DS75361

DS75361 Dual TTL-to-MOS Driver

Literature Number: SNOSBR4A

National Semiconductor

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DS75361 Dual TTL-to-MOS Driver

General Description

The DS75361 is a monolithic integrated dual TTL-to-MOS driver interface circuit. The device accepts standard TTL input signals and provides high-current and high-voltage output levels for driving MOS circuits. It is used to drive address, control, and timing inputs for several types of MOS RAMs including the 1103 and MM5270 and MM5280.

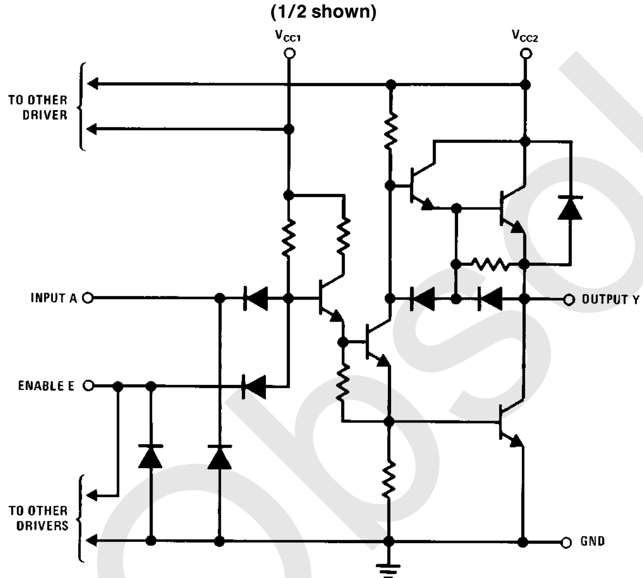
The DS75361 operates from standard TTL 5V supplies and the MOS V_{SS} supply in many applications. The device has been optimized for operation with V_{CC2} supply voltage from 16V to 20V; however, it is designed for use over a much wider range of V_{CC2}.

Features

- Capable of driving high-capacitance loads
- Compatible with many popular MOS RAMs
- V_{CC2} supply voltage variable over wide range to 24V
- Diode-clamped inputs
- TTL compatible
- Operates from standard bipolar and MOS supplies
- High-speed switching
- Transient overdrive minimizes power dissipation
- Low standby power dissipation

Schematic and Connection Diagrams

(1/2 shown)



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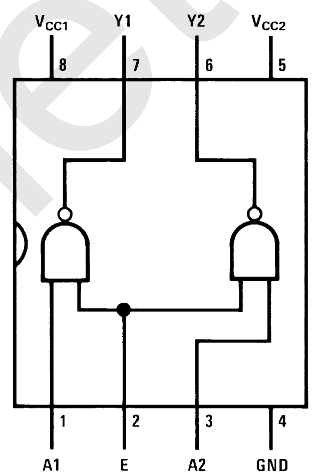
Dual-In-Line Package



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Top View

Order Number DS75361N
See NS Package Number N08E

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 Range of V_{CC1} (Note 1)	−0.5 to 7V
Supply Voltage Range of V_{CC2}	−0.5V to 25V
Input Voltage	5.5V
Inter-Input Voltage (Note 4)	5.5V
Storage Temperature Range	−65°C to +150°C
Maximum Power Dissipation* at 25°C	
Molded Package	1022 mW
Lead Temperature 1/16 inch from Case for 10 Seconds: N or P Package	200°C

*Derate molded package 8.2 mW/° above about 25°C.

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC1})	4.75	5.25	V
Supply Voltage (V_{CC2})	4.75	24	V
Operating Temperature (T_A)	0	+70	°C

Electrical Characteristics (Notes 2 and 3)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
V_{IH}	High-Level Input Voltage			2			V
V_{IL}	Low-Level Input Voltage					0.8	V
V_I	Input Clamp Voltage	I_I = −12 mA				−1.5	V
V_{OH}	High-Level Output Voltage	V_{IL} = 0.8V, I_{OH} = −50 μA		V_{CC2} − 1	V_{CC2} − 0.7		V
		V_{IL} = 0.8V, I_{OH} = −10 mA		V_{CC2} − 2.3	V_{CC2} − 1.8		V
V_{OL}	Low-Level Output Voltage	V_{IH} = 2V, I_{OL} = 10 mA			0.15	0.3	V
		V_{CC2} = 15V to 24V, V_{IH} = 2V, I_{OL} = 40 mA			0.25	0.5	V
V_O	Output Clamp Voltage	V_I = 0V, I_{OH} = 20 mA				V_{CC2} + 1.5	V
I_I	Input Current at Maximum Input Voltage	V_I = 5.5V				1	mA
I_{IH}	High-Level Input Current	V_I = 2.4V	A Inputs			40	μA
			E Input			80	μA
I_{IL}	Low-Level Input Current	V_I = 0.4V	A Inputs		−1	−1.6	mA
			E Input		−2	−3.2	mA
$I_{CC1(H)}$	Supply Current from V_{CC1}, Both Outputs High	V_{CC1} = 5.25V, All Inputs at 0V,	V_{CC2} = 24V, No Load		2	4	mA
$I_{CC2(H)}$	Supply Current from V_{CC2}, Both Outputs High					0.5	mA
$I_{CC1(L)}$	Supply Current from V_{CC1}, Both Outputs Low	V_{CC1} = 5.25V, All Inputs at 5V,	V_{CC2} = 24V, No Load		16	24	mA
$I_{CC2(L)}$	Supply Current from V_{CC2}, Both Outputs Low				7	11	mA
$I_{CC2(S)}$	Supply Current from V_{CC2}, Stand-by Condition	V_{CC1} = 0V, All Inputs at 5V,	V_{CC2} = 24V, No Load			0.5	mA

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 0°C to +70°C range for the DS75361. All typical values are for T_A = 25°C and V_{CC1} = 5V and V_{CC2} = 20V.

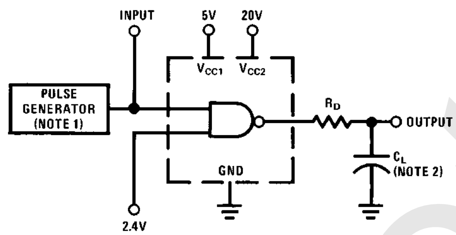
Note 3: All currents into device pins shown as positive, out of device pins as negative, all voltages referenced to ground unless otherwise noted. All values shown as max or min on absolute value basis.

Note 4: This rating applies between the A input of either driver and the common E input.

Switching Characteristics $V_{CC1} = 5V$, $V_{CC2} = 20V$, $T_A = 25°C$

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{DLH}	Delay Time, Low-to-High Level Output	$C_L = 390$ pF, $R_D = 10\Omega$ *(Figure 1)*		11	20	ns
t_{DHL}	Delay Time, High-to-Low Level Output			10	18	ns
t_{TLH}	Transition Time, Low-to-High Level Output			25	40	ns
t_{THL}	Transition Time, High-to-Low Level Output			21	35	ns
tPLH	Propagation Delay Time, Low-to-High Level Output		10	36	55	ns
t_{PHL}	Propagation Delay Time, High-to-Low Level Output		10	31	47	ns

AC Test Circuit and Switching Time Waveforms



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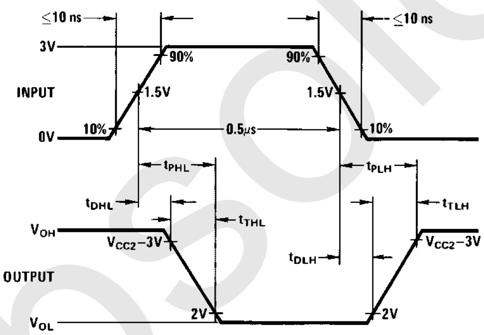

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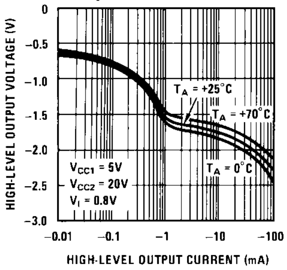
Note 1: The pulse generator has the following characteristics: PRR = 1 MHz, $Z_{OUT} = 50\Omega$.

Note 2: C_L includes probe and jig capacitance.

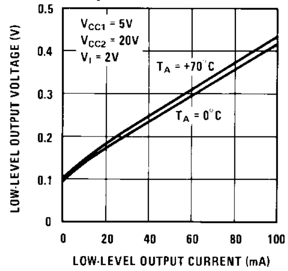
FIGURE 1. Switching Times, Each Driver

Typical Performance Characteristics

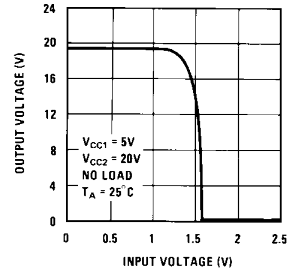
High-Level Output Voltage vs Output Current



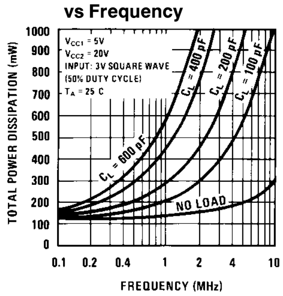
Low-Level Output Voltage vs Output Current



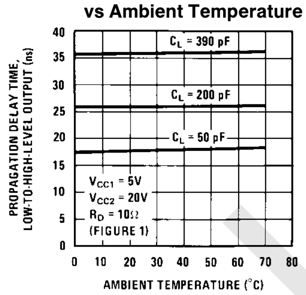
Voltage Transfer Characteristics



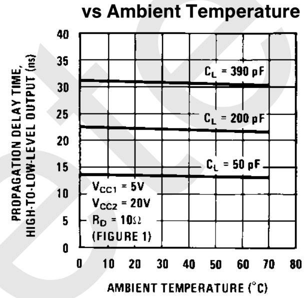
Total Dissipation (Both Drivers) vs Frequency



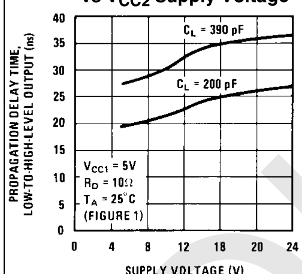
Propagation Delay Time, Low-to-High Level Output vs Ambient Temperature



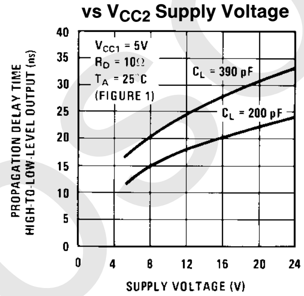
Propagation Delay Time, High-to-Low Level Output vs Ambient Temperature



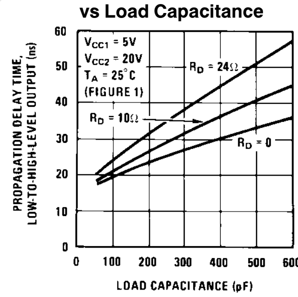
Propagation Delay Time, Low-to-High Level Output vs V_{CC2} Supply Voltage



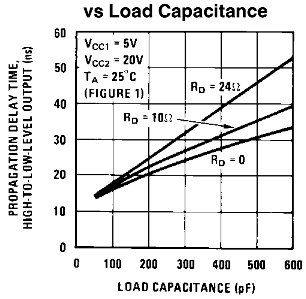
Propagation Delay Time, High-to-Low Level Output vs V_{CC2} Supply Voltage



Propagation Delay Time, Low-to-High Level Output vs Load Capacitance



Propagation Delay Time, High-to-Low Level Output vs Load Capacitance



TL/F/7557–2

Typical Applications

The fast switching speeds of this device may produce undesirable output transient overshoot because of load or wiring inductance. A small series damping resistor may be used to reduce or eliminate this output transient overshoot. The optimum value of the damping resistor to use depends on the specific load characteristics and switching speed. A typical value would be between 10Ω and 30Ω *(Figure 3)*.

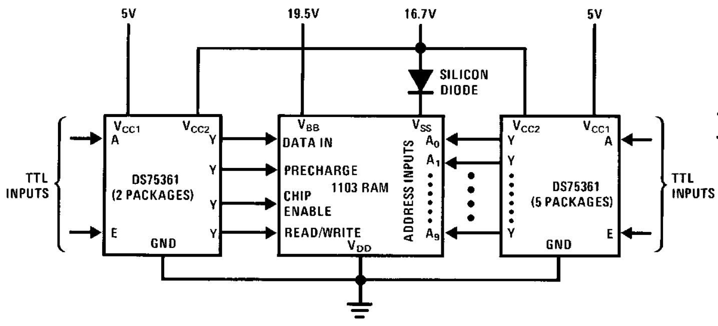
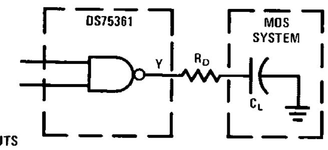


FIGURE 2. Interconnection of DS75361 Devices with 1103 RAM



Note: $R_D \approx 10\Omega$ to 30Ω (Optional).

FIGURE 3. Use of Damping Resistor to Reduce or Eliminate Output Transient Overshoot in Certain DS75361 Applications

Thermal Information

POWER DISSIPATION PRECAUTIONS

Significant power may be dissipated in the DS75361 driver when charging and discharging high-capacitance loads over a wide voltage range at high frequencies. The total dissipation curve shows the power dissipated in a typical DS75361 as a function of load capacitance and frequency. Average power dissipated by this driver can be broken into three components:

$$P_{T(AV)} = P_{DC(AV)} + P_{C(AV)} + P_{S(AV)}$$

where $P_{DC(AV)}$ is the steady-state power dissipation with the output high or low, $P_{C(AV)}$ is the power level during charging or discharging of the load capacitance, and $P_{S(AV)}$ is the power dissipation during switching between the low and high levels. None of these include energy transferred to the load and all are averaged over a full cycle.

The power components per driver channel are:

$$P_{DC(AV)} = \frac{P_L t_L + P_H t_H}{T}$$

$$P_{C(AV)} \approx C\,V_C^2\,f$$

$$P_{S(AV)} = \frac{P_{LH} t_{LH} + P_{HL} t_{HL}}{T}$$

where the times are defined in *Figure 4*.

P_L, P_H, P_{LH}, and P_{HL} are the respective instantaneous levels of power dissipation and C is load capacitance.

The DS75361 is so designed that P_S is a negligible portion of P_T in most applications. Except at very high frequencies, $t_L + t_H \gg t_{LH} + t_{HL}$ so that P_S can be neglected. The total dissipation curve for no load demonstrates this point. The power dissipation contributions from both channels are then added together to obtain total device power.

The following example illustrates this power calculation technique. Assume both channels are operating identically with C = 200 pF, f = 2 MHz, V_{CC1} = 5V, V_{CC2} = 20V, and duty cycle = 60% outputs high ($t_H/T = 0.6$). Also, assume V_{OH} = 19.3V, V_{OL} = 0.1V, P_S is negligible, and that the current from V_{CC2} is negligible when the output is high.

On a per-channel basis using data sheet values:

$$P_{DC(AV)} = \left[(5V)\left(\frac{2\ mA}{2}\right) + (20V)\left(\frac{0\ mA}{2}\right) \right](0.6) + \left[(5V)\left(\frac{16\ mA}{2}\right) + (20V)\left(\frac{7\ mA}{2}\right) \right](0.4)$$

$P_{DC(AV)} = 47$ mW per channel

$P_{C(AV)} \approx (200\ pF)\ (19.2V)^2\ (2\ MHz)$

$P_{C(AV)} \approx 148$ mW per channel.

For the total device dissipation of the two channels:

$P_{T(AV)} \approx 2\ (47 + 148)$

$P_{T(AV)} \approx 390$ mW typical for total package.

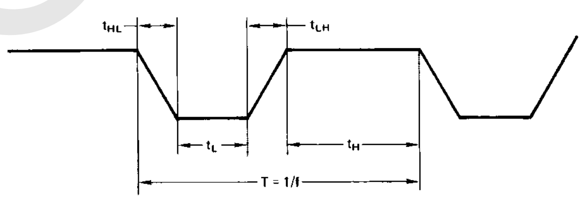
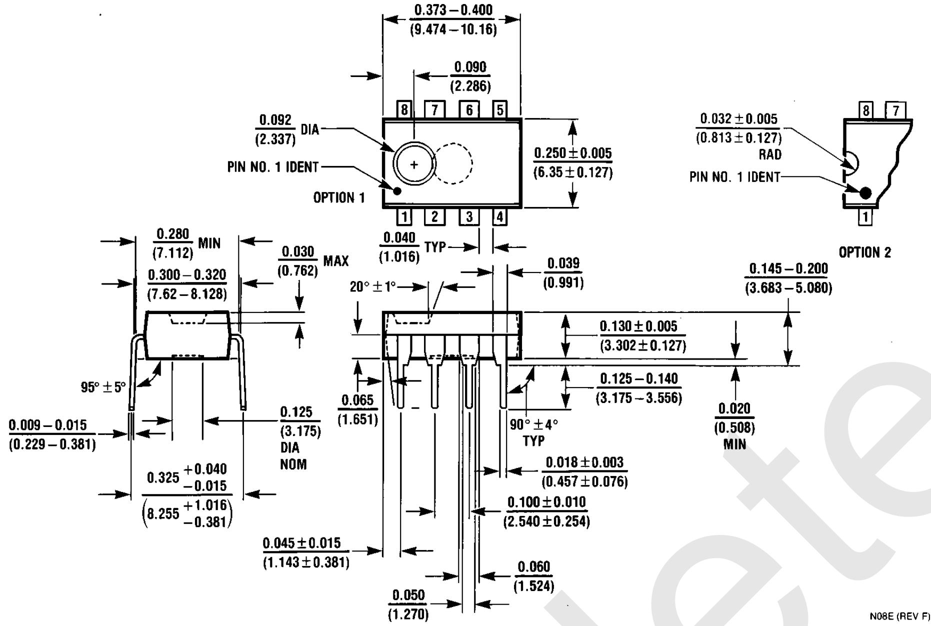


FIGURE 4. Output Voltage Waveform

Physical Dimensions inches (millimeters)



Molded Dual-In-Line Package
Order Number DS75361N
See NS Package Number N08E

National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

National Semiconductor Europe
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2408