Am26LS29

Quad Three-State Single Ended RS-423 Line Driver

Advanced Micro Devices

DISTINCTIVE CHARACTERISTICS

- Four single ended line drivers in one package for maximum package density
- Output short-circuit protection
- Individual rise time control for each output
- High capacitive load drive capability
- Low I_{CC} and I_{EE} power consumption (26mW/driver typ.)
- Meets all requirements of RS-423
- Three-state outputs for bus oriented systems
- Outputs do not clamp line with power off. Outputs are in high-impedance state over entire transmission line voltage range of RS-423
- Low current PNP inputs compatible with TTL, MOS and CMOS
- Available in military and commercial temperature range
- Advanced low power Schottky processing

GENERAL DESCRIPTION

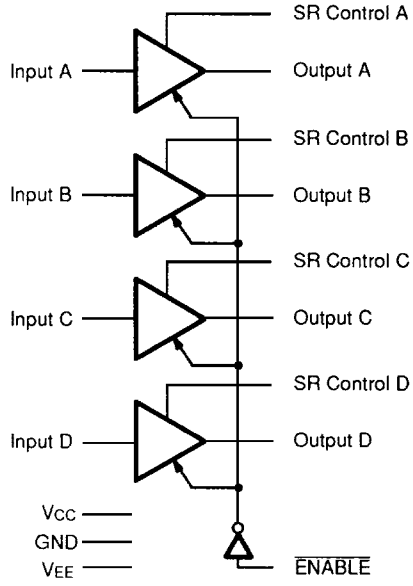
The Am26LS29 is a quad single ended line driver, designed for digital data transmission. The Am26LS29 meets all the requirements of EIA Standard RS-423 and Federal STD 1030. It features four buffered outputs with high source and sink current, and output short circuit protection.

A slew rate control pin allows the use of an external capacitor to control slew rate for suppression of near end cross talk to receivers in the cable.

The Am26LS29 has three-state outputs for bus oriented systems. The outputs in the high-impedance state will not clamp the line over the transmission line voltage of RS-423. A typical full duplex system would use the Am26LS29 line driver and up to twelve Am26LS32 line receivers or an Am26LS32 line receiver and up to thirty-two Am26LS29 line drivers with only one enabled at a time and all others in the three-state mode.

The Am26LS29 is constructed using advanced low-power Schottky processing.

BLOCK DIAGRAM



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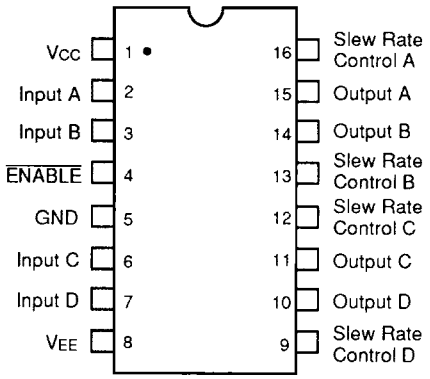
RELATED PRODUCTS

Part Number	Description
26LS30	Dual Differential RS-422 Party Line/Quad Single Ended RS-423 Line Driver
26LS32	Quad Differential Line Receiver
26LS33	Quad Differential Line Receiver

CONNECTION DIAGRAMS

Top View

DIP



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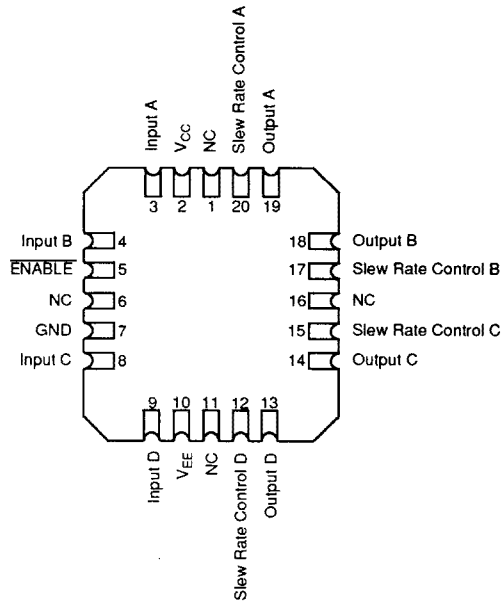
LCC



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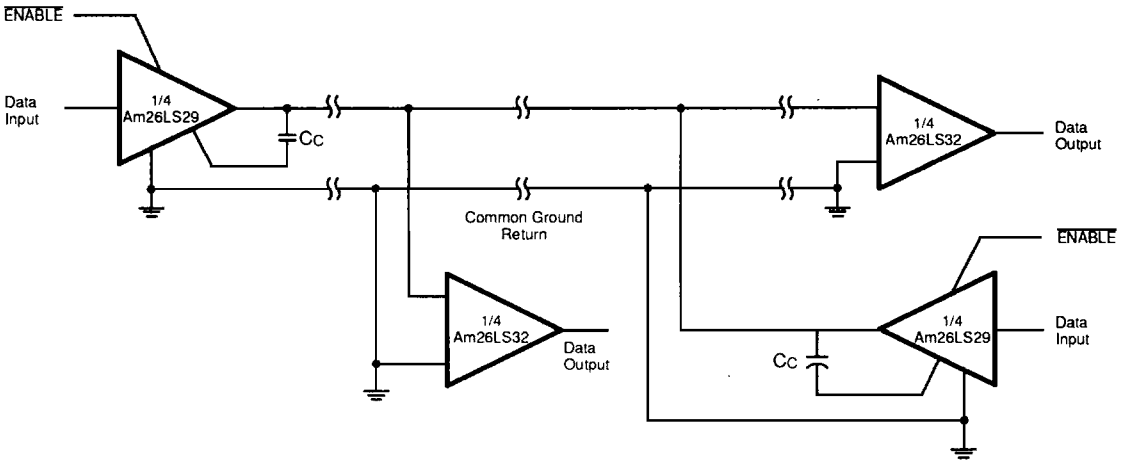
Note:
Pin 1 is marked for orientation

TYPICAL APPLICATION



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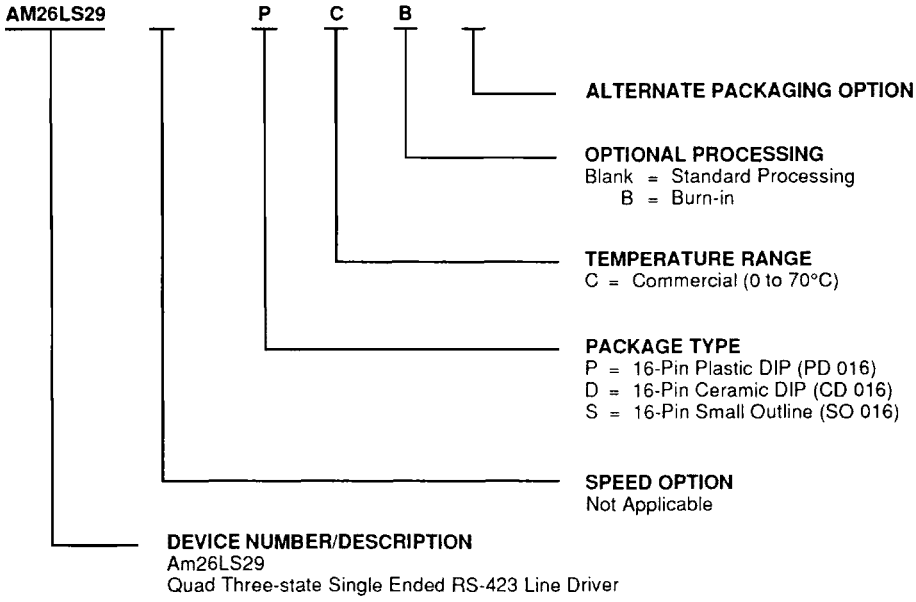
ORDERING INFORMATION
Standard Products

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



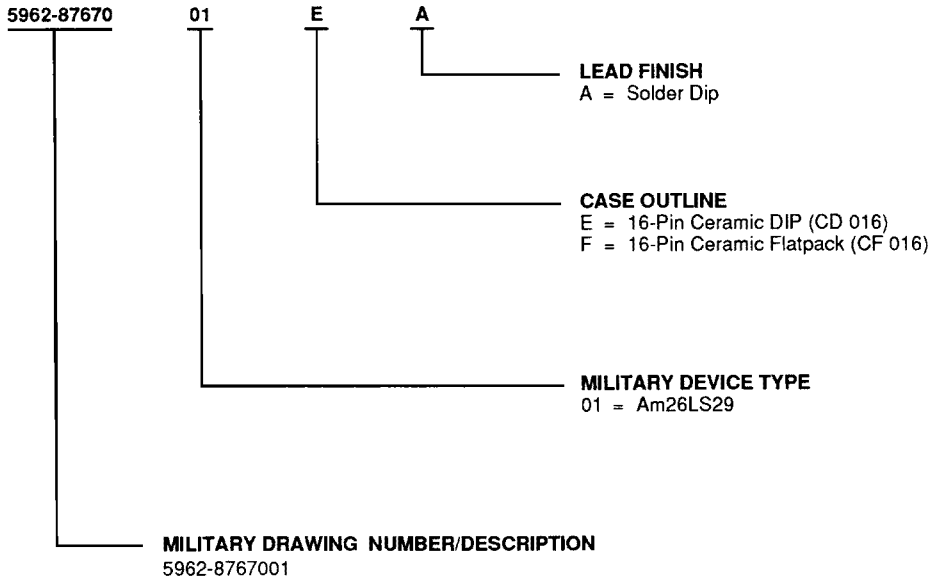
AM26LS29	PC, PCB, DC, DCB, SC

Valid Combinations

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

ORDERING INFORMATION
Standard Military Drawing 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 ordering number for SMD/DESC (Valid Combination) is formed by a combination of:



5962-8767001	EA, FA

Valid Combinations

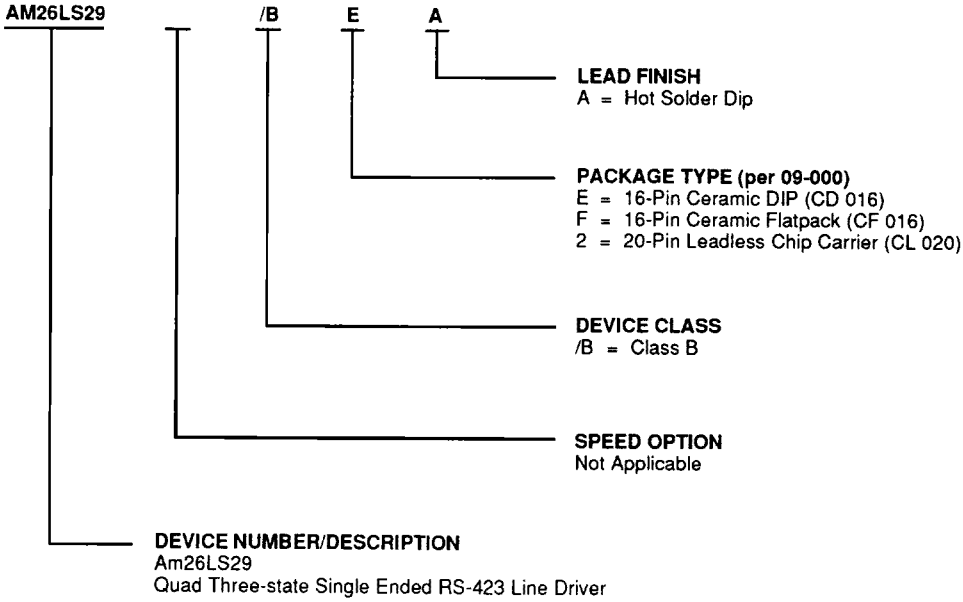
The Valid Combinations table lists configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations, to check on newly released combinations, and to obtain additional data on AMD's standard military grade products.

Group A Tests

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

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 ordering number (Valid Combination) is formed by a combination of:



AM26LS29	/BEA /BFA /B2A

Valid Combinations

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

Group A Tests

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

ABSOLUTE MAXIMUM RATINGS

Storage Temperature Range	−65°C to +165°C
Supply Voltage:	
V+	7.0 V
V−	−7.0 V
Power Dissipation	165 mW
Input Voltage	−1.5 to +15 V
Enable Voltage	±15 V
Output Sink Current	300°C

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

Temperature (T_A)	0°C to +70°C
Supply Voltage (V_{CC})	+4.75 V to +5.25 V
(V_{EE})	−4.75 V to −5.25 V

Military (M) Devices

Temperature (T_A)	−55 to +125°C
Supply Voltage (V_{CC})	+4.5 V to +5.5 V
(V_{EE})	−4.75 V to −5.5 V

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

DC CHARACTERISTICS over COMMERCIAL operating range unless otherwise specified

Parameter Symbol	Parameter Description	Test Conditions		Min.	Typ. (Note 1)	Max.	Unit
V_O	Output Voltage	$\|V_{CC}\| = \|V_{EE}\|$ = Min.	V_{IN} = 2.4 V	4.0	4.4	6.0	V
$\overline{V_O}$		$R_L = \infty$ (Note 3)	V_{IN} = 0.4 V	−4.0	−4.4	−6.0	V
V_T	Output Voltage (Note 4)	$\|V_{CC}\| = \|V_{EE}\|$ = Min.	V_{IN} = 2.4 V	3.6	4.1		V
$\overline{V_T}$		$R_L = 450\ \Omega$	V_{IN} = 0.4 V	−3.6	−4.1		V
$\|V_T\| - \|\overline{V_T}\|$	Output Unbalance (Note 4)	$\|V_{CC}\| = \|V_{EE}\|$, $R_L = 450\ \Omega$			0.02	0.4	V
I_{X+}	Output Leakage Power Off	$V_{CC} = V_{EE} = 0V$	V_O = 10 V			100	µA
I_{X-}			V_O = −10 V			−100	µA
I_{S+}	Output Short Circuit Current (Note 6)	$\|V_{CC}\| = \|V_{EE}\|$ = Max.	V_{IN} = 2.4 V	−20	−80	−150	mA
I_{S-}		V_O = 0 V	V_{IN} = 0.4 V	20	80	150	mA
I_{CC}	Positive Supply Current	V_{IN} = 0.4 V, $R_L = \infty$, $\|V_{CC}\| = \|V_{EE}\|$ = Max.			18	30	mA
I_{EE}	Negative Supply Current	V_{IN} = 0.4 V, $R_L = \infty$, $\|V_{CC}\| = \|V_{EE}\|$ = Max.			−10	−22	mA
I_O	Off State (High Impedance) Output Current	V_{CC} = Max	V_O = 10 V			100	µA
		$\|V_{CC}\| = \|V_{EE}\|$ = Max.	V_O = −10 V			−100	µA
V_{IH}	High Level Input Voltage	(Note 7)		2.0			V
V_{IL}	Low Level Input Voltage	(Note 7)				0.8	V
I_{IH}	High Level Input Current	V_{IN} = 2.4 V, $\|V_{CC}\| = \|V_{EE}\|$ = Max.				40	µA
		$V_{IN} \le 15$ V, V_{CC} = 5.5 V, V_{EE} = −5.0 (Note 5)				100	µA
I_{IL}	Low Level Input Current	V_{IN} = 0.4 V, $\|V_{CC}\| = \|V_{EE}\|$ = Max.			−30	−200	µA
V_I	Input Clamp Voltage	I_{IN} = −12mA, V_{CC} = Min., V_{EE} = Max.				−1.5	V

Notes:

1. Typical limits are at V_{CC} = 5.0 V, V_{EE} = −5.0 V, 25°C ambient and maximum loading.
2. Symbols and definitions correspond to EIA RS-423 where applicable.
3. Output voltage is +3.9 V minimum and −3.9 V minimum at −55°C.
4. This parameter is tested by forcing an equivalent current.
5. V_{EE} = −5.0 V due to tester limitation.
6. Not more than one output should be shorted at a time. Duration of short circuit test should not exceed one second.
7. Input thresholds are tested during DC tests and may be done in combination with testing of other DC parameters.

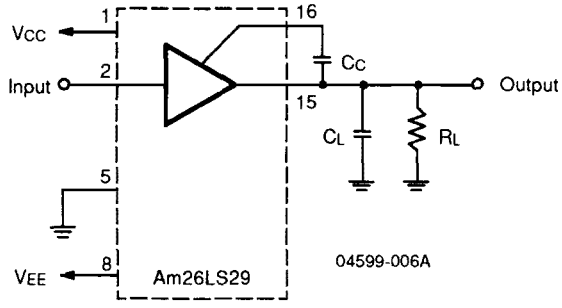
SWITCHING CHARACTERISTICS (T_A = +25°C, V_{CC} = 5.0V)

Parameter Symbol	Parameter Description	Test Conditions		Min.	Typ.	Max.	Unit
t_r	Rise Time	R_L = 450 Ω, C_L = 500 pF, Fig. 1	C_C = 50 pF		3.0		µs
			C_C = 0 pF		120	300	ns
t_f	Fall Time	R_L = 450 Ω, C_L = 500 pF, Fig. 1	C_C = 50 pF		3.0		µs
			C_C = 0 pF		120	300	ns
t_{pdh}	Output Propagation Delay	R_L = 450 Ω, C_L = 500 pF, C_C = 0 pF			180	300	ns
t_{pdl}	Output Propagation Delay	R_L = 450 Ω, C_L = 500 pF, C_C = 0 pF			180	300	ns
t_{LZ}	Output Enable to Output	R_L = 100 Ω, C_L = 500 pF, C_C = 0 pF, Fig. 2			180	300	ns
t_{HZ}					200	350	
t_{ZL}		R_L = 100 Ω, C_L = 500 pF, C_C = 0 pF, Fig. 2			200	350	
t_{ZH}					180	300	

AC CHARACTERISTICS (T_A = –55°C to +125°C, V_{CC} = 4.75 V to 5.5 V)

Parameter Symbol	Parameter Description	Test Conditions	Min.	Typ.	Max.	Unit
t_r	Rise Time	R_L = 450 Ω, C_L = 500 pF, C_C = 0 pF			450	µs
t_f	Fall Time	R_L = 450 Ω, C_L = 500 pF, C_C = 0 pF			450	µs
t_{pdh}	Output Propagation Delay	R_L = 450 Ω, C_L = 500 pF, C_C = 0 pF			450	ns
t_{pdl}	Output Propagation Delay	R_L = 450 Ω, C_L = 500 pF, C_C = 0 pF			450	ns
t_{LZ}	Output Enable to Output	R_L = 100 Ω, C_L = 500 pF, C_C = 0 pF			400	ns
t_{HZ}		R_L = 100 Ω, C_L = 500 pF, C_C = 0 pF			400	ns
t_{ZL}		R_L = 100 Ω, C_L = 500 pF, C_C = 0 pF			400	ns
t_{ZH}		R_L = 100 Ω, C_L = 500 pF, C_C = 0 pF			400	ns

SWITCHING TEST CIRCUIT



SWITCHING TEST WAVEFORM

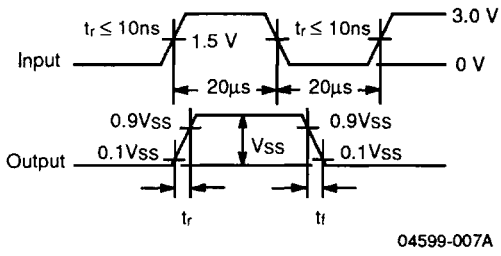
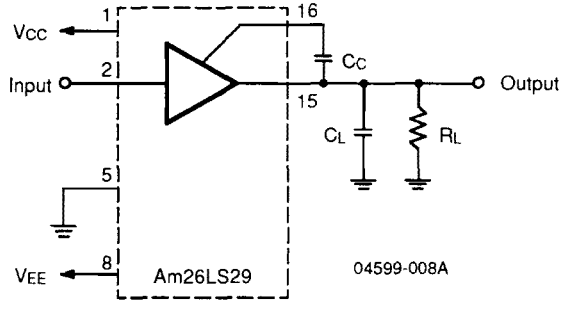


Figure 1. Rise Time Control

SWITCHING TEST CIRCUIT



SWITCHING TEST WAVEFORM

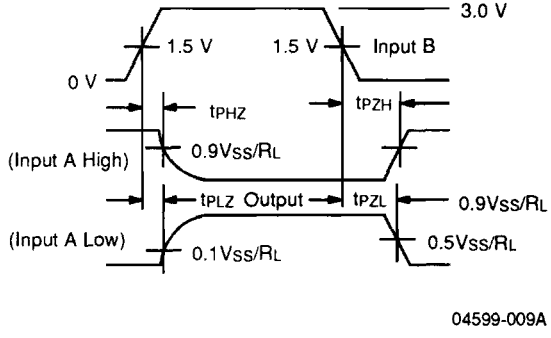
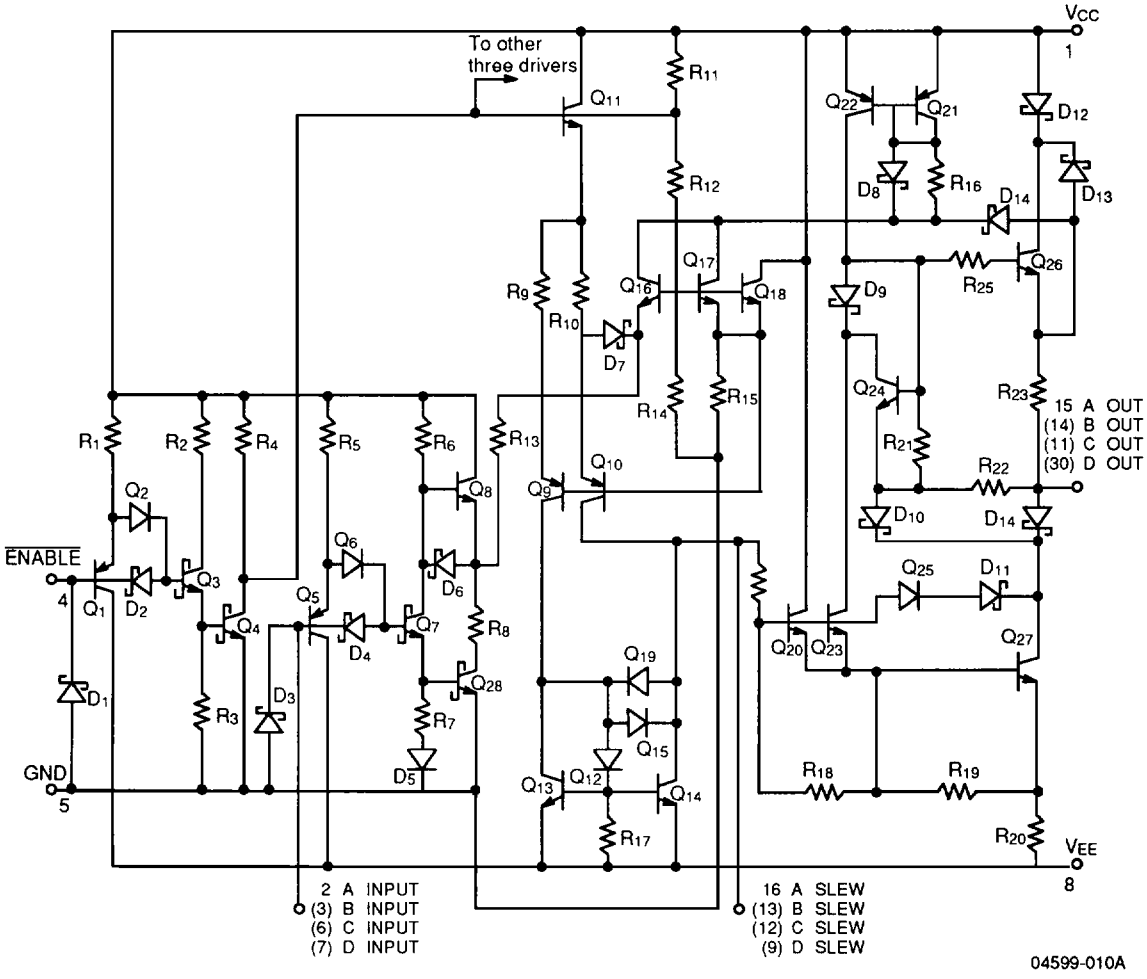


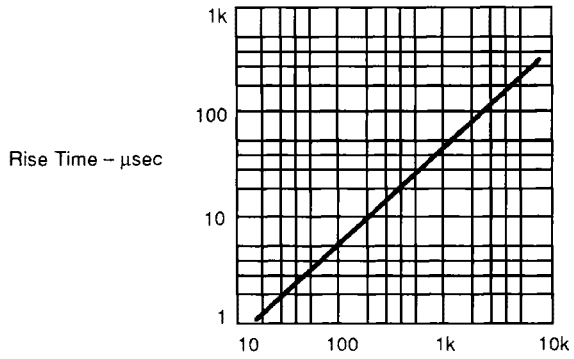
Figure 2. Three-State Delays

Am26LS29 EQUIVALENT CIRCUIT



TYPICAL PERFORMANCE CURVES

**Slew Rate (Rise or Fall Time)
Versus External Capacitor**



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