National Semiconductor

March 1986

DS1649/DS3649/DS1679/DS3679 Hex TRI-STATE® TTL to MOS Drivers

General Description

The DS1649/DS3649 and DS1679/DS3679 are Hex TRI-STATE MOS drivers with outputs designed to drive large capacitive loads up to 500 pF associated with MOS memory systems. PNP input transistors are employed to reduce input currents allowing the large fan-out to these drivers needed in memory systems. The circuit has Schottky-clamped transistor logic for minimum propagation delay, and TRI-STATE outputs for bus operation.

The DS1649/DS3649 has a 15Ω resistor in series with the outputs to dampen transients caused by the fast-switching output. The DS1679/DS3679 has a direct low impedance output for use with or without an external resistor.

Features

- High speed capabilities
  - Typ 9 ns driving 50 pF
  - Typ 30 ns driving 500 pF
- TRI-STATE outputs for data bussing
- Built-in 15Ω damping resistor (DS1649/DS3649)
- Same pin-out as DM8096 and DM74366

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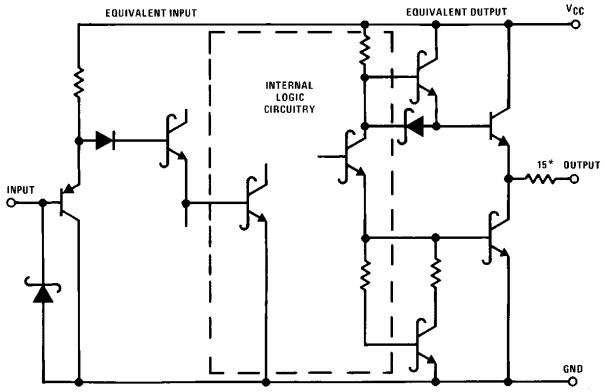
Schematic Diagram



*DS1649/DS3649 only

TL/F/7515–1

Truth Table

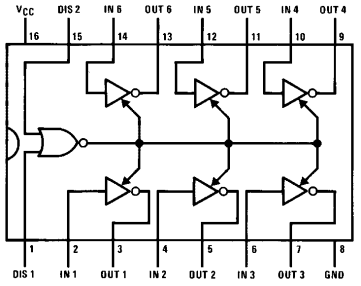
Disable Input		Input	Output
DIS 1	DIS 2		
0	0	0	1
0	0	1	0
0	1	X	Hi-Z
1	0	X	Hi-Z
1	1	X	Hi-Z

X = Don't care

Hi-Z = TRI-STATE mode

Connection Diagram

Dual-In-Line Package

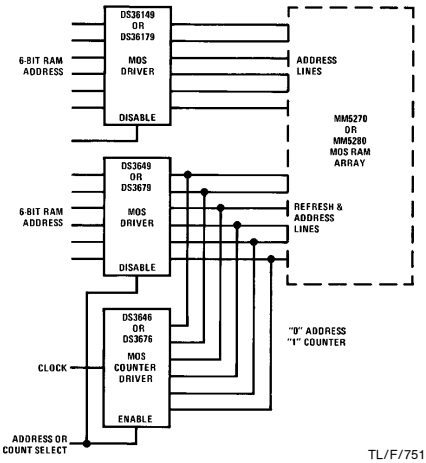


TL/F/7515–2

Top View

Order Number DS1649J, DS3649J, DS1679J, DS3679J, DS3649N or DS3679N
See NS Package Number J16A or N16A

Typical Application



TL/F/7515–3

RRD-B30M105/Printed in U. S. A.

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	1371 mW
Molded Package	1280 mW
Lead Temperature (Soldering, 10 sec.)	300°C

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC}	4.5	5.5	V
Temperature (T_A)			
DS1649, DS1679	−55	+125	°C
DS3649, DS3679	0	+70	°C

*Derate cavity package 9.1 mW/°C above 25°C; derate molded package 10.2 mW/°C above 25°C.

Electrical Characteristics (Note 2 and 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	μA
$I_{IN(0)}$	Logical "0" Input Current	V_{CC} = 5.5V, V_{IN} = 0.5V			−50	−250	μA
V_{CLAMP}	Input Clamp Voltage	V_{CC} = 4.5V, I_{IN} = −18 mA			−0.75	−1.2	V
V_{OH}	Logical "1" Output Voltage (No Load)	V_{CC} = 4.5V, I_{OH} = −10 μA	DS1649/DS1679	2.7	3.6		V
			DS3649/DS3679	2.8	3.6		
V_{OL}	Logical "0" Output Voltage (No Load)	V_{CC} = 4.5V, I_{OL} = 10 μA	DS1649/DS1679		0.25	0.4	V
			DS3649/DS3679		0.25	0.35	V
V_{OH}	Logical "1" Output Voltage (With Load)	V_{CC} = 4.5V, I_{OH} = −1.0 mA	DS1649	2.4	3.5		V
			DS1679	2.5	3.5		V
			DS3649	2.6	3.5		V
			DS3679	2.7	3.5		V
V_{OL}	Logical "0" Output Voltage (With Load)	V_{CC} = 4.5V, I_{OL} = 20 mA	DS1649		0.6	1.1	V
			DS1679		0.4	0.5	V
			DS3649		0.6	1.0	V
			DS3679		0.4	0.5	V
I_{1D}	Logical "1" Drive Current	V_{CC} = 4.5V, V_{OUT} = 0V (Note 4)			−250		mA
I_{0D}	Logical "0" Drive Current	V_{CC} = 4.5V, V_{OUT} = 4.5V (Note 4)			150		mA
Hi-Z	TRI-STATE Output Current	V_{OUT} = 0.4V to 2.4V, DIS1 or DIS2 = 2.0V		−40		40	μA
I_{CC}	Power Supply Current	V_{CC} = 5.5V	One DIS Input = 3.0V All Other Inputs = X		42	75	mA
			All Inputs = 0V		11	20	mA

Switching Characteristics (V_{CC} = 5V, T_A = 25°C) (Note 4)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
$t_{S\pm}$	Storage Delay Negative Edge	(*Figure 1*)	C_L = 50 pF		4.5	7	ns
			C_L = 500 pF		7.5	12	ns
$t_{S\pm}$	Storage Delay Positive Edge	(*Figure 1*)	C_L = 50 pF		5	8	ns
			C_L = 500 pF		8	13	ns
t_F	Fall Time	(*Figure 1*)	C_L = 50 pF		5	8	ns
			C_L = 500 pF		22	35	ns
t_R	Rise Time	(*Figure 1*)	C_L = 50 pF		6	9	ns
			C_L = 500 pF		21	35	ns
t_{ZL}	Delay from Disable Input to Logical "0" Level (from High Impedance State)	C_L = 50 pF, R_L = 2 kΩ to V_{CC} (*Figure 2*)			10	15	ns
t_{ZH}	Delay from Disable Input to Logical "1" Level (from High Impedance State)	C_L = 50 pF, R_L = 2 kΩ to GND (*Figure 2*)			8	15	ns
t_{LZ}	Delay from Disable Input to High Impedance State (from Logical "0" Level)	C_L = 50 pF, R_L = 400Ω to V_{CC} (*Figure 3*)			15	25	ns
t_{HZ}	Delay from Disable Input to High Impedance State (from Logical "1" Level)	C_L = 50 pF, R_L = 400Ω to GND (*Figure 3*)			10	25	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.

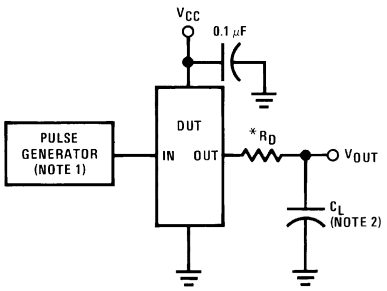
Note 2: Unless otherwise specified min/max limits apply across the −55°C to +125°C temperature range for the DS1649 and DS1679 and across the 0°C to +70°C range for the DS3649 and DS3679. All typical values are for T_A = 25°C and V_{CC} = 5V.

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.

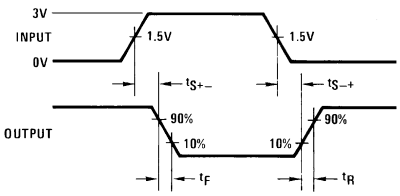
Note 4: When measuring output drive current and switching response for the DS1679 and DS3679 a 15Ω resistor should be placed in series with each output. This resistor is internal to the DS1649/DS3649 and need not be added.

AC Test Circuits and Switching Time Waveforms

$t_{S\pm}$, $t_{S\mp}$, t_R, t_F



TL/F/7515–4

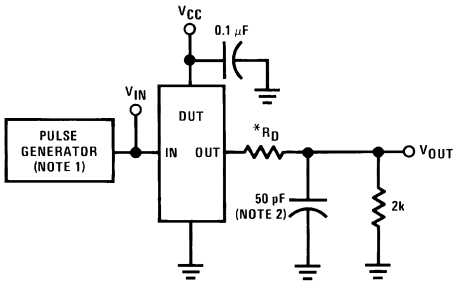


TL/F/7515–5

FIGURE 1

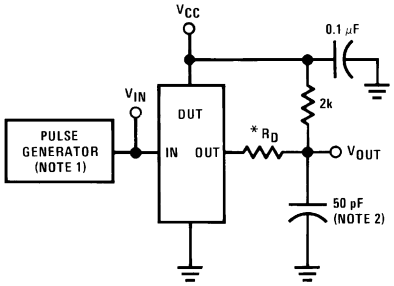
AC Test Circuits and Switching Time Waveforms (Continued)

t_{ZH}

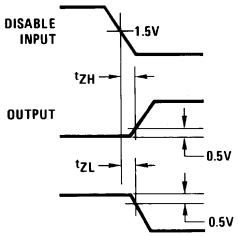


TL/F/7515–6

t_{ZL}



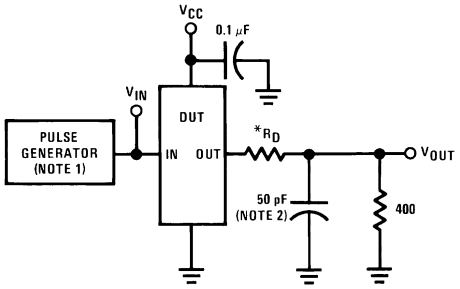
TL/F/7515–7



TL/F/7515–8

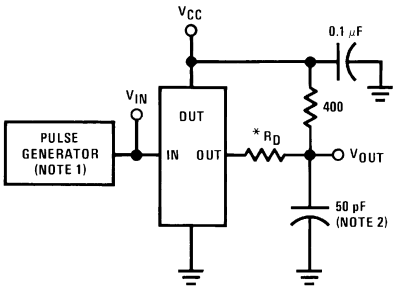
FIGURE 2

t_{HZ}

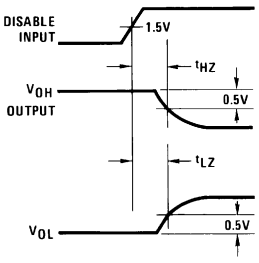


TL/F/7515–9

t_{LZ}



TL/F/7515–10



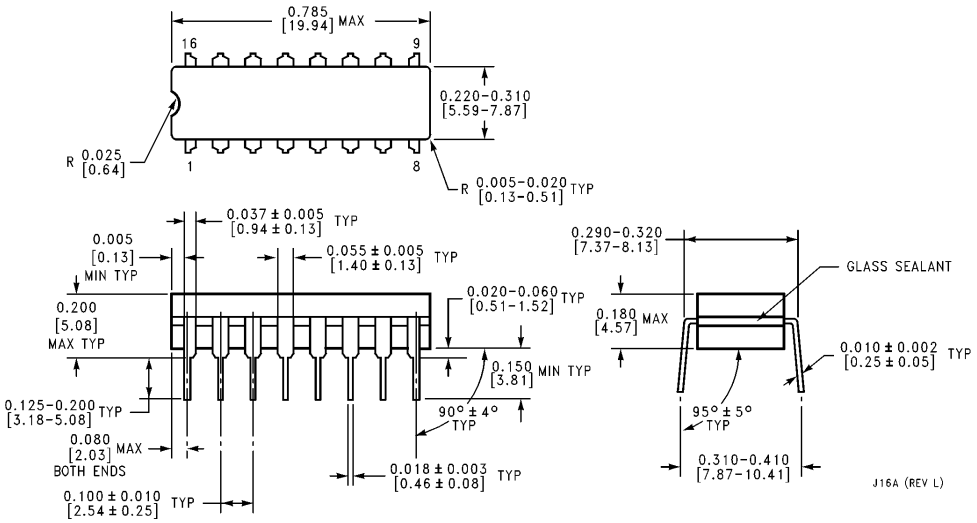
*Internal on DS1649 and DS3649

TL/F/7515–11

FIGURE 3

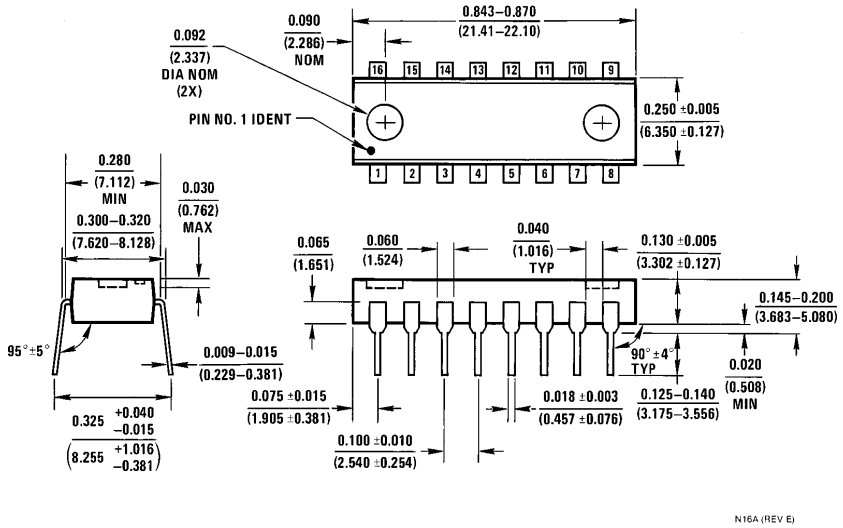
Note 1: The pulse generator has the following characteristics: $Z_{OUT} = 50\Omega$ and PRR $\leq$ 1 MHz. Rise and fall times between 10% and 90% points $\leq$ 5 ns.
Note 2: C_L includes probe and jig capacitance.

Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
Order Number DS1649J, DS3649J,
DS1679J or DS3679J
NS Package Number J16A

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number DS3649N or DS3679N
NS Package Number N16A

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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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