National Semiconductor

DS55113/DS75113 Dual TRI-STATE® Differential Line Driver

General Description

The DS55113/DS75113 dual differential line drivers with TRI-STATE outputs are designed to provide all the features of the DS55114/DS75114 line drivers with the added feature of driver output controls. There are individual controls for each output pair, as well as a common control for both output pairs. When an output control is low, the associated output is in a high-impedance state and the output can neither drive nor load the bus. This permits many devices to be connected together on the same transmission line for party-line applications.

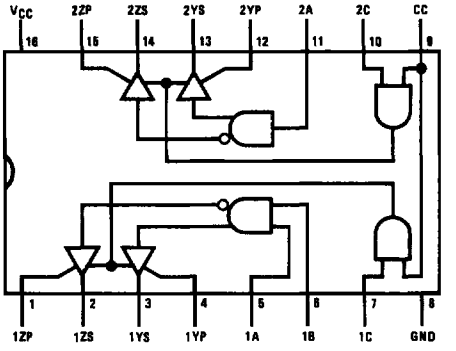
The output stages are similar to TTL totem-pole outputs, but with the sink outputs, YS and ZS, and the corresponding active pull-up terminals, YP and ZP, available on adjacent package pins.

Features

- Each circuit offers a choice of open-collector or active pull-up (totem-pole) outputs
- Single 5V supply
- Differential line operation
- Dual channels
- TTL/LS compatibility
- High-impedance output state for party-line applications
- Short-circuit protection
- High current outputs
- Single-ended or differential AND/NAND outputs
- Common and individual output controls
- Clamp diodes at inputs
- Easily adaptable to DS55114/DS75114 applications

Connection Diagram

Dual-In-Line Package



Positive logic: $Y = AB$
$Z = \overline{AB}$

Output is OFF when C or CC is low

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Top View
Order Number DS55113J, DS75113M or DS75113N
See NS Package Number J16A, M16A or N16A

For Complete Military 883 Specifications, see RETS Datasheet.
Order Number DS55113J/883
See NS Package Number J16A

Truth Table

Inputs				Outputs	
Output Control		Data		AND	NAND
C	CC	A	B*	Y	Z
L	X	X	X	Z	Z
X	L	X	X	Z	Z
H	H	L	X	L	H*
H	H	X	L	L	H
H	H	H	H	H	L

H = high level
L = low level
X = irrelevant
Z = high impedance (OFF)
*B input and 4th line of truth table applicable only to driver number 1

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{CC}) (Note 1)	7V
Input Voltage	5.5V
OFF-State Voltage Applied to Open-Collector Outputs	12V
Maximum Power Dissipation* at 25°C	
Cavity Package	1433 mW
Molded DIP Package	1362 mW
SO Package	1002 mW
Operating Free-Air Temperature Range	
DS55113	−55°C to +125°C
DS75113	0°C to +70°C
Storage Temperature Range	−65°C to +150°C
Lead Temperature (1/16" from case for 60 seconds): J Package	300°C
Lead Temperature (1/16" from case for 4 seconds): N Package	260°C

*Derate cavity package 9.6 mW/°C above 25°C; derate molded DIP package 10.9 mW/°C above 25°C; derate SO package 8.01 mW/°C above 25°C (Note 2).

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})			
DS55113	4.5	5.5	V
DS75113	4.75	5.25	V
High Level Output Current (I_{OH})		−40	mA
Low Level Output Current (I_{OL})		40	mA
Operating Free-Air Temperature (T_A)			
DS55113	−55	125	°C
DS75113	0	70	°C

Electrical Characteristics Over recommended operating free-air temperature range (unless otherwise noted)

Symbol	Parameter		Conditions (Note 3)			DS55113			DS75113			Units
						Min	Typ (Note 4)	Max	Min	Typ (Note 4)	Max	
V_{IH}	High Level Input Voltage					2			2			V
V_{IL}	Low Level Input Voltage							0.8			0.8	V
V_{IK}	Input Clamp Voltage		V_{CC} = Min, I_I = −12 mA				−0.9	−1.5		−0.9	−1.5	V
V_{OH}	High Level Output Voltage		V_{CC} = Min, V_{IH} = 2V, V_{IL} = 0.8V		I_{OH} = −10 mA	2.4	3.4		2.4	3.4		V
					I_{OH} = −40 mA	2	3.0		2	3.0		
V_{OL}	Low Level Output Voltage		V_{CC} = Min, V_{IH} = 2V, V_{IL} = 0.8V, I_{OL} = 40 mA				0.23	0.4		0.23	0.4	V
V_{OK}	Output Clamp Voltage		V_{CC} = Max, I_O = −40 mA				−1.1	−1.5		−1.1	−1.5	V
$I_{O(off)}$	Off-State Open-Collector Output Current		V_{CC} = Max	V_{OH} = 12V	T_A = 25°C		1	10				μA
					T_A = 125°C			200				
				V_{OH} = 5.25V	T_A = 25°C					1	10	
					T_A = 70°C						20	
I_{OZ}	Off-State (High-Impedance-State) Output Current		V_{CC} = Max, Output Controls at 0.8V	T_A = 25°C, V_O = 0 to V_{CC}				±10			±10	μA
				T_A = Max	V_O = 0V			−150			−20	
					V_O = 0.4V			±80			±20	
					V_O = 2.4V			±80			±20	
					V_O = V_{CC}			80			20	
I_I	Input Current at Maximum Input Voltage	A, B, C	V_{CC} = Max, V_I = 5.5V					1			1	mA
		CC						2			2	
I_{IH}	High Level Input Current	A, B, C	V_{CC} = Max, V_I = 2.4V					40			40	μA
		CC						80			80	
I_{IL}	Low Level Input Current	A, B, C	V_{CC} = Max, V_I = 0.4V					−1.6			−1.6	mA
		CC						−3.2			−3.2	

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Electrical Characteristics

Over recommended operating free-air temperature range (unless otherwise noted) (Continued)

Symbol	Parameter	Conditions (Note 3)		DS55113			DS75113			Units
				Min	Typ (Note 4)	Max	Min	Typ (Note 4)	Max	
I_{OS}	Short-Circuit Output Current (Note 5)	V_{CC} = Max, V_O = 0V		−40	−90	−120	−40	−90	−120	mA
I_{CC}	Supply Current (Both Drivers)	All Inputs at 0V, No Load T_A = 25°C	V_{CC} = Max		47	65		47	65	mA
			V_{CC} = 7V		65	85		65	85	

Note 1: All voltage values are with respect to network ground terminal.

Note 2: For operation above 25°C free-air temperature, refer to Dissipation Derating Curves in the Thermal information section.

Note 3: All parameters with the exception of OFF-state open-collector output current are measured with the active pull-up connected to the sink output.

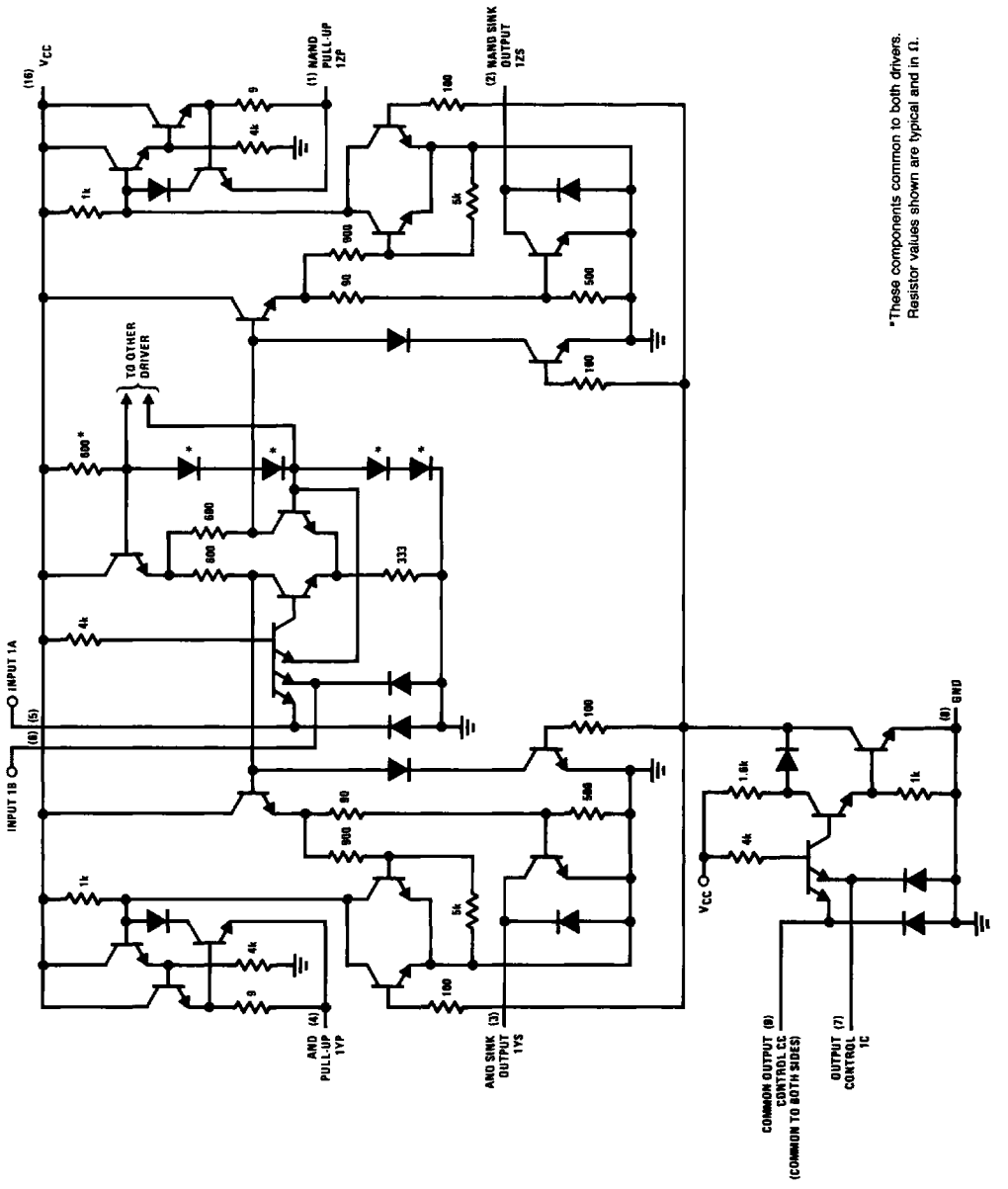
Note 4: All typical values are at T_A = 25°C and V_{CC} = 5V, with the exception of I_{CC} at 7V.

Note 5: Only one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

Switching Characteristics V_{CC} = 5V, C_L = 30 pF, T_A = 25°C

Symbol	Parameter	Conditions	DS55113			DS75113			Unit
			Min	Typ	Max	Min	Typ	Max	
t_{PLH}	Propagation Delay Time, Low-to High-Level Output	*(Figure 1)*		13	20		13	30	ns
t_{PHL}	Propagation Delay Time, High-to Low-Level Output			12	20		12	30	ns
t_{PZH}	Output Enable Time to High Level	R_L = 180Ω, *(Figure 2)*		7	15		7	20	ns
t_{PZL}	Output Enable Time to Low Level	R_L = 250Ω, *(Figure 3)*		14	30		14	40	ns
t_{PHZ}	Output Disable Time from High Level	R_L = 180Ω, *(Figure 2)*		10	20		10	30	ns
t_{PLZ}	Output Disable Time from Low Level	R_L = 250Ω, *(Figure 3)*		17	35		17	35	ns

Schematic Diagram (One side shown only)



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AC Test Circuits and Switching Time Waveforms

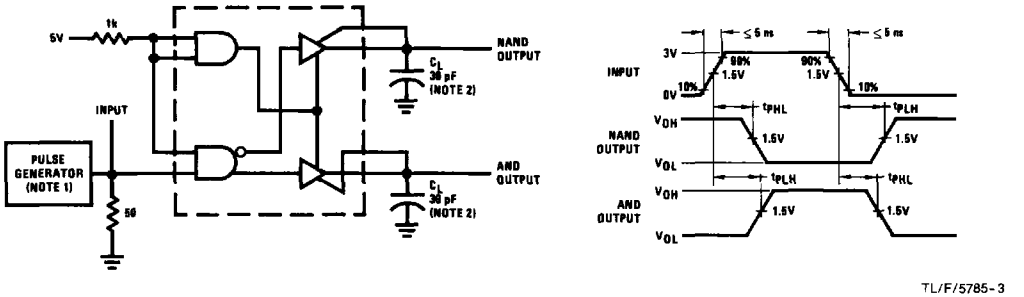

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FIGURE 1. t_{PLH} and t_{PHL}

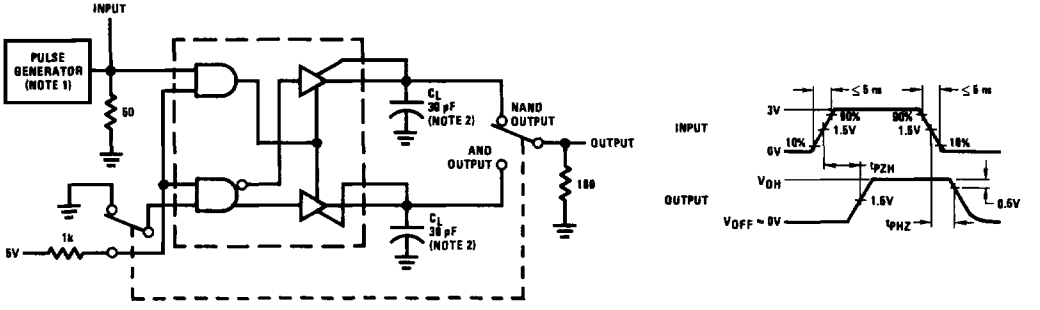

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FIGURE 2. t_{PZH} and t_{PHZ}

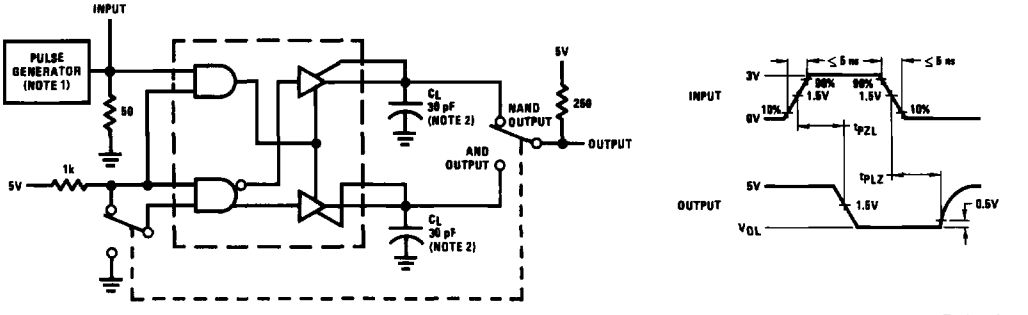

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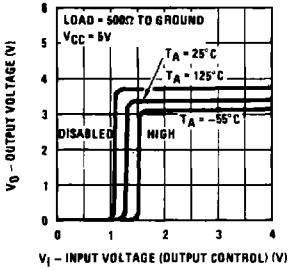
FIGURE 3. t_{PZL} and t_{PLZ}

Note 1: The pulse generator has the following characteristics: Z_{OUT} = 50Ω, PRR = 500 kHz, t_W = 100 ns.

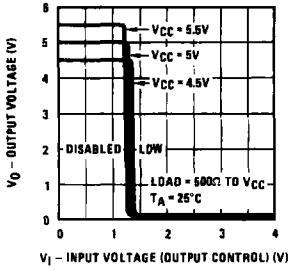
Note 2: C_L includes probe and jig capacitance.

Typical Performance Characteristics*

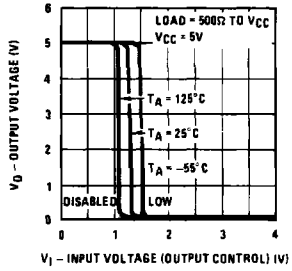
Output Voltage vs Output Control Voltage



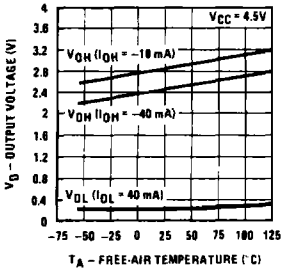
Output Voltage vs Output Control Voltage



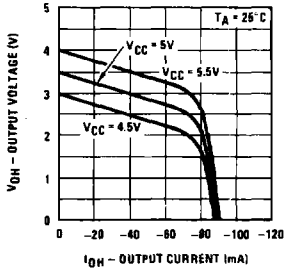
Output Voltage vs Output Control Voltage



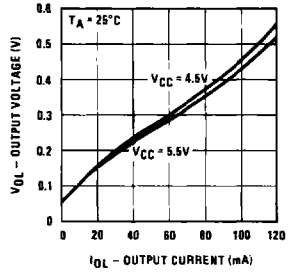
Output Voltage vs Free-Air Temperature



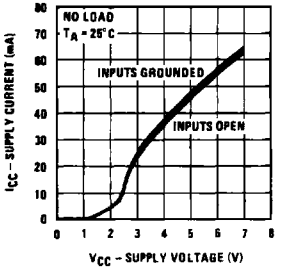
High Level Output Voltage vs Output Current



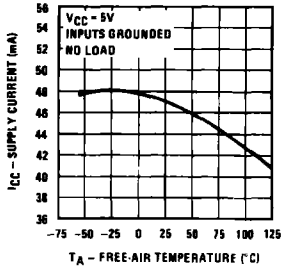
Low Level Output Voltage vs Output Current



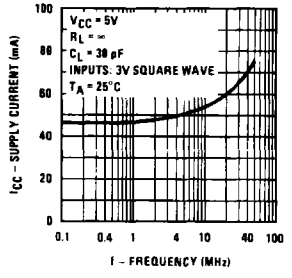
Supply Current (Both Drivers) vs Supply Voltage



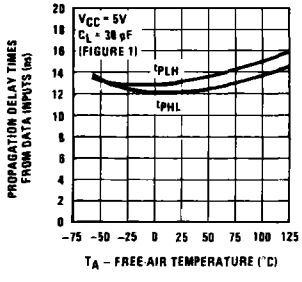
Supply Current (Both Drivers) vs Free-Air Temperature



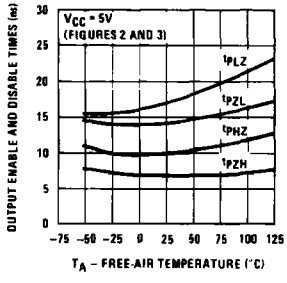
Supply Current (Both Drivers) vs Frequency



Propagation Delay Times from Data Inputs vs Free-Air Temperature



Output Enable and Disable Times vs Free-Air Temperature



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*Data for temperatures below 0°C and above 70°C and for supply voltages below 4.75V and above 5.25V are applicable to DS55113 circuits only. These parameters were measured with the active pull-up connected to the sink output.

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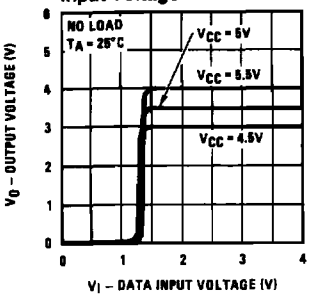
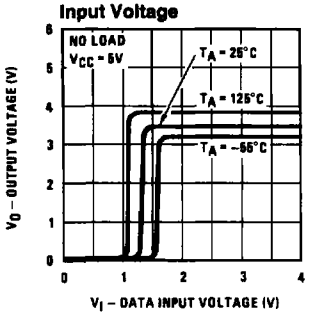
Typical Performance Characteristics* (Continued)

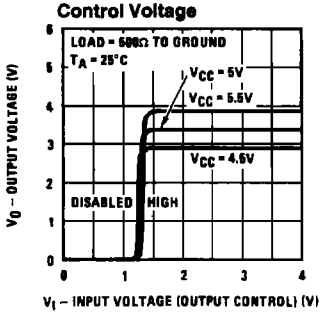
Output Voltage vs Data Input Voltage



Output Voltage vs Data Input Voltage



Output Voltage vs Output Control Voltage



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*Data for temperatures below 0°C and above 70°C and for supply voltages below 4.75V and above 5.25V are applicable to DS55113 circuits only. These parameters were measured with the active pull-up connected to the sink output.