

## DS55113/DS75113 Dual TRI-STATE® Differential Line Driver

### General Description

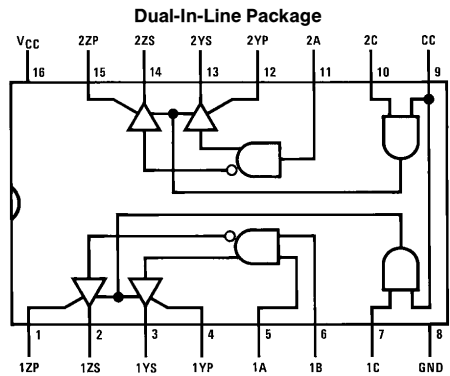
The DS55113/DS75113 dual differential line drivers with TRI-STATE outputs are designed to provide all the features of the DS55114/DS75114 line drivers with the added feature of driver output controls. There are individual controls for each output pair, as well as a common control for both output pairs.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



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

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## 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			$\mu\text{A}$	
				$T_A = 125^\circ\text{C}$			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	$V_{CC} = \text{Max}, \text{Output Controls at } 0.8V$	$T_A = 25^\circ\text{C}, V_O = 0 \text{ to } V_{CC}$				$\pm 10$		$\pm 10$	$\mu\text{A}$	
				$T_A = \text{Max}$				$\pm 150$			$\pm 20$
			$V_O = 0V$				$\pm 80$		$\pm 20$		
			$V_O = 0.4V$				$\pm 80$		$\pm 20$		
			$V_O = 2.4V$				$\pm 80$		$\pm 20$		
			$V_O = V_{CC}$				80		20		
$I_I$	Input Current at Maximum Input Voltage	A, B, C CC	$V_{CC} = \text{Max}, V_I = 5.5V$				1		1	mA	
							2		2		
$I_{IH}$	High Level Input Current	A, B, C CC	$V_{CC} = \text{Max}, V_I = 2.4V$				40		40	$\mu\text{A}$	
							80		80		
$I_{IL}$	Low Level Input Current	A, B, C CC	$V_{CC} = \text{Max}, V_I = 0.4V$				-1.6		-1.6	mA	
							-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.

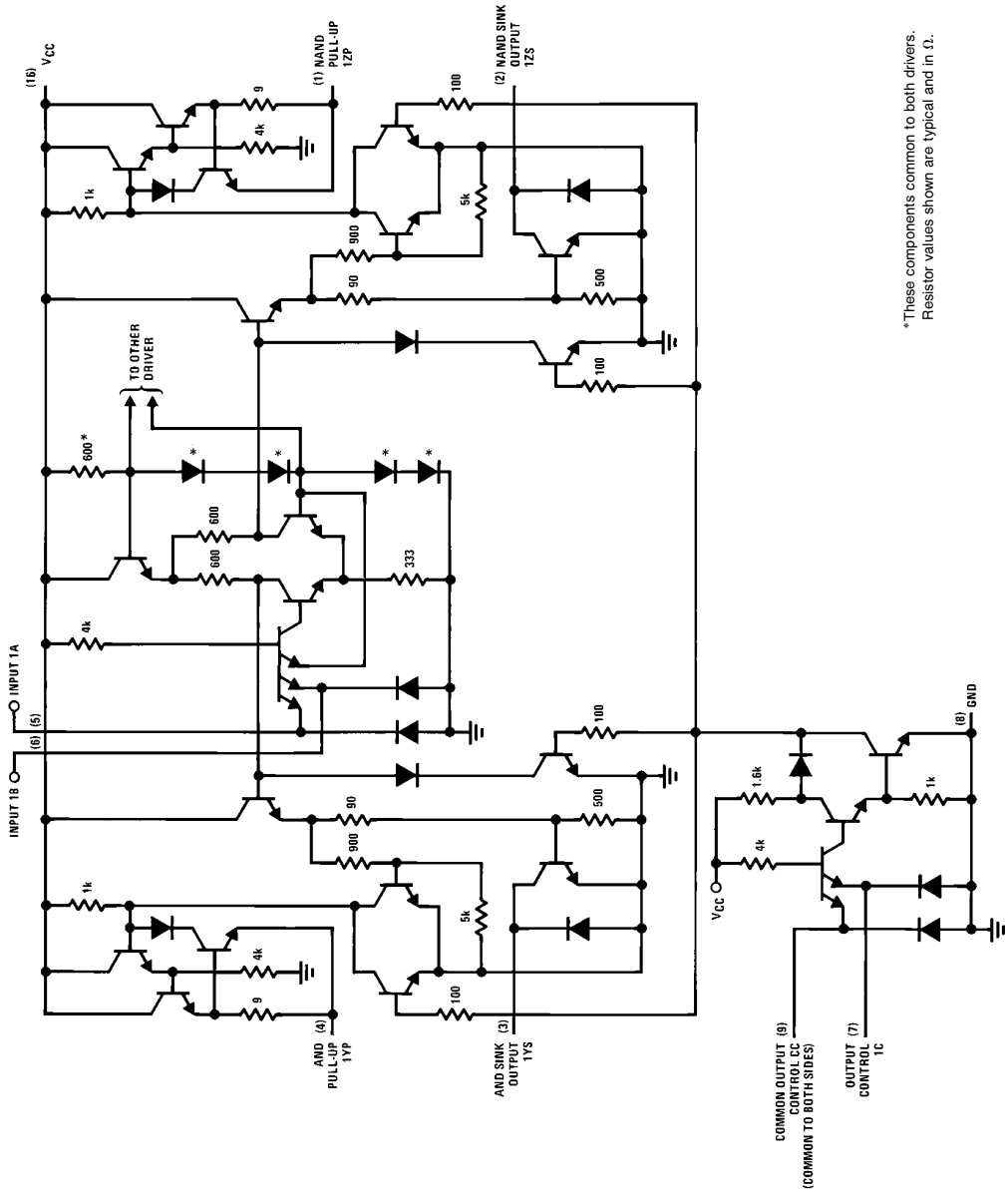
**Note 4:** All typical values are at  $T_A = 25^\circ\text{C}$  and  $V_{CC} = 5V$ , with the exception of  $I_{CC}$  at 7V.

**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	<i>(Figure 1)</i>		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)



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

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## AC Test Circuits and Switching Time Waveforms

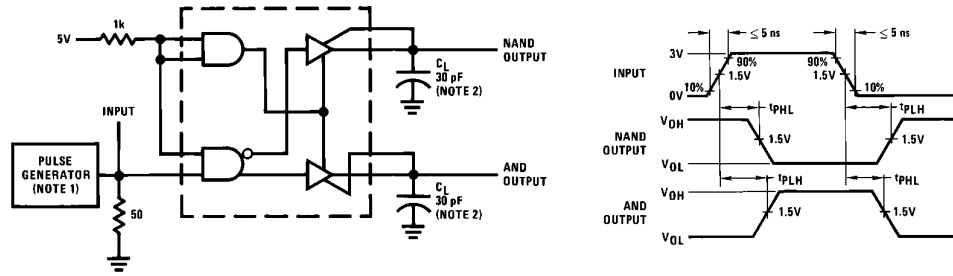


FIGURE 1.  $t_{pLH}$  and  $t_{pHL}$

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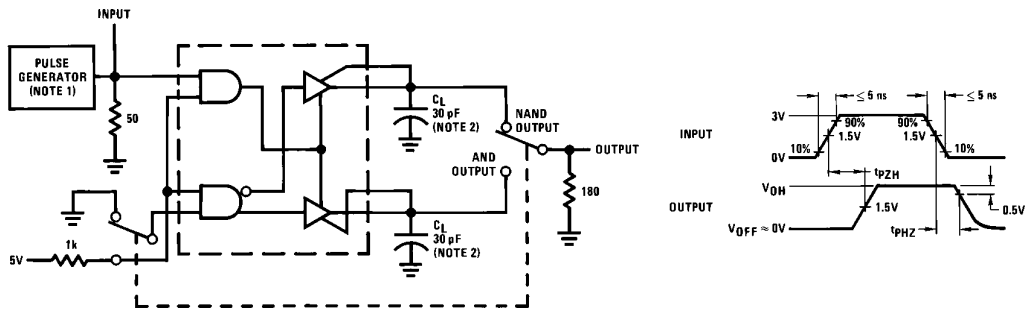


FIGURE 2.  $t_{pZH}$  and  $t_{pHZ}$

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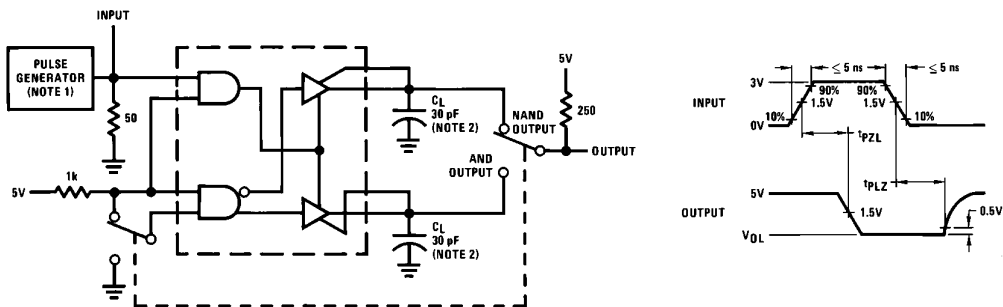


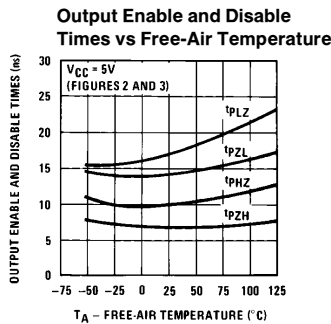
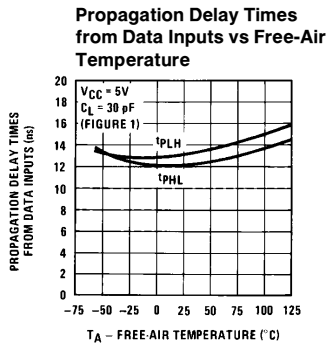
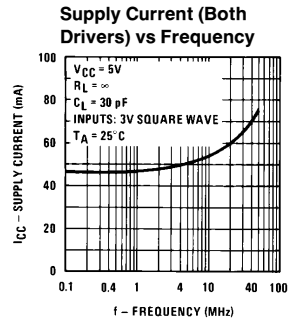
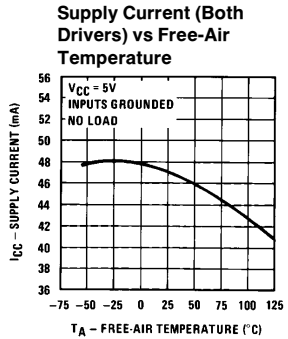
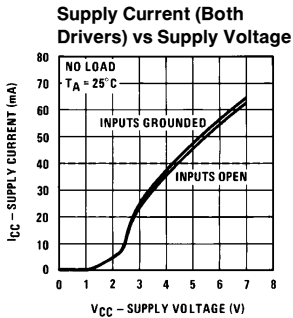
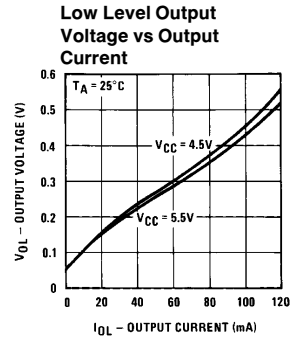
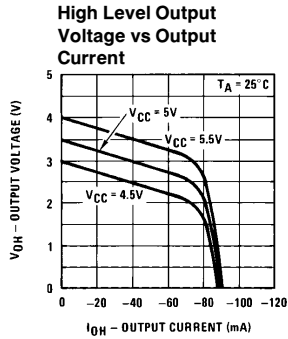
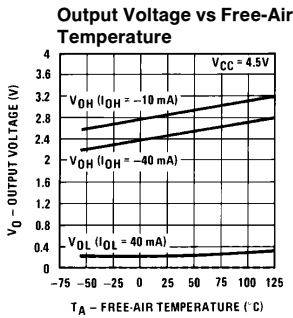
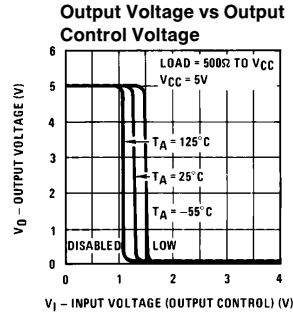
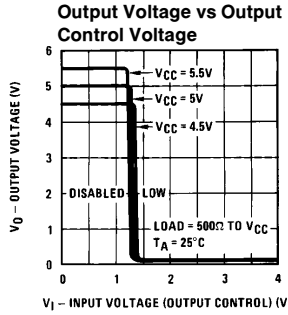
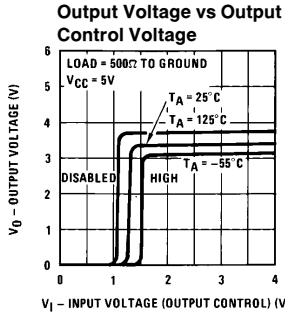
FIGURE 3.  $t_{pZL}$  and  $t_{pLZ}$

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**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.

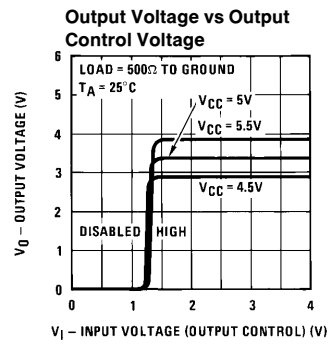
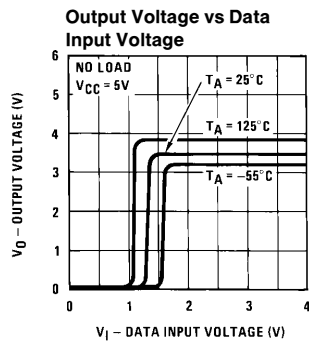
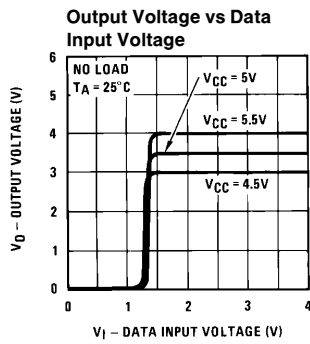
# Typical Performance Characteristics\*



\*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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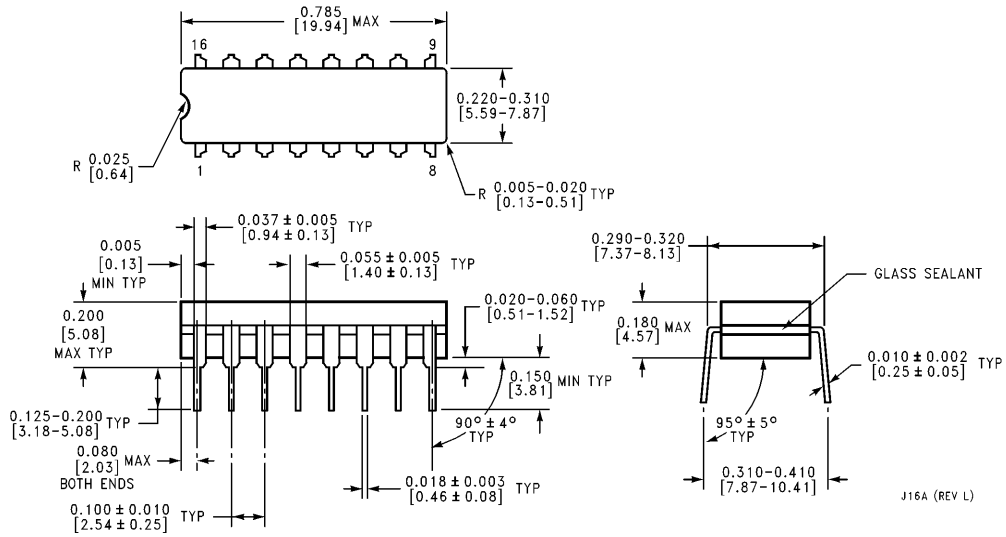
## Typical Performance Characteristics\* (Continued)



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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.

**Physical Dimensions** inches (millimeters)

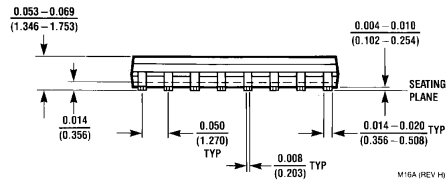
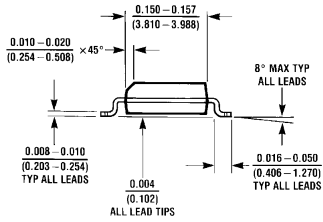
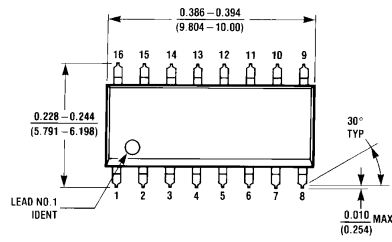


**Ceramic Dual-In-Line Package (J)**  
**Order Number DS55113J**  
**NS Package Number J16A**

J16A (REV L)



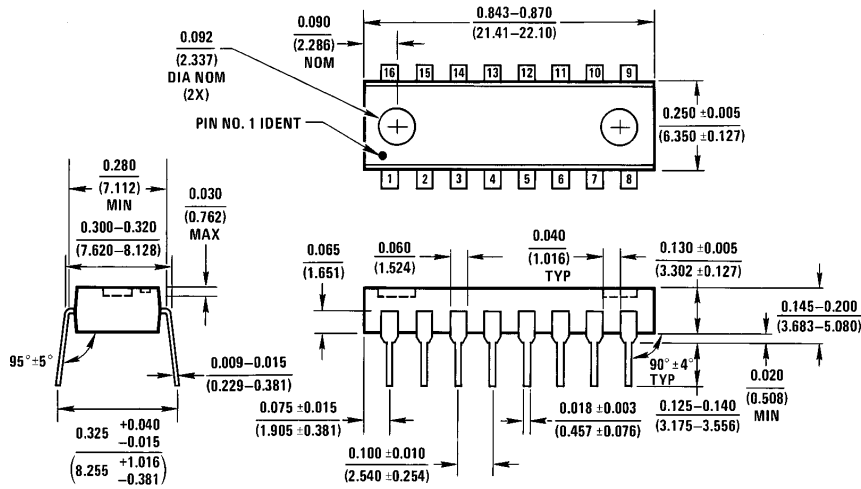
**Physical Dimensions** inches (millimeters) (Continued)



**SO Package (M)**  
**Order Number DS75113M**  
**NS Package Number M16A**

M16A (REV H)

**Physical Dimensions** inches (millimeters) (Continued)



**Molded Dual-In-Line Package (N)**  
**Order Number DS75113N**  
**NS Package Number N16A**

N16A (REV E)

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