



# Am26LS31

## Quad High Speed Differential Line Driver

### DISTINCTIVE CHARACTERISTICS

- Output skew – 2.0 ns typical
- Input to output delay – 12 ns
- Operation from single +5 V supply
- 16-pin hermetic and molded DIP package
- Outputs won't load line when  $V_{CC} = 0$
- Four line drivers in one package for maximum package density
- Output short-circuit protection
- Complementary outputs
- Meets the requirements of EIA standard RS-422
- High output drive capability for 100  $\Omega$  terminated transmission lines
- Available in military and commercial temperature range
- Advanced low-power Schottky processing

### GENERAL DESCRIPTION

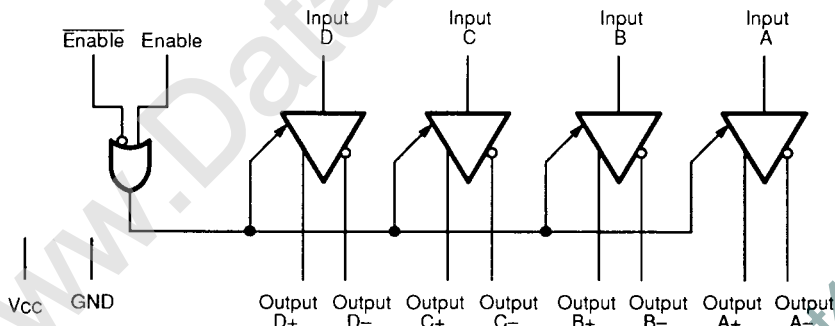
The Am26LS31 is a quad-differential line driver, designed for digital data transmission over balanced lines. The Am26LS31 meets all the requirements of EIA standard RS-422 and federal standard 1020. It is designed to provide unipolar differential drive to twisted-pair or parallel-wire transmission lines.

The circuit provides an enable and disable function common to all four drivers. The Am26LS31 features

3-state outputs and logical OR-ed complementary enable inputs. The inputs are all LS compatible and are all one unit load.

The Am26LS31 is constructed using advanced low-power Schottky processing.

### BLOCK DIAGRAM



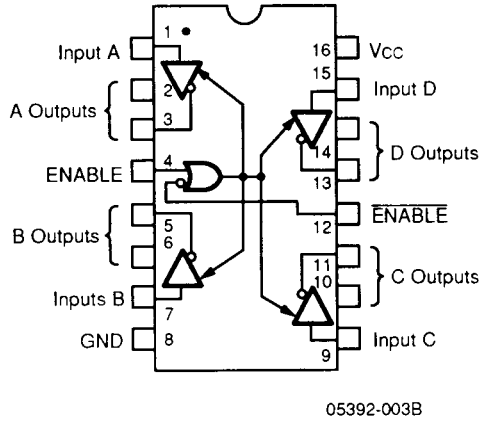
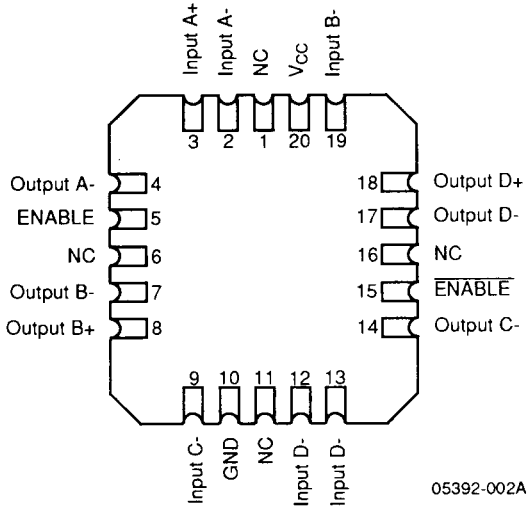
05392-001A

### RELATED PRODUCTS

Part No.	Description
26LS30	Dual Differential RS-422 Party Line/Quad Single Ended RS-423 Line Driver
26LS32	Quad Differential RS-422 Line Receiver

CONNECTION DIAGRAMS

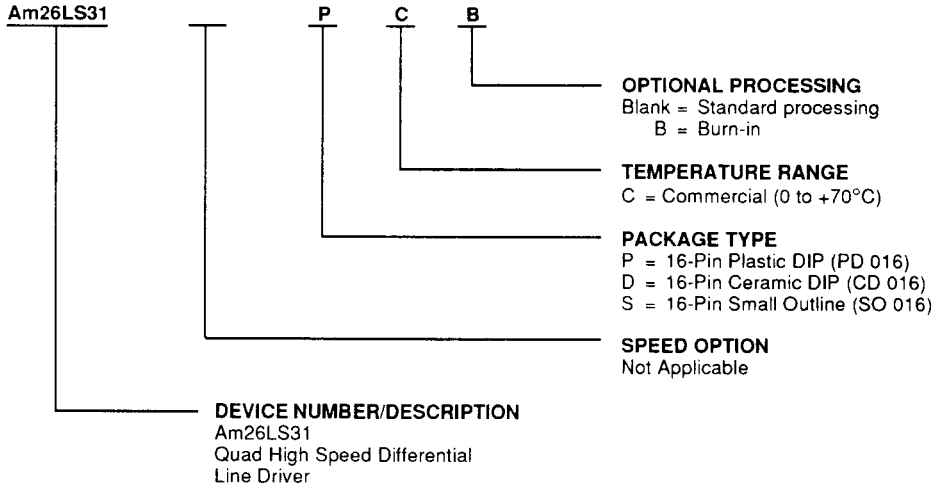
Top View



**ORDERING INFORMATION**

**Standard Products**

AMD standard products are available in several packages and operating ranges. The order number (Valid Combination) is formed by a combination of:



Valid Combinations	
AM26LS31	PC, PCB DC, DCB SC

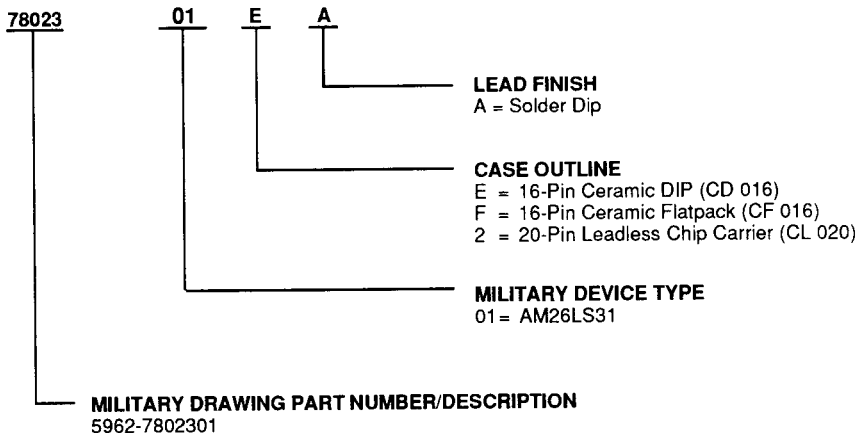
**Valid Combinations**

Valid Combinations list configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations or to check on newly released combinations, and to obtain additional data on AMD's standard military grade products.

**MILITARY ORDERING INFORMATION**

**SMD/DESC Products**

AMD products for Aerospace and Defense applications are available in several packages and operating ranges. Standard Military Drawing (SMD)/DESC products are fully compliant with MIL-STD-883C requirements. The order number (Valid Combination) is formed by a combination of:



Valid Combinations	
5962-7802301	MEA, MFA, M2A

**Valid Combinations**

Valid Combinations list configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations, or to check on newly released combinations.

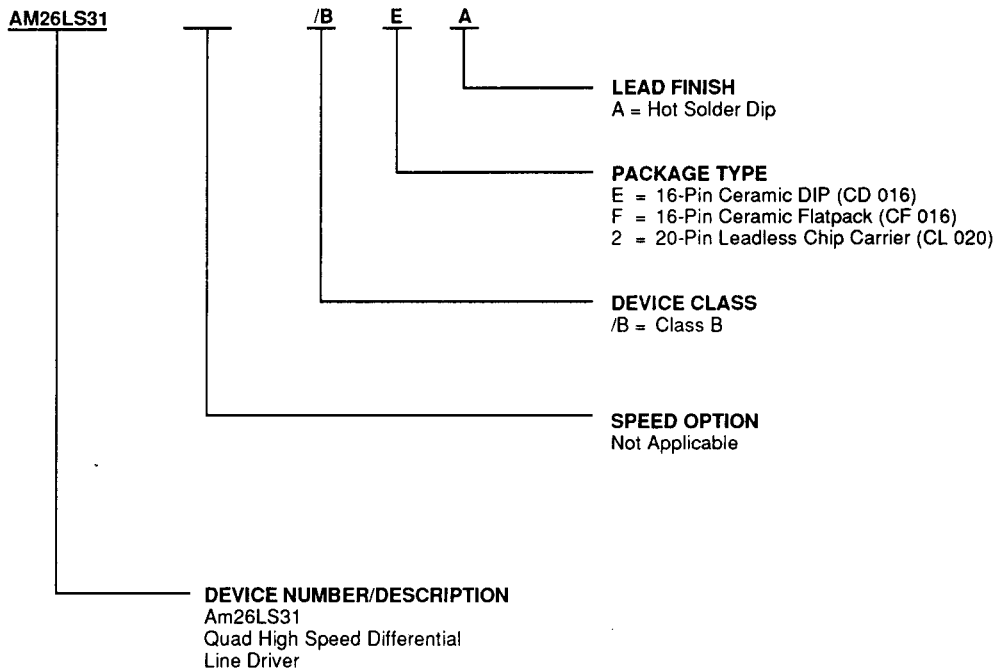
**Group A Tests**

Group A tests consist of Subgroups  
1, 2, 3, 7, 8, 9, 10, 11.

**MILITARY ORDERING INFORMATION**

**APL Products**

AMD products for Aerospace and Defense applications are available in several packages and operating ranges. APL (Approved Products List) products are fully compliant with MIL-STD-883C requirements. The order number (Valid Combination) is formed by a combination of:



Valid Combinations	
Am26LS31	/BEA, /BFA, /B2A

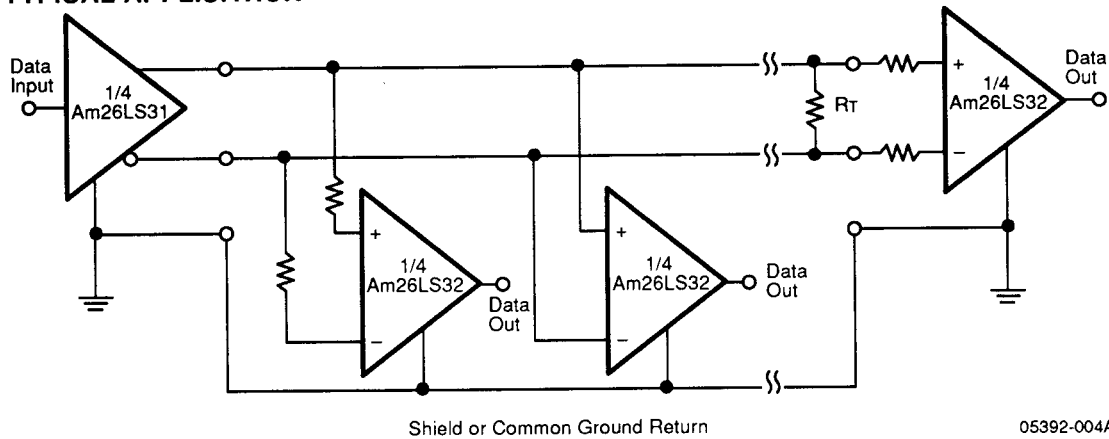
**Valid Combinations**

Valid Combinations list configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations, or to check on newly released combinations.

**Group A Tests**

Group A tests consist of Subgroups 1, 2, 3, 7, 8, 9, 10, 11.

## TYPICAL APPLICATION



**ABSOLUTE MAXIMUM RATINGS**

Storage Temperature	-65 to +150°C
Supply Voltage	-0.5 to 7.0 V
DC Input Voltage	-1.5 to 7.0 V
DC Output Voltage	-0.5 to V <sub>CC</sub> max

Stresses above those listed under Absolute Maximum Ratings may cause permanent device failure. Functionality at or above these limits is not implied. Exposure to absolute maximum ratings for extended periods may affect device reliability.

**OPERATING RANGES****Commercial (C) Devices**

Ambient Temperature (T <sub>A</sub> )	0 to +70°C
Supply Voltage (V <sub>CC</sub> )	+4.75 to +5.25 V

**Military (M) Devices**

Temperature	-55 to +125°C
Supply Voltage (V <sub>CC</sub> )	+4.5 to +5.5 V

Operating ranges define those limits between which the functionality of the device is guaranteed.

**DC CHARACTERISTICS over operating ranges unless otherwise specified**

Parameter Symbol	Parameter Description	Test Conditions (Note 2)	Min.	Typ. (Note 1)	Max.	Unit
V <sub>OH</sub>	Output HIGH Voltage	V <sub>CC</sub> = Min; I <sub>OH</sub> = -20 mA	2.5	3.2		V
V <sub>OL</sub>	Output LOW Voltage	V <sub>CC</sub> = Min; I <sub>OL</sub> = 20 mA		0.32	0.5	V
V <sub>IH</sub>	Input HIGH Voltage	V <sub>CC</sub> = Min; (Note 3)	2.0			V
V <sub>IL</sub>	Input LOW Voltage	V <sub>CC</sub> = Max. (Note 3)			0.8	V
I <sub>IL</sub>	Input LOW Current	V <sub>CC</sub> = Max., V <sub>IN</sub> = 0.4 V		-0.20	-0.36	mA
I <sub>IH</sub>	Input HIGH Current	V <sub>CC</sub> = Max., V <sub>IN</sub> = 2.7 V		0.5	20	μA
I <sub>I</sub>	Input Reverse Current	V <sub>CC</sub> = Max., V <sub>IN</sub> = 7.0 V			0.1	mA
I <sub>O</sub>	Off-State (High-Impedance) Output Current	V <sub>CC</sub> = Max. V <sub>O</sub> = 2.5 V V <sub>O</sub> = 0.5 V			20 -20	μA
V <sub>I</sub>	Input CLAMP Voltage	V <sub>CC</sub> = Min., I <sub>IN</sub> = -18 mA		-0.8	-1.5	V
I <sub>OFF</sub>	Power off leakage Current	V <sub>CC</sub> = 0 V V <sub>OUT</sub> = 6 V V <sub>OUT</sub> = -.25 V			100 -100	μA
I <sub>SC</sub>	Output Short Circuit Current	V <sub>CC</sub> = Max., (Note 4)	-30	-60	-150	mA
I <sub>CC</sub>	Power Supply Current	V <sub>CC</sub> = Max., all outputs disabled		60	80	mA

**AC Parameters V<sub>CC</sub> = 5.0 V, T<sub>A</sub> = 25°C**

t <sub>PLH</sub>	Input to Output	V <sub>CC</sub> = 5.0 V, T <sub>A</sub> = 25°C, Load = Note 2		12	20	ns
t <sub>PHL</sub>	Input to Output	V <sub>CC</sub> = 5.0 V, T <sub>A</sub> = 25°C, Load = Note 2		12	20	ns
SKEW	Output to Output	V <sub>CC</sub> = 5.0 V, T <sub>A</sub> = 25°C, Load = Note 2		2.0	6.0	ns
t <sub>LZ</sub>	Enable to Output	V <sub>CC</sub> = 5.0 V, T <sub>A</sub> = 25°C, C <sub>L</sub> = 10 pF R <sub>L1</sub> = 180 Ω, R <sub>L2</sub> = 75 Ω		23	35	ns
t <sub>HZ</sub>	Enable to Output	V <sub>CC</sub> = 5.0 V, T <sub>A</sub> = 25°C, C <sub>L</sub> = 10 pF R <sub>L1</sub> = 180 Ω, R <sub>L2</sub> = 75 Ω		17	30	ns
t <sub>ZL</sub>	Enable to Output	V <sub>CC</sub> = 5.0 V, T <sub>A</sub> = 25°C, Load = Note 2		35	45	ns
t <sub>ZH</sub>	Enable to Output	V <sub>CC</sub> = 5.0 V, T <sub>A</sub> = 25°C, Load = Note 2		30	40	ns

**Notes:**

1. All typical values are V<sub>CC</sub> = 5.0 V, T<sub>A</sub> = 25°C.
2. C<sub>L</sub> = 30 pF, V<sub>IN</sub> = 1.3 V to V<sub>OUT</sub> = 1.3 V, V<sub>PULSE</sub> = 0 V to +3.0 V, R<sub>L1</sub> = 180 Ω, R<sub>L2</sub> = 75 Ω.
3. Input thresholds are tested during DC tests and may be done in combination with testing of other DC parameters.
4. Not more than one output should be shorted at a time. Duration of the short circuit test should not exceed one second.

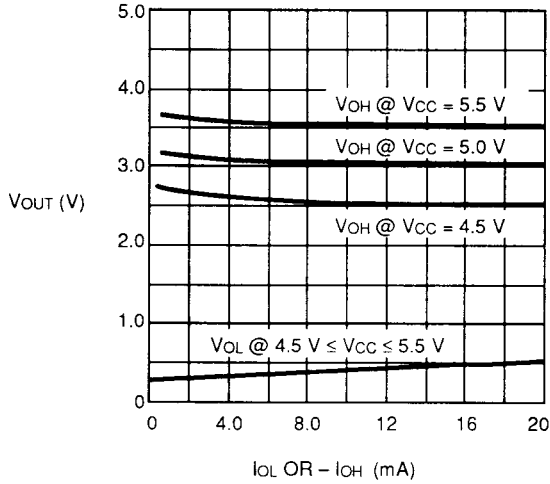
## SWITCHING CHARACTERISTICS

Parameter Symbol	Parameter Description	Test Conditions	Min.	Typ. (Note 1)	Max.	Unit
<b>AC Parameters (Commercial)</b> $V_{CC} = 4.75\text{ V} - 5.25\text{ V}$ ; $T_A = 0^\circ\text{C} - 70^\circ\text{C}$						
t <sub>PLH</sub>	Propagation Delay from Input to Output	$C_L = 30\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		18	30	ns
t <sub>PHL</sub>	Propagation Delay from Input to Output	$C_L = 30\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		18	30	ns
t <sub>SKEW</sub>	Output to Output	$C_L = 30\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		3.0	9.0	ns
t <sub>PLZ</sub>	Propagation Delay from Enable to Output	$C_L = 10\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		35	53	ns
t <sub>PHZ</sub>	Propagation Delay from Enable to Output	$C_L = 10\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		25	45	ns
t <sub>PZL</sub>	Propagation Delay from Enable to Output	$C_L = 30\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		53	68	ns
t <sub>PZH</sub>	Propagation Delay from Enable to Output	$C_L = 30\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		45	60	ns
<b>AC Parameters (Military)</b> $V_{CC} = 4.75\text{ V} - 5.25\text{ V}$ ; $T_A = -55^\circ\text{C} - +125^\circ\text{C}$						
t <sub>PLH</sub>	Propagation Delay from Input to Output	$C_L = 30\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		18	30	ns
t <sub>PHL</sub>	Propagation Delay from Input to Output	$C_L = 30\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		18	30	ns
t <sub>SKEW</sub>	Output to Output	$C_L = 30\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		3.0	9.0	ns
t <sub>PLZ</sub>	Propagation Delay from Enable to Output	$C_L = 10\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		35	53	ns
t <sub>PHZ</sub>	Propagation Delay from Enable to Output	$C_L = 10\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		25	45	ns
t <sub>PZL</sub>	Propagation Delay from Enable to Output	$C_L = 30\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		53	68	ns
t <sub>PZH</sub>	Propagation Delay from Enable to Output	$C_L = 30\text{ pF}$ , $R_{L1} = 180\ \Omega$ , $R_{L2} = 75\ \Omega$		45	60	ns



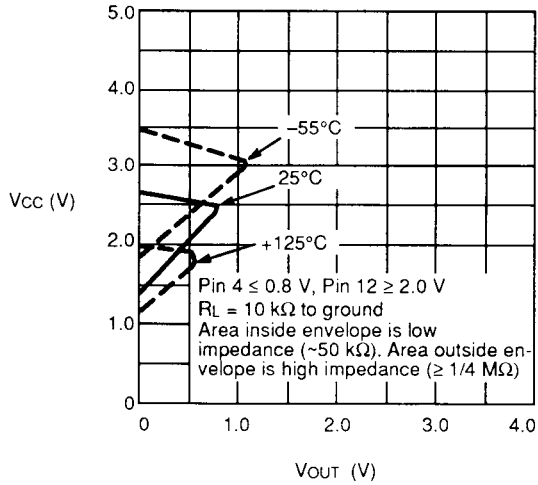
PERFORMANCE CURVES

Guaranteed  $V_{OH}$  and  $V_{OL}$   
 ( $T_A = -55^\circ\text{C}$  to  $+125^\circ\text{C}$ )








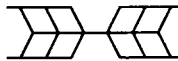
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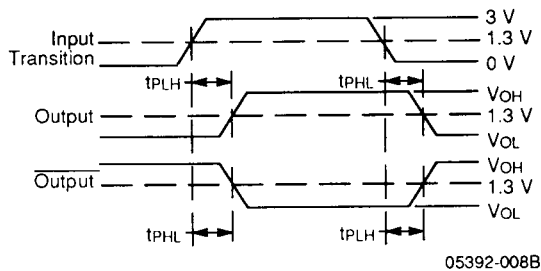
$V_{OUT}$  Versus  $V_{CC}$



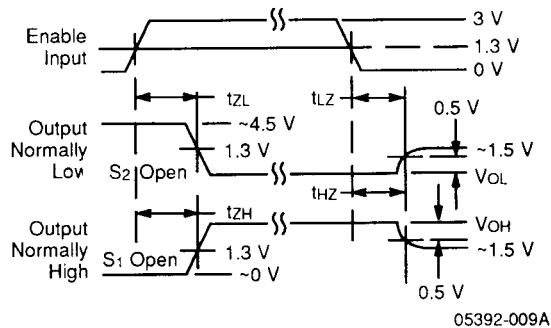
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## KEY TO SWITCHING WAVEFORMS

WAVEFORM	INPUTS	OUTPUTS
	Must Be Steady	Will Be Steady
		
	May Change from H to L	Will Be Changing from H to L
	May Change from L to H	Will Be Changing from L to H
	Don't Care, Any Change Permitted	Changing State Unknown
	Does Not Apply	Center Line is High Impedance "Off" State



**Propagation Delay**  
(Notes 1 and 3)

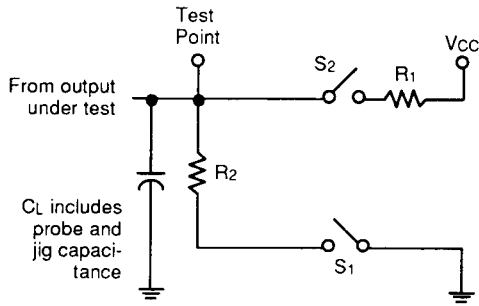


**Enable and Disable Times**  
(Notes 2 and 3)

**Notes:**

1. Diagram shown for  $\overline{\text{Enable}}$  LOW.
2. S<sub>1</sub> and S<sub>2</sub> of Load Circuit are closed except where shown.
3. Pulse Generator for All Pulses: Rate ≤ 1.0 MHz; Z<sub>0</sub> = 50 Ω; t<sub>r</sub> ≤ 15 ns; t<sub>f</sub> ≤ 6.0 ns.

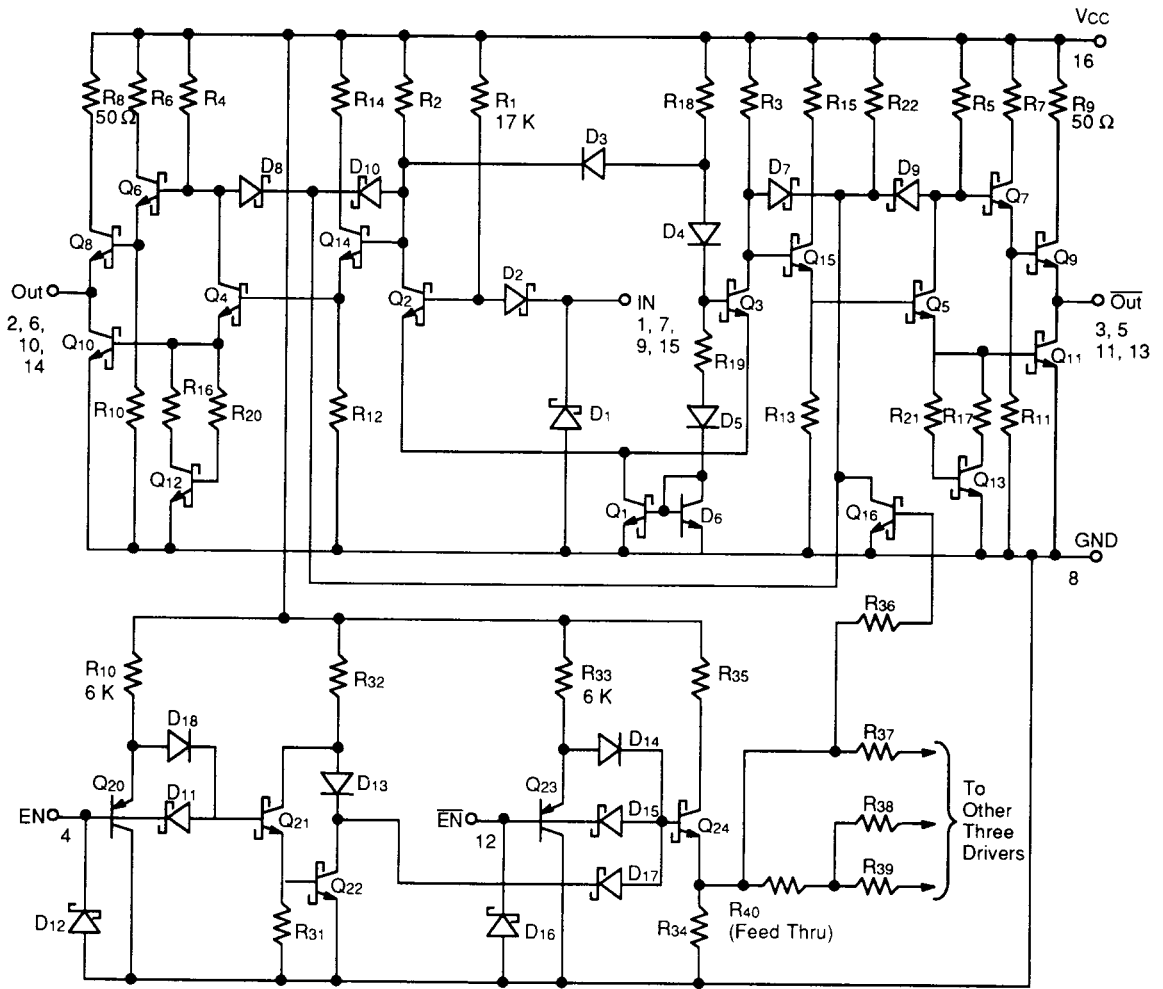
SWITCHING TEST CIRCUIT



05392-007B

Three-State Outputs

EQUIVALENT CIRCUIT (1/4 Am26LS31)



05392-010A