

## DS1628/DS3628 Octal TRI-STATE® MOS Drivers

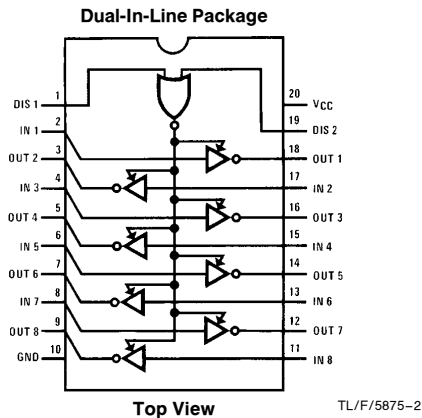
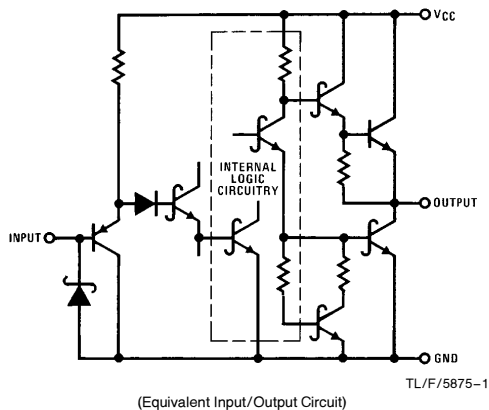
### General Description

The DS1628/DS3628 are octal Schottky memory drivers with TRI-STATE outputs designed to drive high capacitive loads associated with MOS memory systems. The drivers' output ( $V_{OH}$ ) is specified at 3.4V to provide additional noise immunity required by MOS inputs. A PNP input structure is employed to minimize input currents. The circuit employs Schottky-clamped transistors for high speed. A NOR gate of two inputs, DIS1 and DIS2, controls the TRI-STATE mode.

### Features

- High speed capabilities
  - Typical 5 ns driving 50 pF & 8 ns driving 500 pF
- TRI-STATE outputs
- High  $V_{OH}$  (3.4V min)
- High density
  - Eight drivers and two disable controls for TRI-STATE in a 20-pin package
- PNP inputs reduce DC loading on bus lines
- Glitch-free power up/down

### Schematic and Connection Diagrams



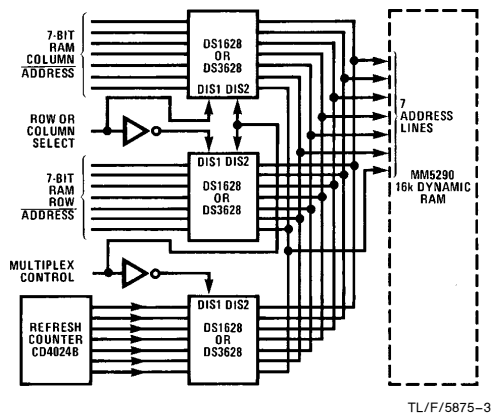
Order Number  
DS1628J, DS3628J, DS3628N  
See NS Package Number J20A or N20A

### Truth Table

| Disable Input |       | Input | Output |
|---------------|-------|-------|--------|
| DIS 1         | DIS 2 |       |        |
| H             | H     | X     | Z      |
| H             | X     | X     | Z      |
| X             | H     | X     | Z      |
| L             | L     | H     | L      |
| L             | L     | L     | H      |

H = high level  
L = low level  
X = don't care  
Z = high impedance (off)

### Typical Application



TRI-STATE® is a registered trademark of National Semiconductor Corp.

**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                           | 7.0V            |
| Logical "1" Input Voltage                | 7.0V            |
| Logical "0" Input Voltage                | −1.5V           |
| Storage Temperature Range                | −65°C to +150°C |
| Maximum Power Dissipation* at 25°C       |                 |
| Cavity Package                           | 1667 mW         |
| Molded Package                           | 1832 mW         |
| Lead Temperature (Soldering, 10 seconds) | 300°C           |

\*Derate cavity package 11.1 mW/°C above 25°C; derate molded package 14.7 mW/°C above 25°C.

**Operating Conditions**

|                             | Min | Max  | Units |
|-----------------------------|-----|------|-------|
| Supply voltage ( $V_{CC}$ ) | 4.5 | 5.5  | V     |
| Temperature ( $T_A$ )       |     |      |       |
| DS1628                      | −55 | +125 | °C    |
| DS3628                      | 0   | +70  | °C    |

**Electrical Characteristics** (Notes 2, 3)

| Symbol      | Parameter                              | Conditions                                                                       | Min           | Typ  | Max  | Units   |
|-------------|----------------------------------------|----------------------------------------------------------------------------------|---------------|------|------|---------|
| $V_{IN(1)}$ | Logical "1" Input Voltage              |                                                                                  | 2.0           |      |      | V       |
| $V_{IN(0)}$ | Logical "0" Input Voltage              |                                                                                  |               |      | 0.8  | V       |
| $I_{IN(1)}$ | Logical "1" Input Current              | $V_{CC} = 5.5V$ $V_{IN} = 5.5V$                                                  |               | 0.1  | 40   | $\mu A$ |
| $I_{IN(0)}$ | Logical "0" Input Current              | $V_{CC} = 5.5V$ $V_{IN} = 5.5V$                                                  |               | −180 | −400 | $\mu A$ |
| $V_{CLAMP}$ | Input Clamp Voltage                    | $V_{CC} = 4.5V$ $I_{IN} = -18 mA$                                                |               | −0.7 | −1.2 | V       |
| $V_{OH}$    | Logical "1" Output Voltage (No Load)   | $V_{CC} = 4.5V$ , $I_{OH} = -10 \mu A$                                           | DS1628        | 3.4  | 4.3  | V       |
|             |                                        |                                                                                  | DS3628        | 3.5  | 4.3  | V       |
| $V_{OL}$    | Logical "0" Output Voltage (No Load)   | $V_{CC} = 4.5V$ , $I_{OL} = 10 \mu A$                                            | DS1628        | 0.25 | 0.4  | V       |
|             |                                        |                                                                                  | DS3628        | 0.25 | 0.35 | V       |
| $V_{OH}$    | Logical "1" Output Voltage (With Load) | $V_{CC} = 4.5V$ , $I_{OH} = -1.0 mA$                                             | DS1628        | 2.5  | 3.9  | V       |
|             |                                        |                                                                                  | DS3628        | 2.7  | 3.9  | V       |
| $V_{OL}$    | Logical "0" Output Voltage (With Load) | $V_{CC} = 4.5V$ , $I_{OL} = 20 mA$                                               | DS1628/DS3628 | 0.35 | 0.5  | V       |
| $I_{ID}$    | Logical "1" Drive Current              | $V_{CC} = 4.5V$ , $V_{OUT} = 0V$ , (Note 6)                                      |               | −150 |      | mA      |
| $I_{OD}$    | Logical "0" Drive Current              | $V_{CC} = 4.5V$ , $V_{OUT} = 4.5V$ , (Note 6)                                    |               | 150  |      | mA      |
| Hi-Z        | TRI-STATE Output Current               | $V_{OUT} = 0.4V$ to 2.4V, DIS1 or DIS2 = 2.0V                                    | −40           | 0.1  | 40   | $\mu A$ |
| $I_{CC}$    | Power Supply Current                   | $V_{CC} = 5.5V$<br>One DIS Input = 3.0V<br>All Other Inputs = X, Outputs at Hi-Z |               | 90   | 120  | mA      |
|             |                                        | DIS1, DIS2 = 0V, Others = 3V<br>Outputs on                                       |               | 70   | 100  | mA      |
|             |                                        | All Inputs = 0V, Outputs Off                                                     |               | 25   | 50   | mA      |

**Switching Characteristics** ( $V_{CC} = 5V$ ,  $T_A = 25^\circ C$ ) (Note 6)

| Symbol   | Parameter                                                                 | Conditions                                                    | Min | Typ | Max | Units |
|----------|---------------------------------------------------------------------------|---------------------------------------------------------------|-----|-----|-----|-------|
| $t_{S+}$ | Storage Delay Negative Edge                                               | (Figure 1) $C_L = 50 pF$                                      |     | 4.0 | 5.0 | ns    |
|          |                                                                           | $C_L = 500 pF$                                                |     | 6.5 | 8.0 |       |
| $t_{S-}$ | Storage Delay Positive Edge                                               | (Figure 1) $C_L = 50 pF$                                      |     | 4.2 | 5.0 | ns    |
|          |                                                                           | $C_L = 500 pF$                                                |     | 6.5 | 8.0 |       |
| $t_F$    | Fall Time                                                                 | (Figure 1) $C_L = 50 pF$                                      |     | 4.2 | 6.0 | ns    |
|          |                                                                           | $C_L = 500 pF$                                                |     | 19  | 22  |       |
| $t_R$    | Rise Time                                                                 | (Figure 1) $C_L = 50 pF$                                      |     | 5.2 | 7.0 | ns    |
|          |                                                                           | $C_L = 500 pF$                                                |     | 20  | 24  |       |
| $t_{ZL}$ | Delay from Disable Input to Logical "0" Level (from High Impedance State) | $C_L = 50 pF$ to GND $R_L = 2 k\Omega$ to $V_{CC}$ (Figure 2) |     | 19  | 25  | ns    |
| $t_{ZH}$ | Delay from Disable Input to Logical "1" Level (from High Impedance State) | $C_L = 50 pF$ to GND $R_L = 2 k\Omega$ to GND (Figure 2)      |     | 13  | 20  | ns    |

## Switching Characteristics (Continued) ( $V_{CC} = 5V$ , $T_A = 25^\circ C$ ) (Note 6)

| Symbol   | Parameter                                                                 | Conditions                                                            | Min | Typ | Max | Units |
|----------|---------------------------------------------------------------------------|-----------------------------------------------------------------------|-----|-----|-----|-------|
| $t_{LZ}$ | Delay from Disable Input to High Impedance State (from Logical "0" Level) | $C_L = 50 \text{ pF}$ $R_L = 400\Omega$ to $V_{CC}$ to GND (Figure 3) |     | 18  | 25  | ns    |
| $t_{HZ}$ | Delay from Disable Input to High Impedance State (from Logical "1" Level) | $C_L = 50 \text{ pF}$ $R_L = 400\Omega$ to GND (Figure 3)             |     | 8.5 | 15  | ns    |

## AC Test Circuits and Switching Time Waveforms

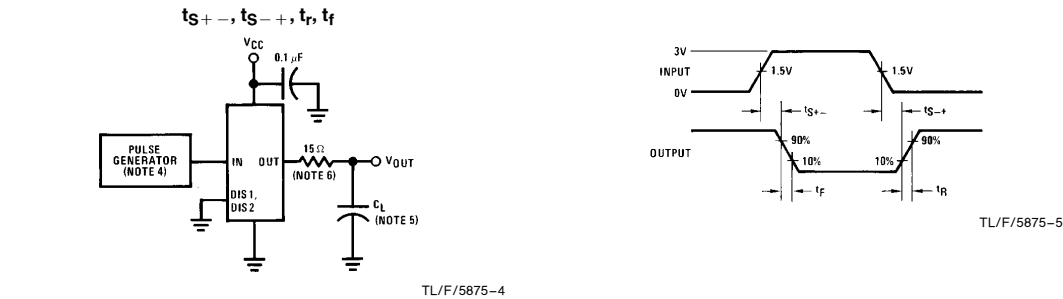


FIGURE 1

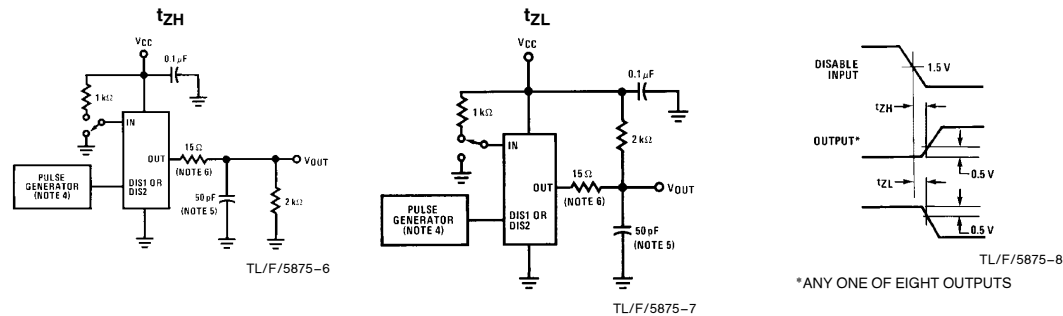


FIGURE 2

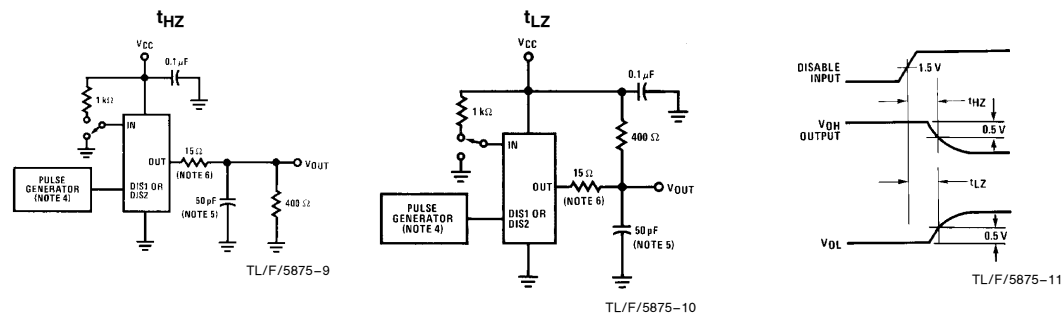


FIGURE 3

**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 DS1628 and across the  $0^\circ C$  to  $+70^\circ C$  range for the DS3628. All typical values are for  $T_A = 25^\circ C$  and  $V_{CC} = 5V$ .

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

**Note 4:** The pulse generator has the following characteristics:  $Z_{OUT} = 50\Omega$  and  $PRR \leq 1 \text{ MHz}$ . Rise and fall times between 10% and 90% points  $\leq 5 \text{ ns}$ .

**Note 5:**  $C_L$  includes probe and jig capacitance.

**Note 6:** When measuring output drive current and switching response for the DS1628 and DS3628 a  $15\Omega$  resistor should be placed in series with each output.

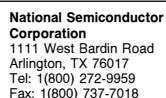
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N20A | REV G

## LIFE SUPPORT POLICY

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



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