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.

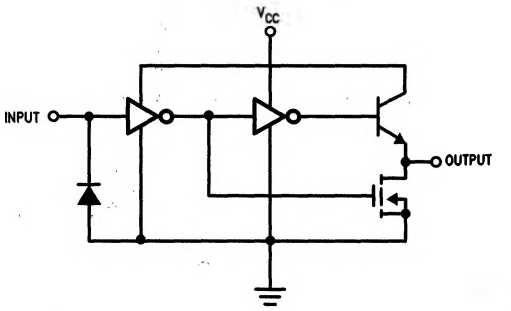
The MM78C29/MM88C29 is a non-inverting single-wire transmission line driver. Since the output ON resistance is a low 20Ω typ., the device can be used to drive lamps, relays, solenoids, and clock lines, besides driving data lines.

Features

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

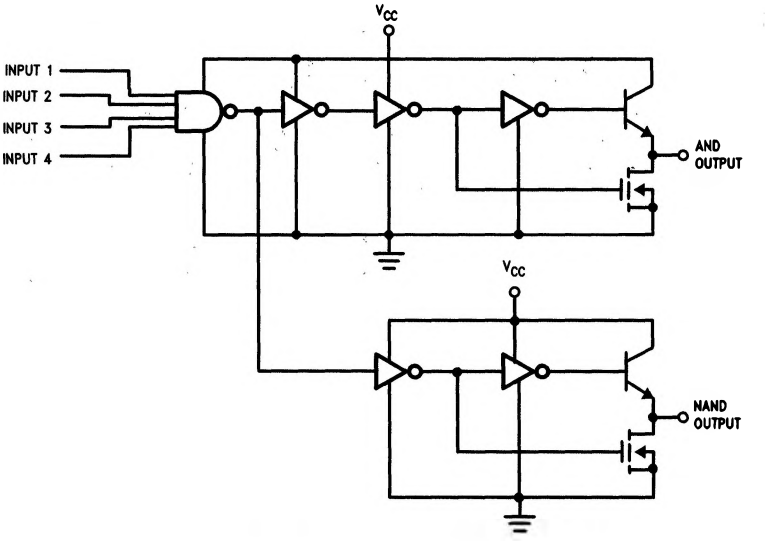
Logic Diagrams

1/4 MM78C29/MM88C29



TL/F/5908–1

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
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} ≥ 4.5V, T_j = 25°C T_j = 125°C	 −57 −32	 −80 −50		 mA mA
	MM88C29/MM88C30	V_{OUT} = V_{CC} − 1.6V, V_{CC} ≥ 4.75V, T_j = 25°C T_j = 85°C	 −47 −32	 −80 −60		 mA mA
	MM78C29/MM88C29 MM78C30/MM88C30	V_{OUT} = V_{CC} − 0.8V V_{CC} ≥ 4.5V	−2	−20		mA
I_{SINK}	Output Sink Current MM78C29/MM78C30	V_{OUT} = 0.4V, V_{CC} = 4.5V, T_j = 25°C T_j = 125°C	 11 8	 20 14		 mA mA
		V_{OUT} = 0.4V, V_{CC} = 10V, T_j = 25°C T_j = 125°C	 22 16	 40 28		 mA mA
	MM88C29/MM88C30	V_{OUT} = 0.4V, V_{CC} = 4.75V, T_j = 25°C T_j = 85°C	 9.5 8	 22 18		 mA mA
		V_{OUT} = 0.4V, V_{CC} = 10V, T_j = 25°C T_j = 125°C	 19 15.5	 40 33		 mA mA
I_{SOURCE}	Output Source Resistance MM78C29/MM78C30	V_{OUT} = V_{CC} − 1.6V, V_{CC} ≥ 4.5V, T_j = 25°C T_j = 125°C		 20 32	 28 50	 Ω Ω
	MM88C29/MM88C30	V_{OUT} = V_{CC} − 1.6V, V_{CC} ≥ 4.75V, T_j = 25°C T_j = 85°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°C		20	36	Ω
		T_j = 125°C		28	50	Ω
		V_{OUT} = 0.4V, V_{CC} = 10V,				
		T_j = 25°C		10	18	Ω
		T_j = 125°C		14	25	Ω
	MM88C29/MM88C30	V_{OUT} = 0.4V, V_{CC} = 4.75V,				
		T_j = 25°C		18	41	Ω
		T_j = 85°C		22	50	Ω
		V_{OUT} = 0.4V, V_{CC} = 10V,				
		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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{pd}	Propagation Delay Time to Logical "1" or "0"	(See *Figure 2*)				
	MM78C29/MM88C29	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"	R_L = 100Ω, C_L = 5000 pF (See *Figure 1*)				
	MM78C30/MM88C30	V_{CC} = 5V			400	ns
		V_{CC} = 10V			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

*AC Parameters are guaranteed by DC correlated testing.

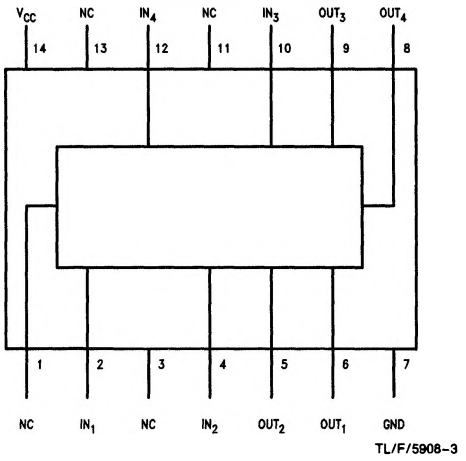
Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual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

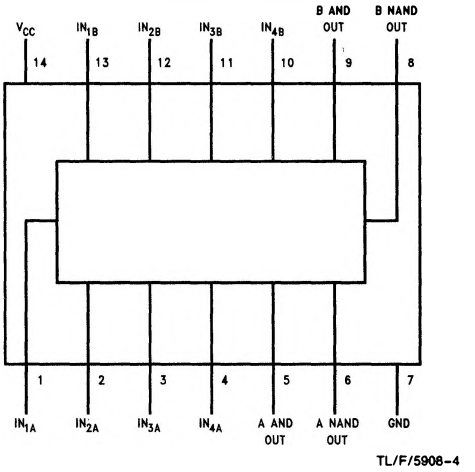
Dual-In-Line Package
MM78C29/MM88C29



Top View

Order Number MM88C29M or MM88C29N

Dual-In-Line Package
MM78C30/MM88C30



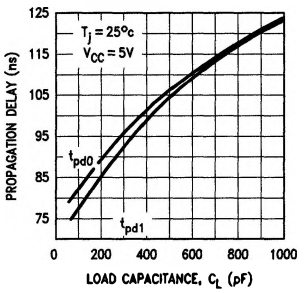
Top View

Order Number MM88C30M or MM88C30N

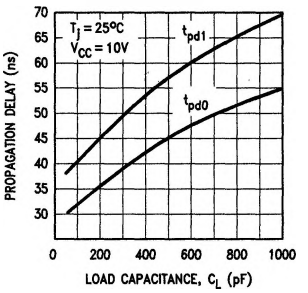
For Complete Military 883 Specifications, see RETS Data Sheet.
Order Number MM78C29J/883, MM78C29W/883, MM78C30J/883 or MM78C30W/883

Typical Performance Characteristics

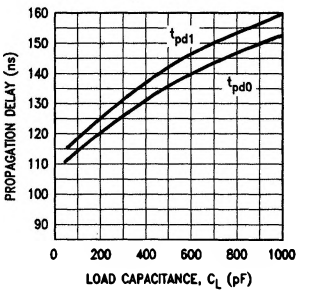
MM78C29/MM88C29
Typical Propagation Delay vs Load Capacitance



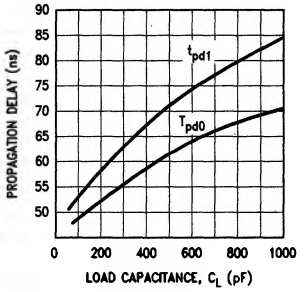
MM78C29/MM88C29
Typical Propagation Delay vs Load Capacitance



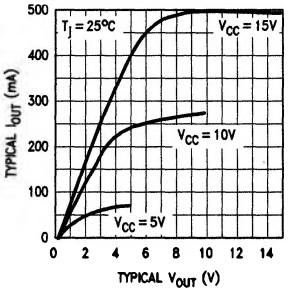
MM78C30/MM88C30
Typical Propagation Delay vs Load Capacitance



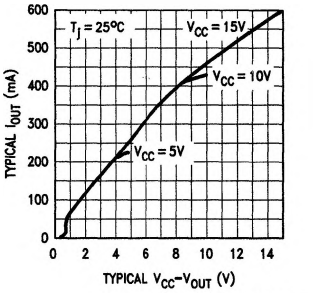
MM78C30/MM88C30
Typical Propagation Delay vs Load Capacitance



Typical Sink Current vs Output Voltage

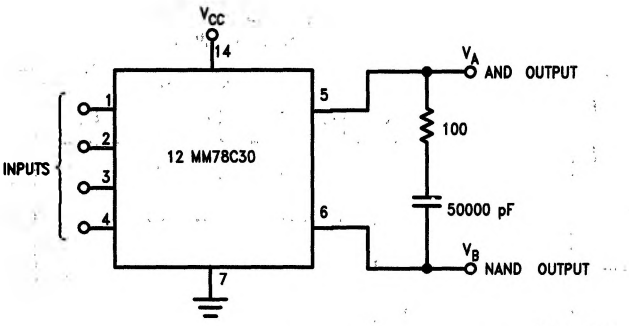


Typical Source Current vs Output Voltage

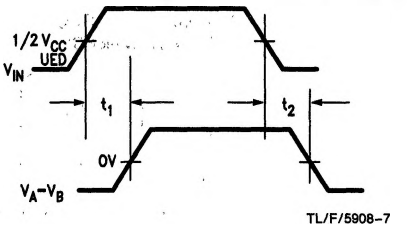


TL/F/5908–5

AC Test Circuits

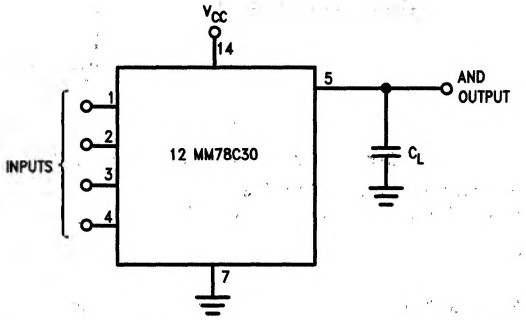


TL/F/5908–6

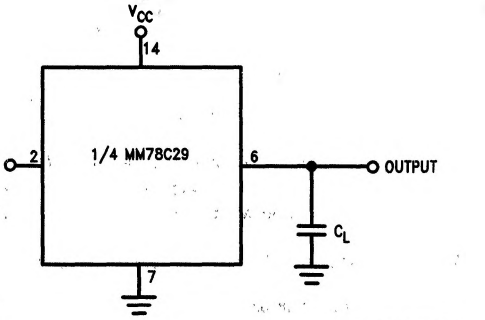


TL/F/5908–7

FIGURE 1



TL/F/5908–8

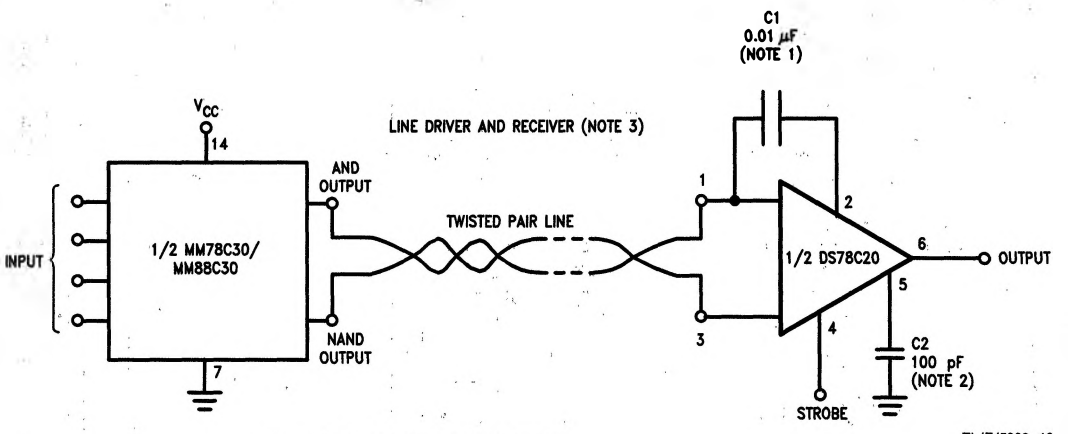


TL/F/5908–9

FIGURE 2

Typical Applications

Digital Data Transmission



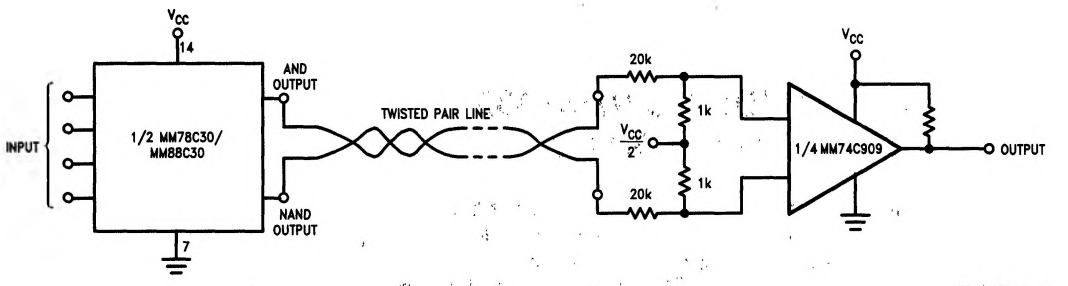
TL/F/5908–10

Note 1: Exact value depends on line length.

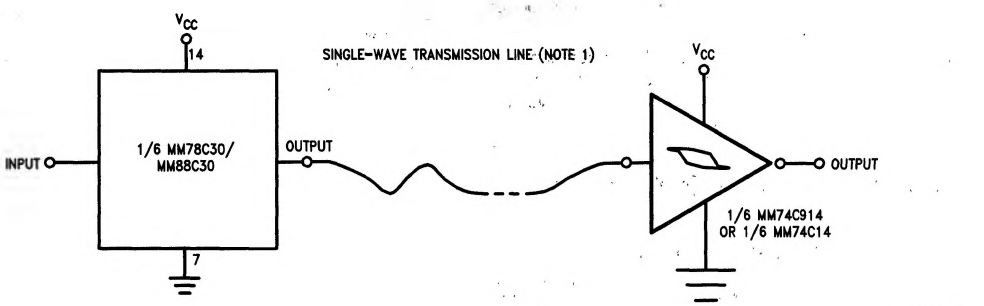
Note 2: Optional to control response time.

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

Typical Applications (Continued)



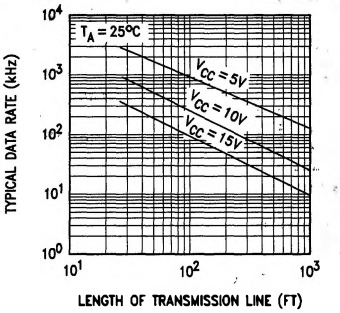
TL/F/5908–11



TL/F/5908–12

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

Typical Data Rate vs Transmission Line Length



TL/F/5908–13

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.