-0.3\,V$ to $V_{CC}+16\,V$	Absolute Maximum V_{CC}	18 V
Operating Temperature Range		Average Current at Output	
MM78C29/MM78C30	−55°C to +125°C	MM78C30/MM88C30	50 mA
MM88C29/MM88C30	−40°C to +85°C	MM78C29/MM88C29	25 mA
Storage Temperature	−65°C to +150°C	Maximum Junction Temperature, T_j	150°C
Package Dissipation	500 mW	Lead Temperature (Soldering, 10 sec.)	300°C
Operating V_{CC} Range	3.0 V to 15 V		

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

Parameter	Conditions	Min.	Typ.	Max.	Units
CMOS to CMOS					
$V_{IN(1)}$ Logical "1" Input Voltage	$V_{CC}=5.0\,V$	3.5			V
	$V_{CC}=10\,V$	8.0			V
$V_{IN(0)}$ Logical "0" Input Voltage	$V_{CC}=5.0\,V$			1.5	V
	$V_{CC}=10\,V$			2.0	V
$I_{IN(1)}$ Logical "1" Input Current	$V_{CC}=15\,V$, $V_{IN}=15\,V$		0.005	1.0	μA
$I_{IN(0)}$ Logical "0" Input Current	$V_{CC}=15\,V$, $V_{IN}=0\,V$	−1.0	−0.005		μA
I_{CC} Supply Current	$V_{CC}=15\,V$		0.05	100	μA
Output Drive					
Output Source Current					
MM78C29/MM78C30	$V_{OUT}=V_{CC}-1.6\,V$,				
	$V_{CC}\geq 4.5\,V$, $T_j=25°C$	−57	−80		mA
	$T_j=125°C$	−32	−50		mA
MM88C29/MM88C30	$V_{OUT}=V_{CC}-1.6\,V$,				
	$V_{CC}\geq 4.75\,V$, $T_j=25°C$	−47	−80		mA
	$T_j=85°C$	−32	−60		mA
MM78C29/MM88C29	$V_{OUT}=V_{CC}-0.8\,V$				
MM78C30/MM88C30	$V_{CC}\geq 4.5\,V$	−2.0	−20		mA
Output Sink Current					
MM78C29/MM78C30	$V_{OUT}=0.4\,V$, $V_{CC}=4.50\,V$,				
	$T_j=25°C$	11	20		mA
	$T_j=125°C$	8.0	14		mA
	$V_{OUT}=0.4\,V$, $V_{CC}=10\,V$,				
	$T_j=25°C$	22	40		mA
	$T_j=125°C$	16	28		mA
MM88C29/MM88C30	$V_{OUT}=0.4\,V$, $V_{CC}=4.75\,V$,				
	$T_j=25°C$	9.5	22		mA
	$T_j=85°C$	8.0	18		mA
	$V_{OUT}=0.4\,V$, $V_{CC}=10\,V$,				
	$T_j=25°C$	19	40		mA
	$T_j=125°C$	15.5	33		mA
Output Source Resistance					
MM78C29/MM78C30	$V_{OUT}=V_{CC}-1.6\,V$,				
	$V_{CC}\geq 4.5\,V$, $T_j=25°C$		20	28	Ω
	$T_j=125°C$		32	50	Ω
MM88C29/MM88C30	$V_{OUT}=V_{CC}-1.6\,V$,				
	$V_{CC}\geq 4.75\,V$, $T_j=25°C$		20	34	Ω
	$T_j=85°C$		27	50	Ω

DC Electrical Characteristics (cont'd)

	Parameter	Conditions	Min.	Typ.	Max.	Units
	Output Sink Resistance					
	MM78C29/MM78C30	$V_{OUT} = 0.4\,V$, $V_{CC} = 4.50\,V$,				
		$T_j = 25°C$		20	36	Ω
		$T_j = 125°C$		28	50	Ω
		$V_{OUT} = 0.4\,V$, $V_{CC} = 10\,V$,				
		$T_j = 25°C$		10	18	Ω
		$T_j = 125°C$		14	25	Ω
	MM88C29/MM88C30	$V_{OUT} = 0.4\,V$, $V_{CC} = 4.75\,V$,				
		$T_j = 25°C$		18	41	Ω
		$T_j = 85°C$		22	50	Ω
		$V_{OUT} = 0.4\,V$, $V_{CC} = 10\,V$,				
		$T_j = 25°C$		10	21	Ω
		$T_j = 85°C$		12	26	Ω
	Output Resistance Temperature Coefficient					
	Source			0.55		%/°C
	Sink			0.40		%/°C
θ_{JA}	Thermal Resistance					
	MM78C29/MM78C30 (D-Package)			100		°C/W
	MM88C29/MM88C30 (N-Package)			150		°C/W

AC Electrical Characteristics $T_A = 25°C$, $C_L = 50\,pF$

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

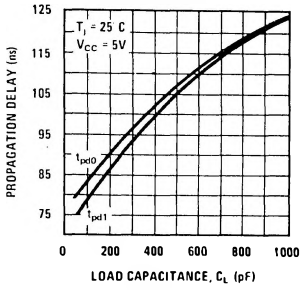
Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual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

Note 2: Capacitance is guaranteed by periodic testing.

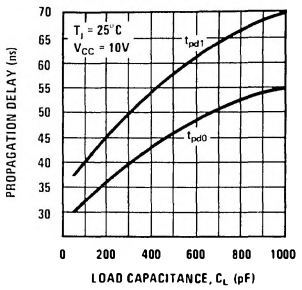
Note 3: C_{PD} determines the no load AC power consumption of any CMOS device. For complete explanation see 54C/74C Family Characteristics application note AN-90.

Typical Performance Characteristics

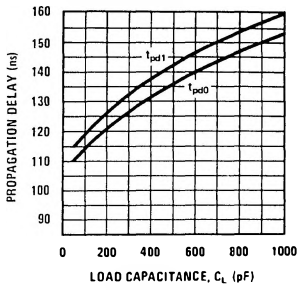
MM78C29/MM88C29
Typical Propagation Delay vs
Load Capacitance



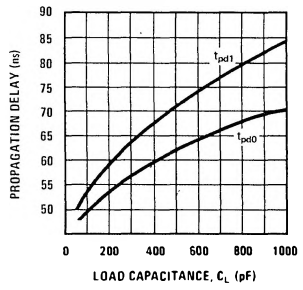
MM78C29/MM88C29
Typical Propagation Delay vs
Load Capacitance



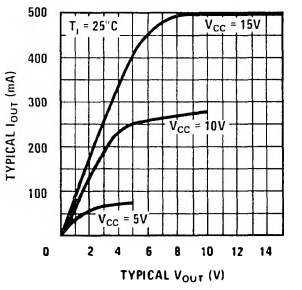
MM78C30/MM88C30
Typical Propagation Delay vs
Load Capacitance



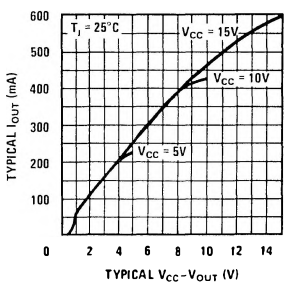
MM78C30/MM88C30
Typical Propagation Delay vs
Load Capacitance



Typical Sink Current vs
Output Voltage



Typical Source Current vs
Output Voltage



AC Test Circuits

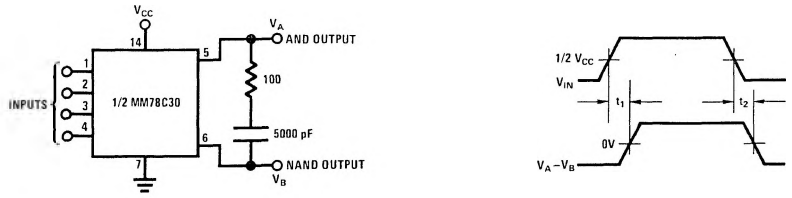


FIGURE 1.

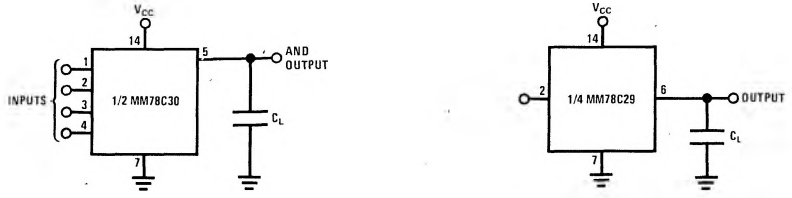
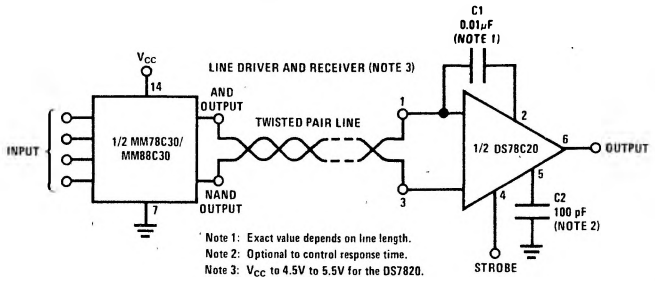


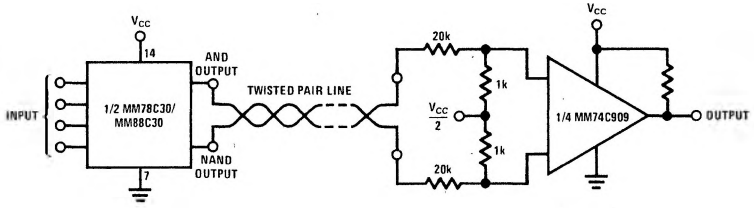
FIGURE 2.

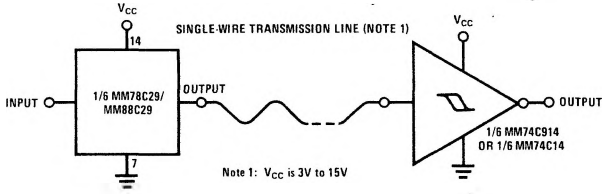
Typical Applications

Digital Data Transmission



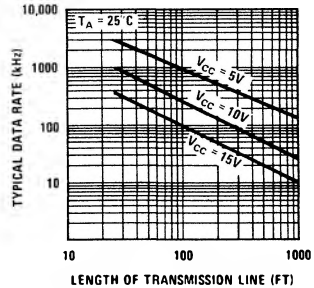
Note 1: Exact value depends on line length.
Note 2: Optional to control response time.
Note 3: V_{CC} to 4.5V to 5.5V for the DS7820.





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

Typical Data Rate vs Transmission Line Length



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.