![National Semiconductor logo]

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 ½ 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 250μA.

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   PNP's
- High output voltage breakdown   56V min.
- High output current capability   300mA max.
- 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)

Schematic Diagram (Equivalent Circuit)

1/2 of circuit shown
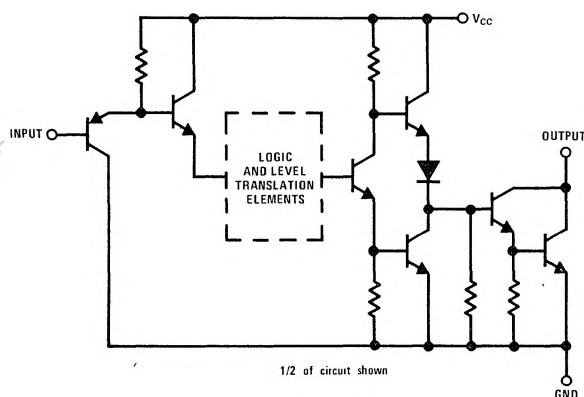
SEE CONNECTION DIAGRAMS FOR ORDERING INFORMATION

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
All Circuits							
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		µA
I_{IL}	Logical "0" Input Current	$V_{IN} = 0.4V$, *(Figure 3)*	$V_{CC} = 5V$		-50		µA
			$V_{CC} = 15V$		-200		µA
V_{OH}	Output Breakdown Voltage	$V_{CC} = 15V$, $I_{OH} = 250µA$, *(Figure 1)*		56	65		V
V_{OL}	Output Low Voltage	$V_{CC} = $ Min, *(Figure 1)*	$I_{OL} = 100$ mA		0.9		V
			$I_{OL} = 300$ mA		1.1		V
DS1631/DS3631							
$I_{CC(0)}$	Supply Currents	$V_{IN} = 0V$, *(Figure 4)*	$V_{CC} = 5V$ Output Low		7		mA
			$V_{CC} = 15V$ Both Drivers		14		mA
$I_{CC(1)}$		*(Figure 4)*	$V_{CC} = 5V$, $V_{IN} = 5V$ Output High		2		mA
			$V_{CC} = 15V$, $V_{IN} = 15V$ Both Drivers		7.5		mA
t_{pd1}	Propagation to "1"	$V_{CC} = 5.0V$, $T_A = 25°C$, $C_L = 15$ pF, $R_L = 50\Omega$, $V_L = 10V$, *(Figure 5)*			200		ns
t_{pd0}	Propagation to "0"	$V_{CC} = 5.0V$, $T_A = 25°C$, $C_L = 15$ pF, $R_L = 50\Omega$, $V_L = 10V$, *(Figure 5)*			150		ns
DS1632/DS3632							
$I_{CC(0)}$	Supply Currents	*(Figure 4)*	$V_{CC} = 5V$, $V_{IN} = 5V$ Output Low		8		mA
			$V_{CC} = 15V$, $V_{IN} = 15V$		18		mA
$I_{CC(1)}$		$V_{IN} = 0V$, *(Figure 4)*	$V_{CC} = 5V$ Output High		2.5		mA
			$V_{CC} = 15V$		9		mA
t_{pd1}	Propagation to "1"	$V_{CC} = 5.0V$, $T_A = 25°C$, $C_L = 15$ pF, $R_L = 50\Omega$, $V_L = 10V$, *(Figure 5)*			150		ns
t_{pd0}	Propagation to "0"	$V_{CC} = 5.0V$, $T_A = 25°C$, $C_L = 15$ pF, $R_L = 50\Omega$, $V_L = 10V$, *(Figure 5)*			150		ns
DS1633/DS3633							
$I_{CC(0)}$	Supply Currents	$V_{IN} = 0V$, *(Figure 4)*	$V_{CC} = 5V$ Output Low		7.5		mA
			$V_{CC} = 15V$		16		mA
$I_{CC(1)}$		*(Figure 4)*	$V_{CC} = 5V$, $V_{IN} = 5V$ Output High		2		mA
			$V_{CC} = 15V$, $V_{IN} = 15V$		7.2		mA
t_{pd1}	Propagation to "1"	$V_{CC} = 5.0V$, $T_A = 25°C$, $C_L = 15$ pF, $R_L = 50\Omega$, $V_L = 10V$, *(Figure 5)*			200		ns
t_{pd0}	Propagation to "0"	$V_{CC} = 5.0V$, $T_A = 25°C$, $C_L = 15$ 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°C, C_L = 15 pF, R_L = 50Ω, V_L = 10V, *(Figure 5)*				150		ns
t_{pd0}	Propagation to "0"	V_{CC} = 5.0V, T_A = 25°C, C_L = 15 pF, R_L = 50Ω, 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°C to +125°C temperature range for the DS1631, DS1632, DS1633 and DS1634 and across the 0°C to +70°C range for the DS3631, DS3632, DS3633 and DS3634. All typical values are for T_A = 25°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.
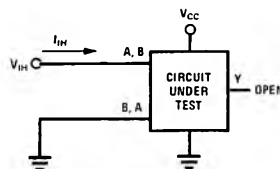
Test Circuits
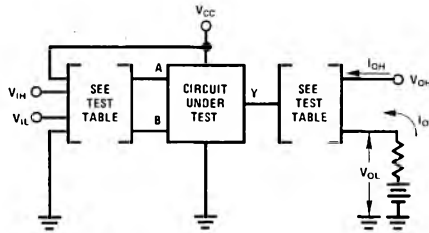
| CIRCUIT	INPUT UNDER TEST	OTHER INPUT	OUTPUT	
			APPLY	MEASURE
LM3611	V_{IH}	V_{IH}	I_{OH}	V_{OH}
	V_{IL}	V_{CC}	I_{OL}	V_{OL}
LM3612	V_{IH}	V_{IH}	I_{OL}	V_{OL}
	V_{IL}	V_{CC}	I_{OH}	V_{OH}
LM3613	V_{IH}	GND	I_{OH}	V_{OH}
	V_{IL}	V_{IL}	I_{OL}	V_{OL}
LM3614	V_{IH}	GND	I_{OL}	V_{OL}
	V_{IL}	V_{IL}	I_{OH}	V_{OH}

Note: Each input is tested separately.

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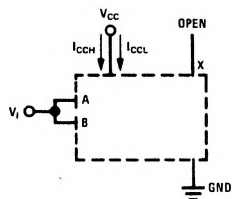

Each input is tested separately.

FIGURE 2. I_{IH}

Test Circuits and Switching Time Waveforms

DS1631/DS3631, DS1632/DS3632, DS1633/DS3633, DS1634/DS3634
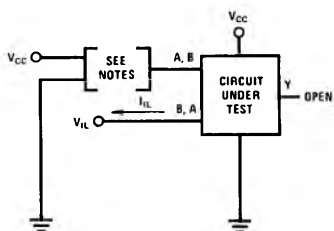
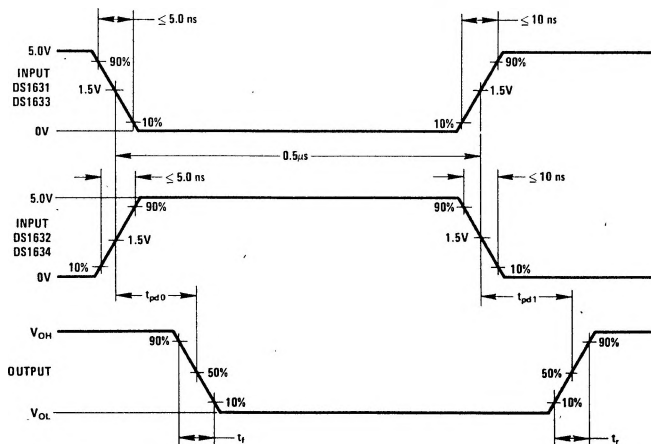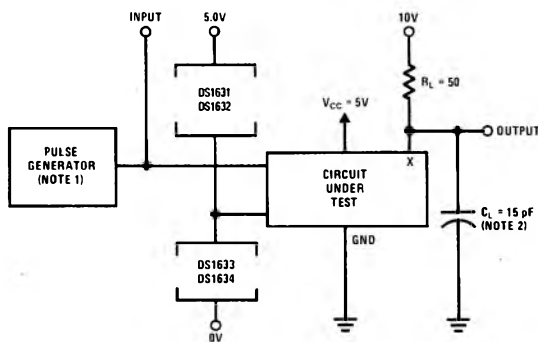Note A: Each input is tested separately.
Note B: When testing DS1633 and DS1634 input not under test is grounded. For all other circuits it is at V_{CC}.

FIGURE 3. I_{IL}

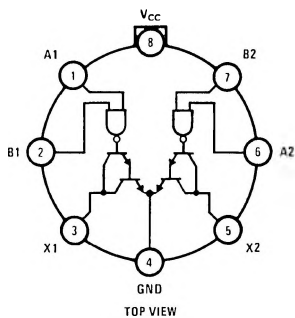Both gates are tested simultaneously.

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
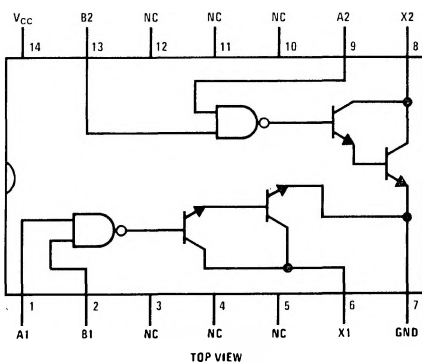
DS1631
Metal Can Package

Vcc
8
A1 1
B2 7 B2
B1 2
A2 6 A2
X1 3
5 X2
4
GND
TOP VIEW

(Pin 4 is electrically connected to the case)
Order Number DS1631H/DS3631H

Dual-In-Line Package

Vcc 8 B2 7 A2 6 X2 5

A1 1 B1 2 X1 3 GND 4
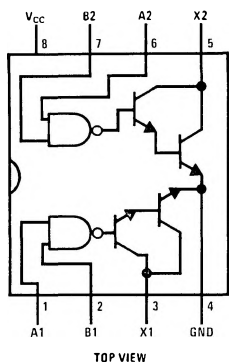
TOP VIEW
Order Number 3631N

Dual-In-Line Package

Vcc 14 B2 13 NC 12 NC 11 NC 10 A2 9 X2 8

A1 1 B1 2 NC 3 NC 4 NC 5 X1 6 GND 7

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

Vcc
8
A1 1
7 B2
B1 2
6 A2
X1 3
5 X2
4
GND
TOP VIEW
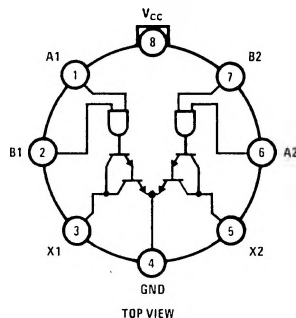
(Pin 4 is electrically connected to the case.)
Order Number DS1632H/DS3632H

Dual-In-Line Package

Vcc 8 B2 7 A2 6 X2 5

A1 1 B1 2 X1 3 GND 4
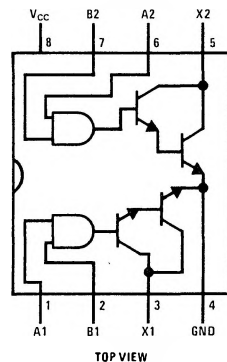
TOP VIEW
Order Number DS3632N

Dual-In-Line Package

Vcc 14 B2 13 NC 12 NC 11 NC 10 A2 9 X2 8

A1 1 B1 2 NC 3 NC 4 NC 5 X1 6 GND 7
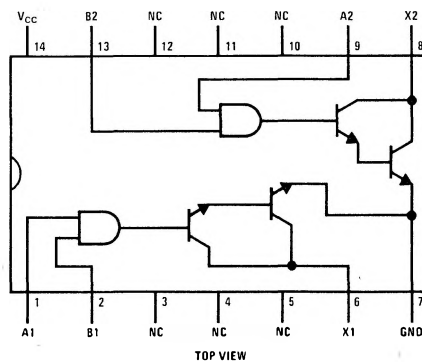
TOP VIEW
Order Number DS1632J/DS3632J

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

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

6-15

Connection Diagrams, Truth Tables, and Ordering Information

DS1633
Metal Can Package
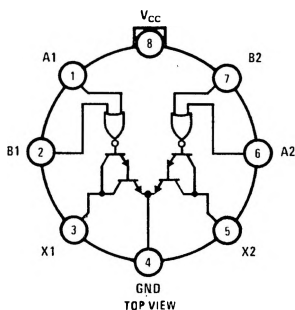
GND
TOP VIEW
(Pin 4 is electrically connected to the case.)
Order Number DS1633H/DS3633H

Dual-In-Line Package

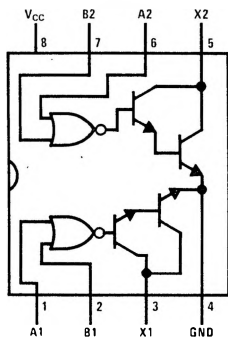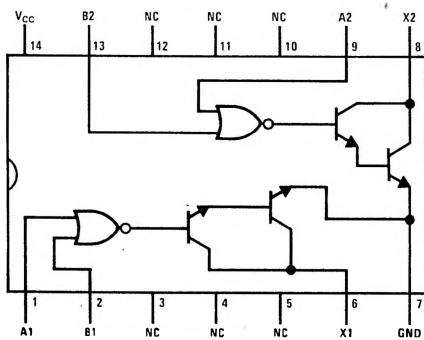

TOP VIEW
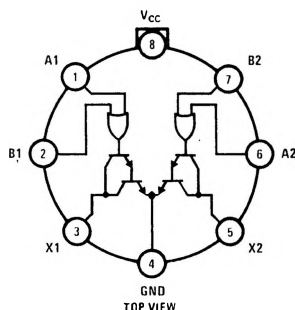**Order Number DS3633N**

Dual-In-Line Package

TOP VIEW
Order Number DS1633J/DS3633J

Positive logic: A + B = X

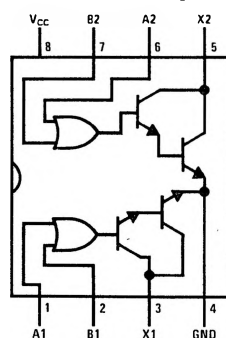| A	B	OUTPUT X
0	0	0
1	0	1
0	1	1
1	1	1

DS1634
Metal Can Package

GND
TOP VIEW
(Pin 4 is electrically connected to the case.)
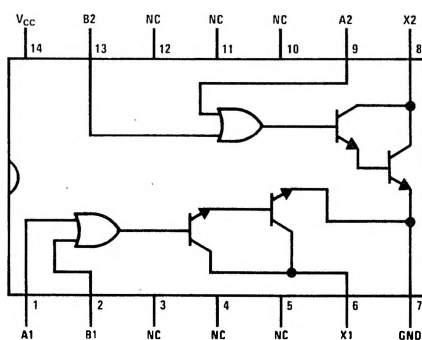**Order Number DS1634H/DS3634H**

Dual-In-Line Package

TOP VIEW
Order Number DS3634N

Dual-In-Line Package

TOP VIEW
Order Number DS1634J/DS3634J

Positive logic: $\overline{A + B}$ = X

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