

## DS1631/DS3631, DS1632/DS3632, DS1633/DS3633, DS1634/DS3634 CMOS Dual Peripheral Drivers

### General Description

The DS1631 series of dual peripheral drivers was designed to be a universal set of interface components for CMOS circuits.

Each circuit has CMOS-compatible inputs with thresholds that track as a function of  $V_{CC}$  (approximately  $\frac{1}{2} V_{CC}$ ). The inputs are PNPs providing the high impedance necessary for interfacing with CMOS.

Outputs have high voltage capability, minimum breakdown voltage is 56V at 250 $\mu$ A.

The outputs are Darlington connected transistors. This allows high current operation (300mA max.) at low internal  $V_{CC}$  current levels since base drive for the output transistor is obtained from the load in proportion to the required loading conditions. This is essential in order to minimize loading on the CMOS logic supply.

Typical  $V_{CC} = 5.0V$  power is 28mW with both outputs ON.  $V_{CC}$  operating range is 4.5V to 15V.

The circuit also features output transistor protection if the  $V_{CC}$  supply is lost by forcing the output into the high

impedance OFF state with the same breakdown levels as when  $V_{CC}$  was implied.

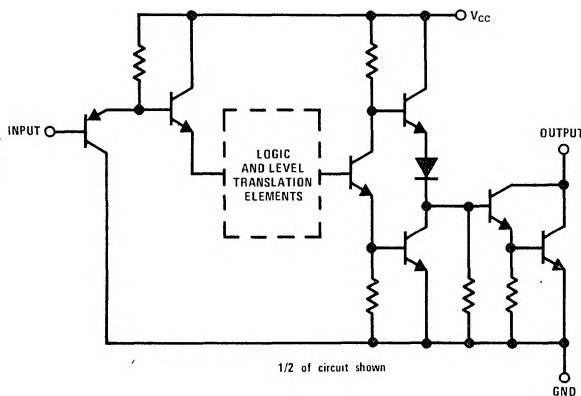
Pin-outs are the same as the respective logic functions found in the following popular series of circuits: DS75451, DS75461, DS3611. This feature allows direct conversion of present systems to the DM74C CMOS family and DS1631 series circuits with great power savings.

The DS1631 series is also TTL/DTL compatible at  $V_{CC} = 5.0V$ .

### Features

- CMOS compatible inputs
  - TTL/DTL compatible inputs
  - High impedance inputs
  - High output voltage breakdown
  - High output current capability
  - Same pin-outs and logic functions as DS75451, DS75461, and DS3611 series circuits
  - Low  $V_{CC}$  power dissipation (28mW both outputs "ON" at 5.0V)
- PNP's  
56V min.  
300mA max.

### Schematic Diagram (Equivalent Circuit)



SEE CONNECTION DIAGRAMS FOR ORDERING INFORMATION

## Absolute Maximum Ratings (Note 1)

Supply Voltage	16V
Voltage at Inputs	-0.3V to $V_{CC} + 0.3V$
Output Voltage	56V
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10 seconds)	300°C

## Operating Conditions

	MIN	MAX	UNITS
Supply Voltage, $V_{CC}$			
DS1631/DS1632/ DS1633/DS1634	4.5	15	V
DS3631/DS3632/ DS3633/DS3634	4.75	15	V
Temperature, $T_A$			
DS1631/DS1632/ DS1633/DS1634	-55	+125	°C
DS3631/DS3632/ DS3633/DS3634	0	+70	°C

## Electrical Characteristics (Notes 2 and 3)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
<b>All Circuits</b>						
$V_{IH}$ Logical "1" Input Voltage	(Figure 1)	$V_{CC} = 5V$	3.5	2.5		V
		$V_{CC} = 10V$	8.0	5		V
		$V_{CC} = 15V$	12.5	7.5		V
$V_{IL}$ Logical "0" Input Voltage	(Figure 1)	$V_{CC} = 5V$		2.5	1.5	V
		$V_{CC} = 10V$		5.5	2.0	V
		$V_{CC} = 15V$		7.5	2.5	V
$I_{IH}$ Logical "1" Input Current	$V_{CC} = 15V, V_{IN} = 15V, (Figure 2)$			0.1		$\mu A$
$I_{IL}$ Logical "0" Input Current	$V_{IN} = 0.4V, (Figure 3)$	$V_{CC} = 5V$		-50		$\mu A$
		$V_{CC} = 15V$		-200		$\mu A$
$V_{OH}$ Output Breakdown Voltage	$V_{CC} = 15V, I_{OH} = 250\mu A, (Figure 1)$		56	65		V
$V_{OL}$ Output Low Voltage	$V_{CC} = \text{Min}, (Figure 1)$	$I_{OL} = 100 \text{ mA}$		0.9		V
		$I_{OL} = 300 \text{ mA}$		1.1		V
<b>DS1631/DS3631</b>						
$I_{CC(0)}$ Supply Currents	$V_{IN} = 0V, (Figure 4)$	$V_{CC} = 5V$	Output Low Both Drivers	7		$\text{mA}$
		$V_{CC} = 15V$		14		$\text{mA}$
$I_{CC(1)}$	(Figure 4)	$V_{CC} = 5V, V_{IN} = 5V$	Output High Both Drivers	2		$\text{mA}$
		$V_{CC} = 15V, V_{IN} = 15V$		7.5		$\text{mA}$
$t_{pd1}$ Propagation to "1"	$V_{CC} = 5.0V, T_A = 25^\circ C, C_L = 15 \text{ pF}, R_L = 50\Omega, V_L = 10V, (Figure 5)$			200		ns
$t_{pd0}$ Propagation to "0"	$V_{CC} = 5.0V, T_A = 25^\circ C, C_L = 15 \text{ pF}, R_L = 50\Omega, V_L = 10V, (Figure 5)$			150		ns
<b>DS1632/DS3632</b>						
$I_{CC(0)}$ Supply Currents	(Figure 4)	$V_{CC} = 5V, V_{IN} = 5V$	Output Low	8		$\text{mA}$
		$V_{CC} = 15V, V_{IN} = 15V$		18		$\text{mA}$
$I_{CC(1)}$	$V_{IN} = 0V, (Figure 4)$	$V_{CC} = 5V$	Output High	2.5		$\text{mA}$
		$V_{CC} = 15V$		9		$\text{mA}$
$t_{pd1}$ Propagation to "1"	$V_{CC} = 5.0V, T_A = 25^\circ C, C_L = 15 \text{ pF}, R_L = 50\Omega, V_L = 10V, (Figure 5)$			150		ns
$t_{pd0}$ Propagation to "0"	$V_{CC} = 5.0V, T_A = 25^\circ C, C_L = 15 \text{ pF}, R_L = 50\Omega, V_L = 10V, (Figure 5)$			150		ns
<b>DS1633/DS3633</b>						
$I_{CC(0)}$ Supply Currents	$V_{IN} = 0V, (Figure 4)$	$V_{CC} = 5V$	Output Low	7.5		$\text{mA}$
		$V_{CC} = 15V$		16		$\text{mA}$
$I_{CC(1)}$	(Figure 4)	$V_{CC} = 5V, V_{IN} = 5V$	Output High	2		$\text{mA}$
		$V_{CC} = 15V, V_{IN} = 15V$		7.2		$\text{mA}$
$t_{pd1}$ Propagation to "1"	$V_{CC} = 5.0V, T_A = 25^\circ C, C_L = 15 \text{ pF}, R_L = 50\Omega, V_L = 10V, (Figure 5)$			200		ns
$t_{pd0}$ Propagation to "0"	$V_{CC} = 5.0V, T_A = 25^\circ C, C_L = 15 \text{ pF}, R_L = 50\Omega, V_L = 10V, (Figure 5)$			150		ns

## Electrical Characteristics (Cont'd.)

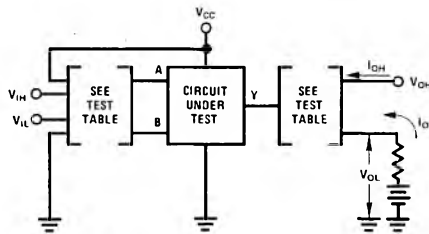
PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
DS1634/DS3634						
$I_{CC(0)}$ Supply Currents	(Figure 4)	$V_{CC} = 5V, V_{IN} = 5V$	Output Low		7.5	mA
		$V_{CC} = 15V, V_{IN} = 15V$			18	mA
$I_{CC(1)}$	$V_{IN} = 0V$ , (Figure 4)	$V_{CC} = 5V$	Output High		3	mA
		$V_{CC} = 15V$			11	mA
$t_{pd1}$ Propagation to "1"		$V_{CC} = 5.0V, T_A = 25^\circ C, C_L = 15 pF, R_L = 50\Omega, V_L = 10V$ , (Figure 5)			150	ns
$t_{pd0}$ Propagation to "0"		$V_{CC} = 5.0V, T_A = 25^\circ C, C_L = 15 pF, R_L = 50\Omega, V_L = 10V$ , (Figure 5)			150	ns

**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:** Unless otherwise specified min/max limits apply across the  $-55^\circ C$  to  $+125^\circ C$  temperature range for the DS1631, DS1632, DS1633 and DS1634 and across the  $0^\circ C$  to  $+70^\circ C$  range for the DS3631, DS3632, DS3633 and DS3634. All typical values are for  $T_A = 25^\circ C$ .

**Note 3:** All currents into device pins shown as positive, out of device pins as negative, all voltages referenced to ground unless otherwise noted. All values shown as max or min on absolute value basis.

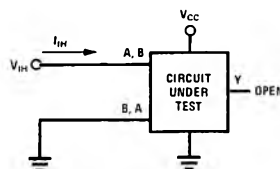
## Test Circuits



CIRCUIT	INPUT UNDER TEST	OTHER INPUT	OUTPUT	
			APPLY	MEASURE
LM3611	$V_{IH}$	$V_{IH}$	$I_{OH}$	$V_{OH}$
	$V_{IL}$	$V_{CC}$	$I_{OL}$	$V_{OL}$
LM3612	$V_{IH}$	$V_{IH}$	$I_{OL}$	$V_{OL}$
	$V_{IL}$	$V_{CC}$	$I_{OH}$	$V_{OH}$
LM3613	$V_{IH}$	GND	$I_{OH}$	$V_{OH}$
	$V_{IL}$	$V_{IL}$	$I_{OL}$	$V_{OL}$
LM3614	$V_{IH}$	GND	$I_{OL}$	$V_{OL}$
	$V_{IL}$	$V_{IL}$	$I_{OH}$	$V_{OH}$

Note: Each input is tested separately.

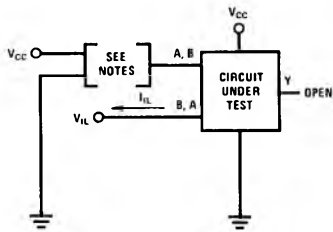
FIGURE 1.  $V_{IH}, V_{IL}, V_{OH}, V_{OL}$



Each input is tested separately.

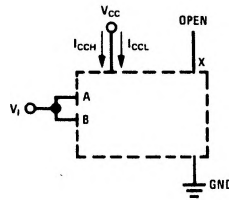
FIGURE 2.  $I_{IH}$

# Test Circuits and Switching Time Waveforms



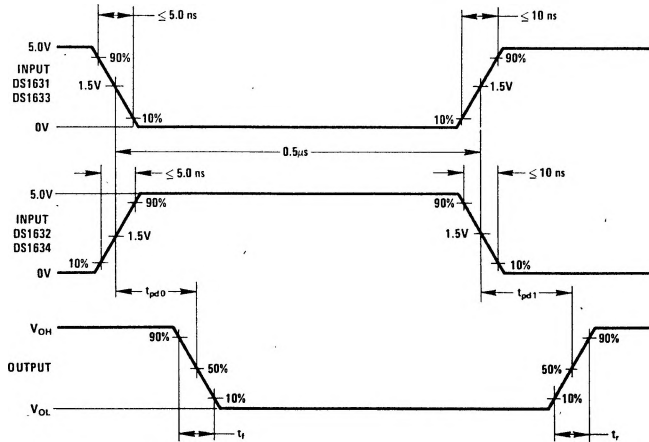
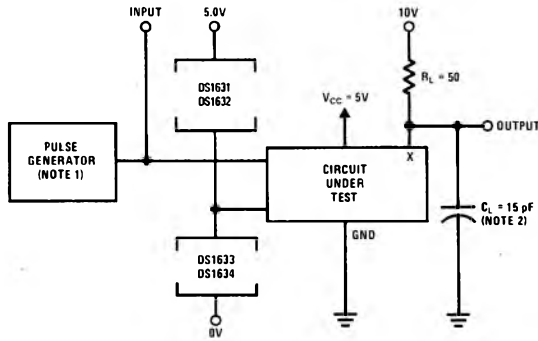
Note A: Each input is tested separately.  
Note B: When testing DS1633 and DS1634 input not under test is grounded. For all other circuits it is at  $V_{CC}$ .

FIGURE 3.  $I_{IL}$



Both gates are tested simultaneously.

FIGURE 4.  $I_{CC}$



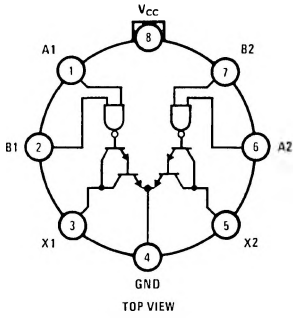
Note 1: The pulse generator has the following characteristics: PRR = 500 kHz,  $Z_{OUT} \approx 50\Omega$ .  
Note 2:  $C_L$  includes probe and jig capacitance.

FIGURE 5. Switching Times.

# Connection Diagrams, Truth Tables, and Ordering Information

DS1631/DS3631, DS1632/DS3632, DS1633/DS3633,  
DS1634/DS3634

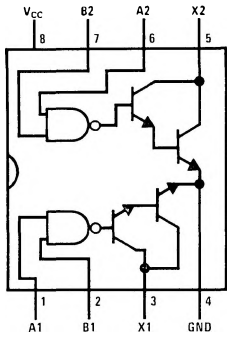
**DS1631**  
Metal Can Package



(Pin 4 is electrically connected to the case.)

Order Number DS1631H/DS3631H

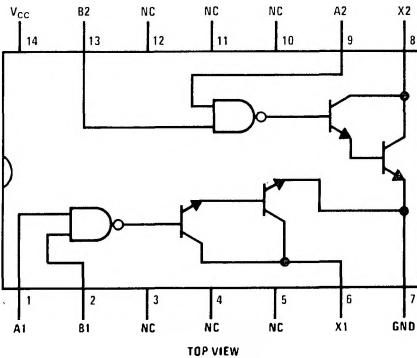
**Dual-In-Line Package**



TOP VIEW

Order Number 3631N

**Dual-In-Line Package**



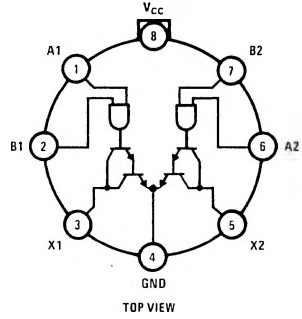
TOP VIEW

Order Number DS1631J/DS3631J

Positive logic:  $AB=X$

A	B	OUTPUT X
0	0	0
1	0	0
0	1	0
1	1	1

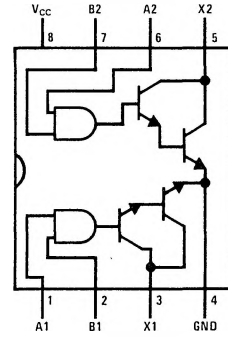
**DS1632**  
Metal Can Package



(Pin 4 is electrically connected to the case.)

Order Number DS1632H/DS3632H

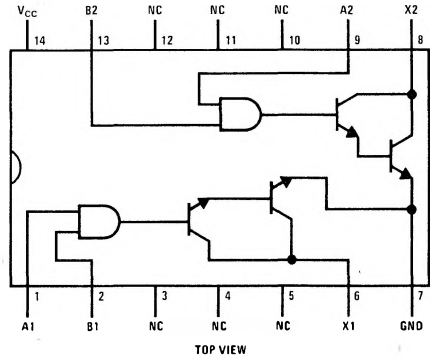
**Dual-In-Line Package**



TOP VIEW

Order Number DS3632N

**Dual-In-Line Package**



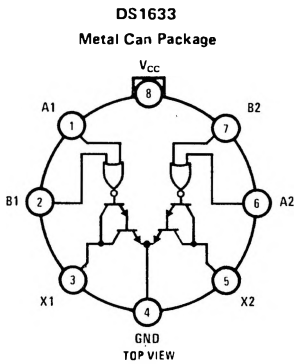
TOP VIEW

Order Number DS1632J/DS3632J

Positive logic:  $\overline{AB}=X$

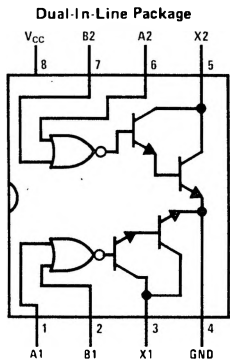
A	B	OUTPUT X
0	0	1
1	0	1
0	1	1
1	1	0

## Connection Diagrams, Truth Tables, and Ordering Information

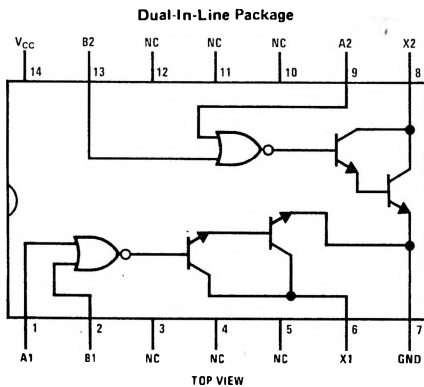


(Pin 4 is electrically connected to the case.)

Order Number DS1633H/DS3633H



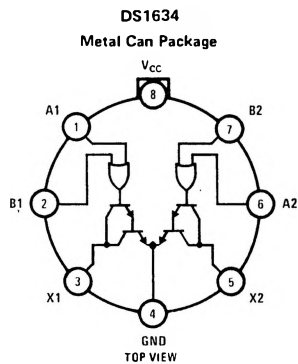
Order Number DS3633N



Order Number DS1633J/DS3633J

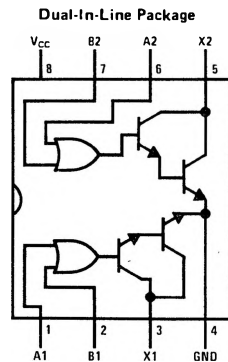
Positive logic:  $A + B = X$

A	B	OUTPUT X
0	0	0
1	0	1
0	1	1
1	1	1

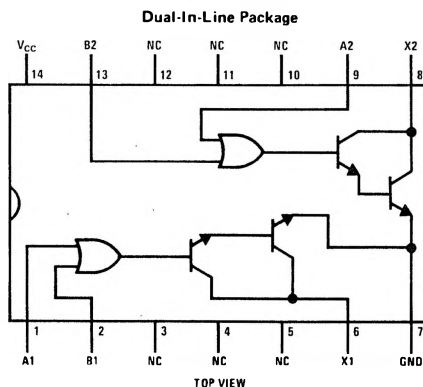


(Pin 4 is electrically connected to the case.)

Order Number DS1634H/DS3634H



Order Number DS3634N



Order Number DS1634J/DS3634J

Positive logic:  $A + B = X$

A	B	OUTPUT X
0	0	1
1	0	0
0	1	0
1	1	0