



DS55113/DS75113 Dual TRI-STATE® Differential Line Driver

General Description

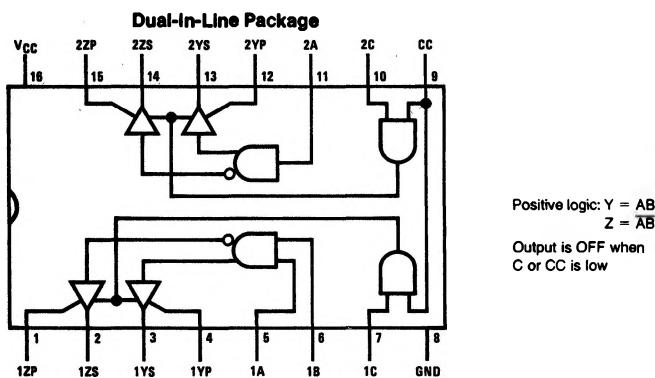
The DS55113/DS75113 dual differential line drivers with TRI-STATE outputs are designed to provide all the features of the DS55114/DS75114 line drivers with the added feature of driver output controls. There are individual controls for each output pair, as well as a common control for both output pairs. 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



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

*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).

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

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

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)	$V_{CC} = \text{Max}, V_O = 0V$	-40	-90	-120	-40	-90	-120	mA
I_{CC}	Supply Current (Both Drivers)	All Inputs at 0V, No Load $T_A = 25^\circ\text{C}$	$V_{CC} = \text{Max}$	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 $T_A = 25^\circ\text{C}$ 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.

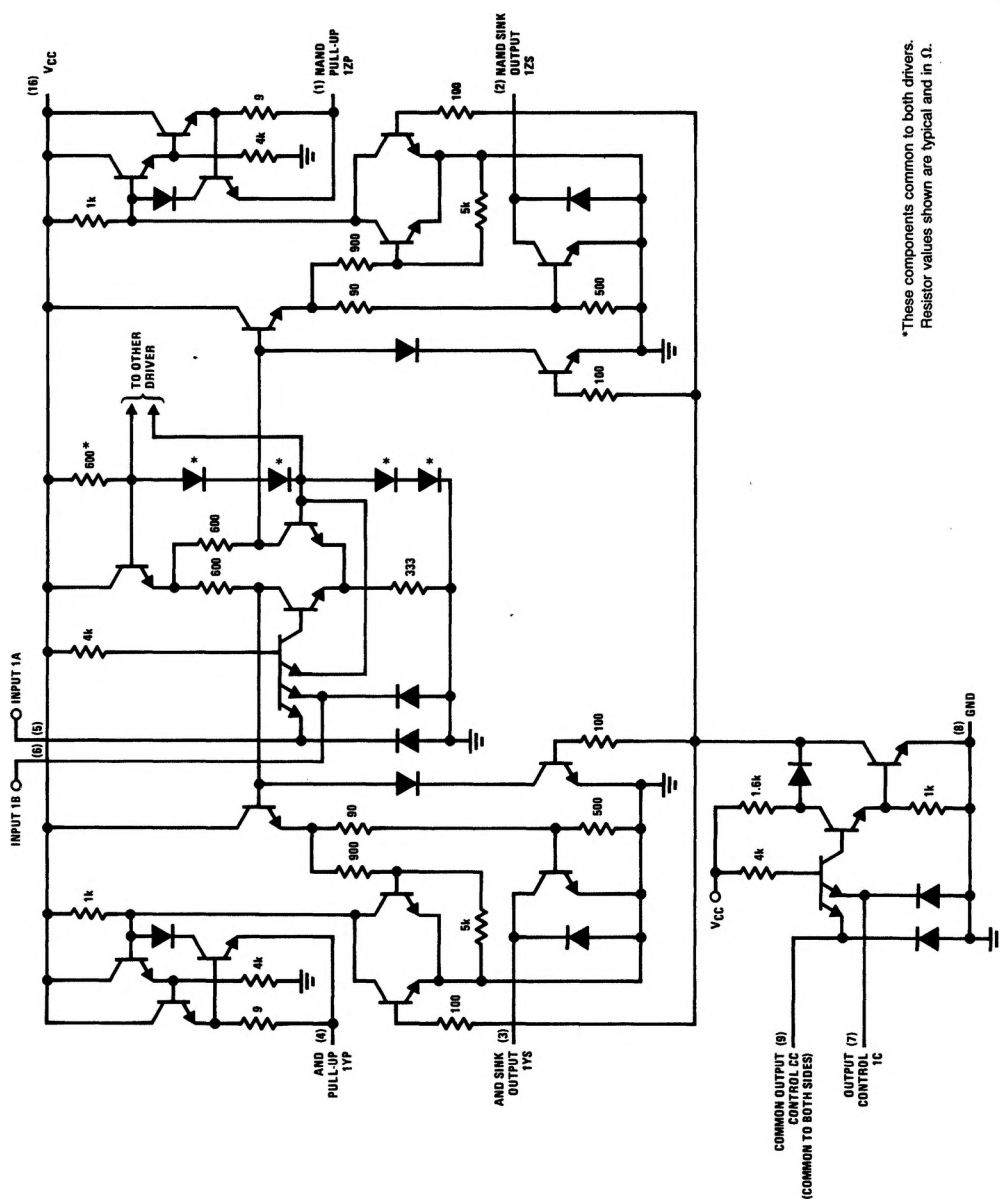
Switching Characteristics $V_{CC} = 5V, C_L = 30\text{ pF}, T_A = 25^\circ\text{C}$

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	$R_L = 180\Omega$, (Figure 2)		7	15		7	20	ns
t_{PZL}	Output Enable Time to Low Level	$R_L = 250\Omega$, (Figure 3)		14	30		14	40	ns
t_{PHZ}	Output Disable Time from High Level	$R_L = 180\Omega$, (Figure 2)		10	20		10	30	ns
t_{PLZ}	Output Disable Time from Low Level	$R_L = 250\Omega$, (Figure 3)		17	35		17	35	ns

Schematic Diagram (One side shown only)

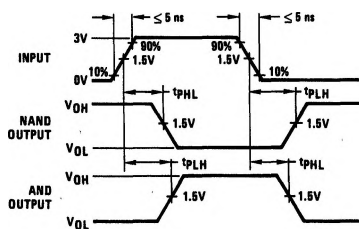
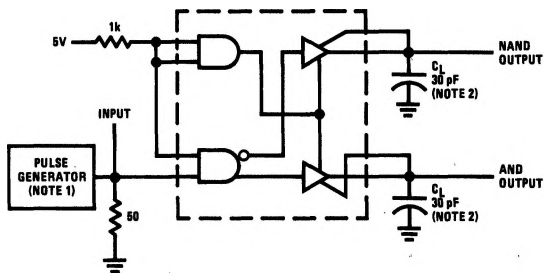
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DS55113/DS75113

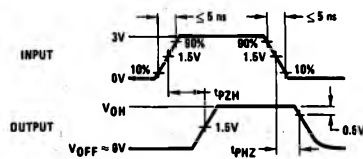
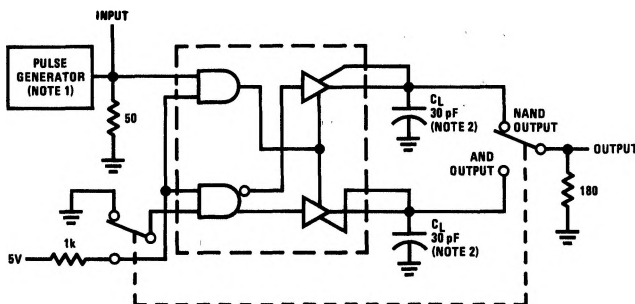


†These components common to both drivers. Resistor values shown are typical and in Ω .

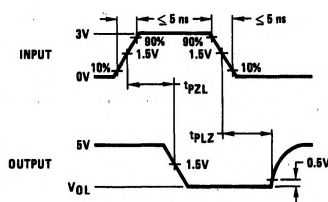
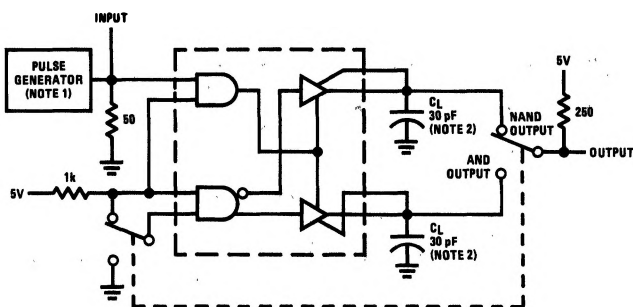
AC Test Circuits and Switching Time Waveforms



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

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

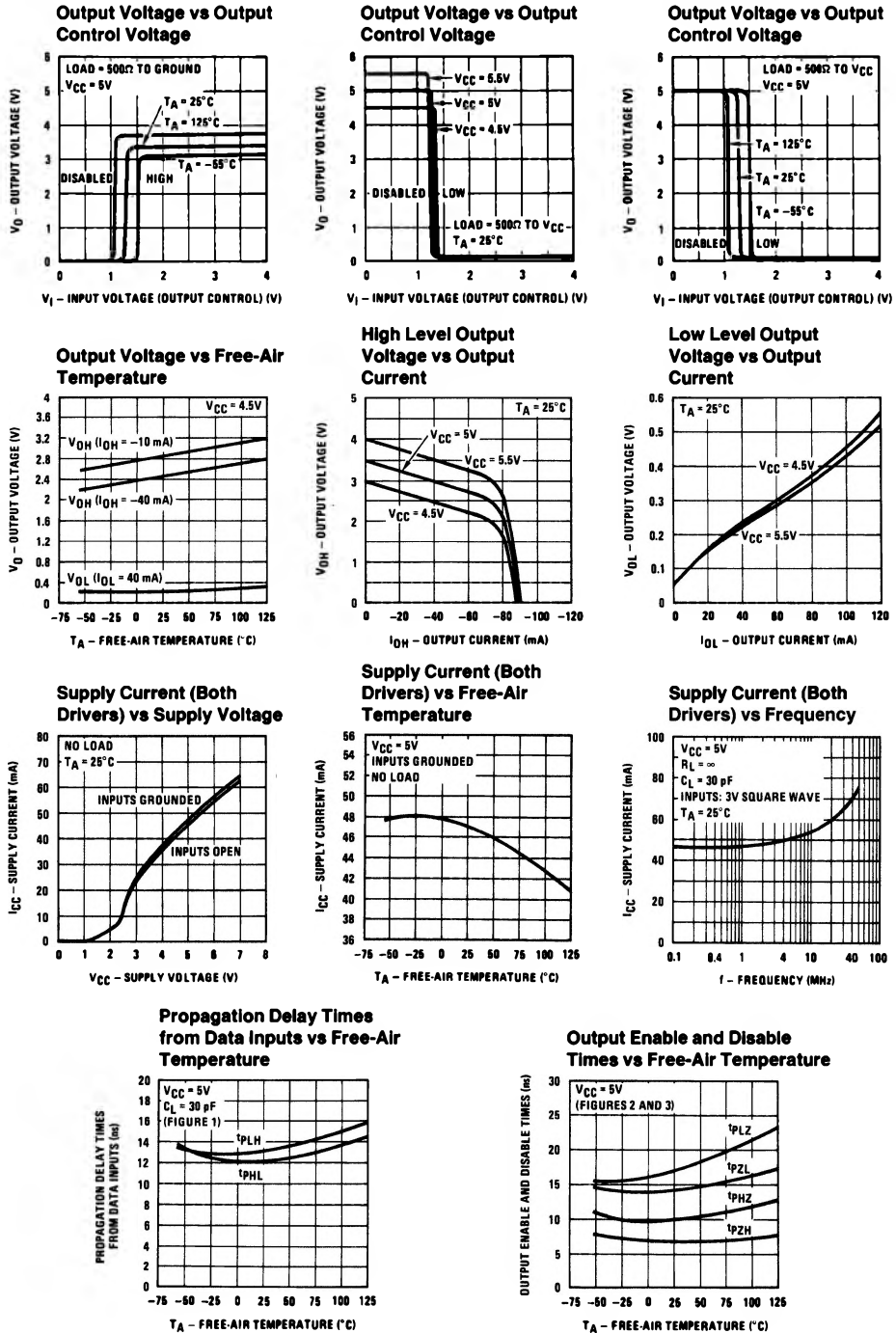
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FIGURE 3. t_{PZL} and t_{PLZ}

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

Note 2: C_L includes probe and jig capacitance.

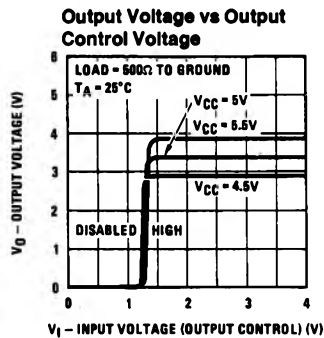
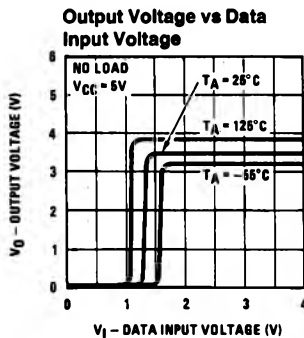
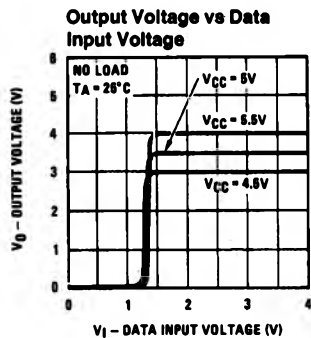
Typical Performance Characteristics*



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*Data for temperatures below $0^\circ C$ and above $70^\circ C$ 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.

Typical Performance Characteristics* (Continued)



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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.