

# Am26LS30

Dual Differential RS-422 Party Line/Quad Single Ended RS-423 Line Driver



## DISTINCTIVE CHARACTERISTICS

- Dual RS-422 line driver or quad RS-423 line driver
- Driver outputs do not clamp line with power off or in hi-impedance state
- Independent output control in the differential mode
- Low  $I_{CC}$  and  $I_{EE}$  power consumption  
RS-422 differential mode; 35 mW/driver typ.  
RS-423 single-ended mode; 26 mW/driver typ.
- Individual slew rate control for each output
- 50  $\Omega$  transmission line drive capability (RS-422 into virtual ground)
- Low current PNP inputs compatible with TTL, MOS and CMOS
- High capacitive load drive capability
- Exact replacement for DS16/3691
- Advanced low power Schottky processing

## GENERAL DESCRIPTION

The Am26LS30 is a line driver designed for digital data transmission. A mode control input provides a choice of operation either as two differential line drivers which meet all of the requirements of EIA Standard RS-422 or four independent single-ended RS-423 line drivers.

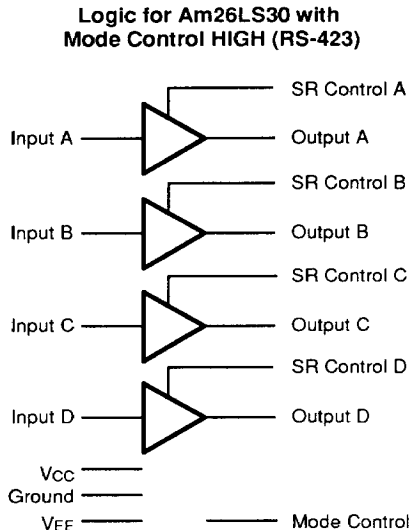
In the differential mode the outputs have individual three-state controls. In the hi-impedance state these outputs will not clamp the line over a common mode transmission line voltage of  $\pm 10$  V. A typical full duplex system would be the Am26LS30 differential line driver

and up to twelve Am26LS32 line receivers or a Am26LS32 line receiver and up to thirty-two Am26LS30 differential drivers.

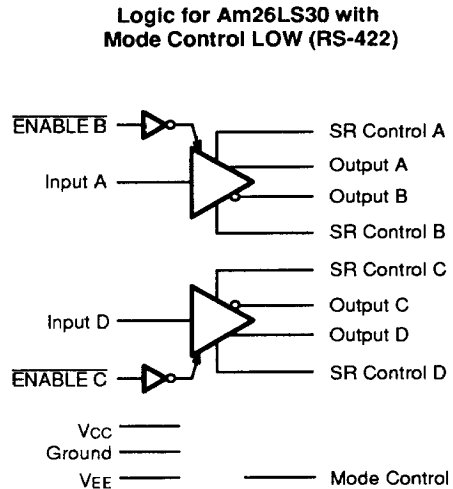
A slew rate control pin allows the use of an external capacitor to control slew rate for suppression of near end cross talk to receivers in the cable.

The Am26LS30 is constructed using Advanced Low Power Schottky processing.

## BLOCK DIAGRAM



04600-001A



04600-002A

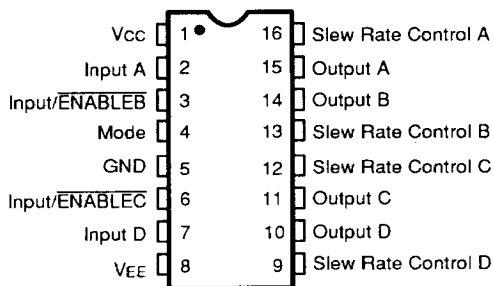
**RELATED AMD PRODUCTS**

Part No.	Description
26LS29	Quad Three-State Single Ended RS-423 Line Driver
26LS32	Quad Differential Line Receiver
26LS33	Quad Differential Line Receiver

**CONNECTION DIAGRAMS**

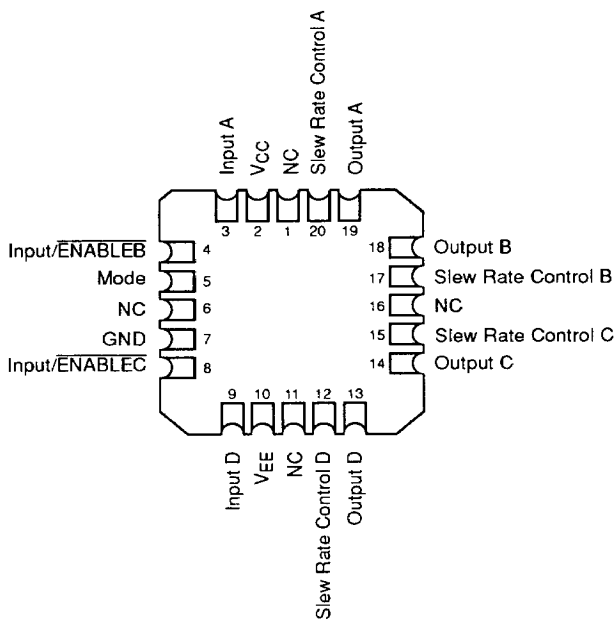
**Top View**

**DIP**



04600-003A

**LCC**



04600-004A

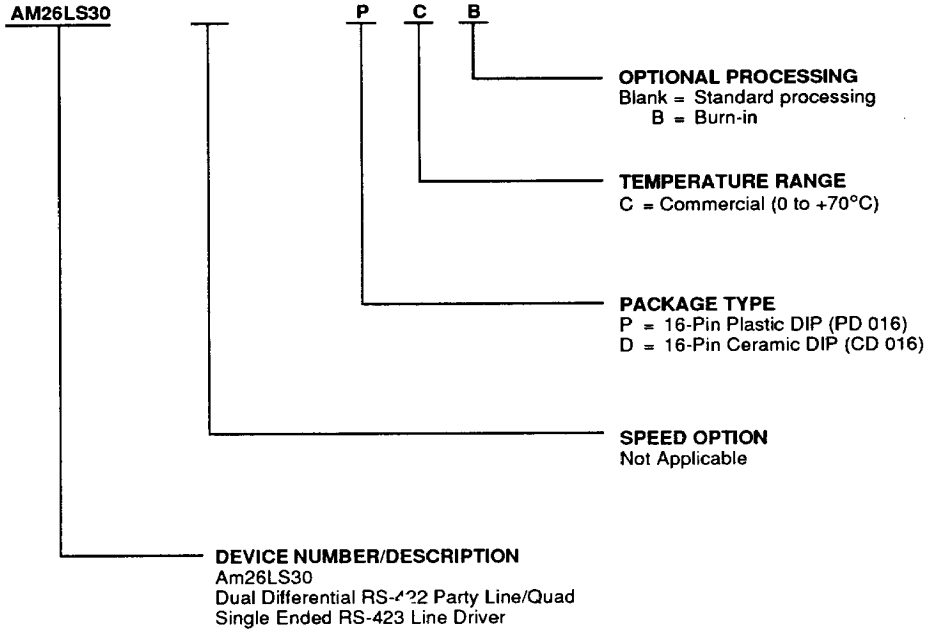
**Note:**

Pin 1 is marked for orientation.

**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:



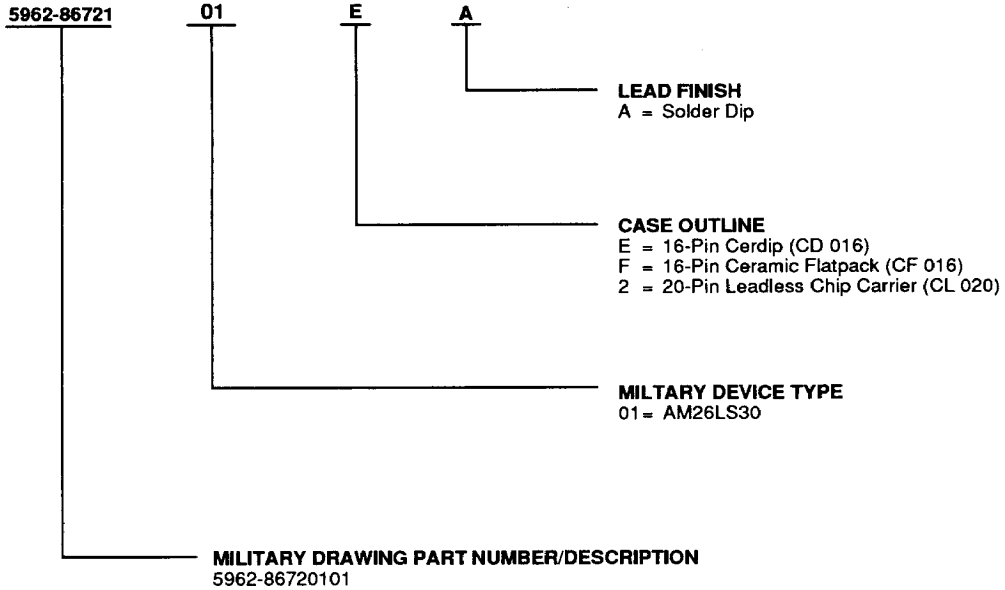
Valid Combinations	
AM26LS30	PC, PCB DC, DCB

**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**  
**Standard Military Drawing (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) for SMD/DESC products is formed by a combination of:



Valid Combinations	
5962-8672101	EA, FA, 2A

**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.

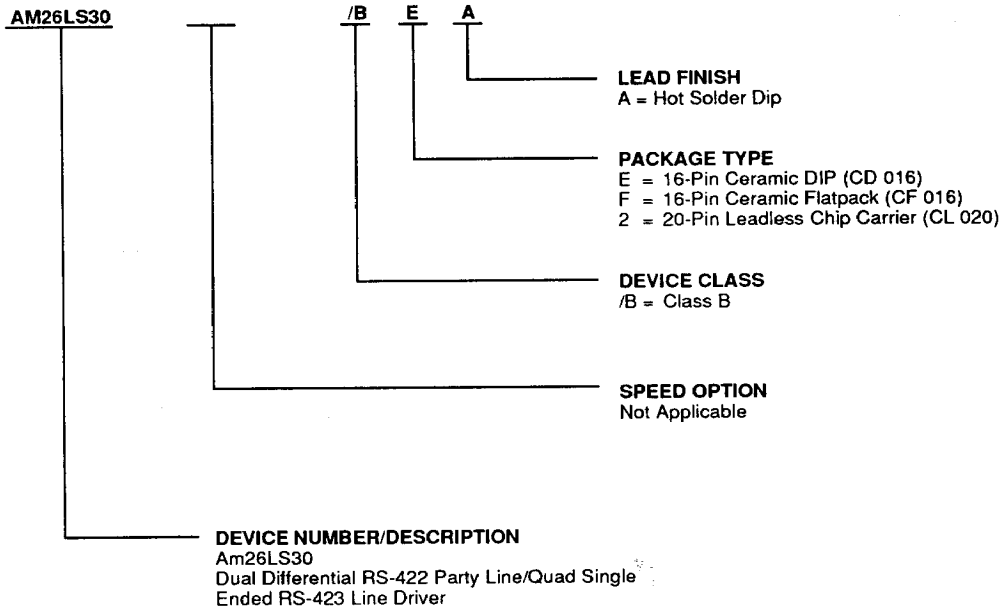
**Group A Tests**

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	
AM26LS30	/BEA, /BFA, /B2A

**Valid Combinations**

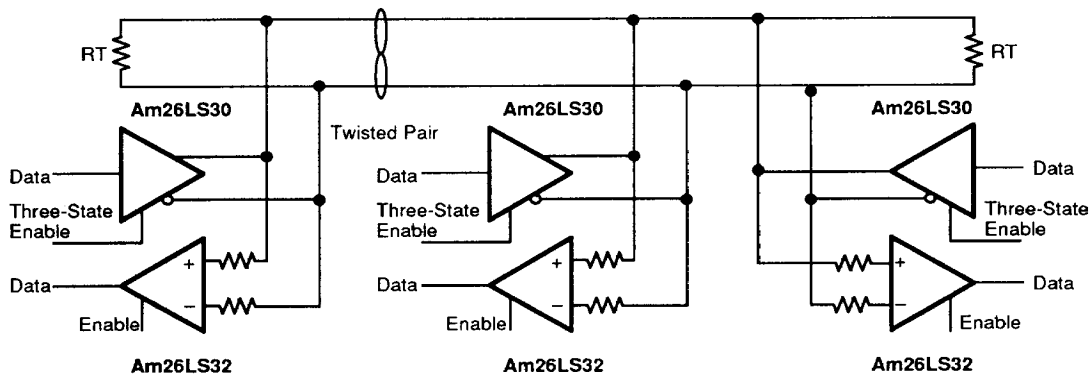
Valid Combinations list configurations planned to be supported in volume for this device. Consult the local AMD sales office to confirm availability of specific valid combinations, or to check on newly released combinations.

**Group A Tests**

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

**Am26LS30 FUNCTION TABLE**

Mode	Inputs		Outputs	
	A(D)	B(C)	A(D)	B(C)
0	0	0	0	1
0	0	1	Z	Z
0	1	0	1	0
0	1	1	Z	Z
1	0	0	0	0
1	0	1	0	1
1	1	0	1	0
1	1	1	1	1

**TYPICAL APPLICATION**

04600-005A

**ABSOLUTE MAXIMUM RATINGS**

Storage Temperature Range	-65 to +150°C
Supply Voltage	
V+	7.0 V
V-	-7.0 V
Power Dissipation	600 mW
Input Voltage	-1.5 to +15.0 V
Output Voltage (Power Off)	±15 V
Lead Soldering Temperature (10 seconds)	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	0 to +70°C
Supply Voltage (V <sub>CC</sub> )	+4.75 V to +5.25 V
Supply Voltage (V <sub>EE</sub> ) RS422	GND
Supply Voltage (V <sub>EE</sub> ) RS423	-4.75 V to -5.25 V

**Military (M) Devices**

Temperature	-55 to +125°C
Supply Voltage (V <sub>CC</sub> )	+4.5 V to +5.5 V
Supply Voltage (V <sub>EE</sub> ) RS422	GND
Supply Voltage (V <sub>EE</sub> ) RS423	-4.75 V to -5.25 V

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

**DC CHARACTERISTICS over operating ranges unless otherwise specified**  
**EIA RS-422 Connection, Mode Voltage ≤ 0.8 V, V<sub>CC</sub> = +4.75 V to +5.5 V, V<sub>EE</sub> = GND**

Parameter Symbol	Parameter Description	Test Conditions (Note 3)	Min.	Typ. (Note 1)	Max.	Unit	
V <sub>O</sub>	Differential Output Voltage,	R <sub>L</sub> = ∞	V <sub>IN</sub> = 2.0 V	3.6	6.0	V	
$\overline{V_O}$	V <sub>A, B</sub>		V <sub>IN</sub> = 0.8 V	-3.6	-6.0		
V <sub>T</sub>	Differential Output Voltage,	R <sub>L</sub> = 100 Ω	V <sub>IN</sub> = 2.0 V	2.4		V	
$\overline{V_T}$	V <sub>A, B</sub>		V <sub>IN</sub> = 0.8 V	-2.0	-2.4		
V <sub>OS</sub> , $\overline{V_{OS}}$	Common Mode Offset Voltage	R <sub>L</sub> = 100 Ω		2.5	3.0	V	
V <sub>T</sub>   -   $\overline{V_T}$	Difference in Differential Output Voltage	R <sub>L</sub> = 100 Ω		0.005	0.4	V	
V <sub>OS</sub>   -   $\overline{V_{OS}}$	Difference in Common Mode Offset Voltage	R <sub>L</sub> = 100 Ω		0.005	0.4	V	
V <sub>SS</sub>	V <sub>T</sub> - $\overline{V_T}$	R <sub>L</sub> = 100 Ω	4.0	4.8		V	
V <sub>CMR</sub>	Output Voltage Common Mode Range	V <sub>ENABLE</sub> = 2.4 V	±10			V	
I <sub>XA</sub>	Output Leakage Current	V <sub>CC</sub> = 0 V	V <sub>CMR</sub> = 10 V		100	μA	
I <sub>XB</sub>			V <sub>CMR</sub> = -10 V		-100		
I <sub>OX</sub>	Off State (High Impedance) Output Current	V <sub>CC</sub> = Max.	V <sub>CMR</sub> = 10 V		100	μA	
			V <sub>CMR</sub> = -10 V		-100		
I <sub>SA</sub> , I <sub>SB</sub>	Output Short Circuit Current	V <sub>CC</sub> = Max.	V <sub>OA</sub> = 6.0 V	20	80	150	mA
			V <sub>IN</sub> = 2.4 V	V <sub>OB</sub> = 0 V	-20	-80	
		V <sub>CC</sub> = Max.	V <sub>OA</sub> = 0 V	-20	-80	-150	mA
			V <sub>IN</sub> = 0.4 V	V <sub>OB</sub> = 6.0 V	20	80	
I <sub>CC</sub>	Supply Current	V <sub>IN</sub> = .4 V, V <sub>CC</sub> = Max.		18	30	mA	
V <sub>IH</sub>	High Level Input Voltage		2.0			V	
V <sub>IL</sub>	Low Level Input Voltage				0.8	V	
I <sub>IH</sub>	High Level Input Current	V <sub>CC</sub> = Max.	V <sub>IN</sub> = 2.4 V		40	μA	
			V <sub>IN</sub> = 15 V		100		
I <sub>IL</sub>	Low Level Input Current	V <sub>CC</sub> = Max.	V <sub>IN</sub> = 0.4 V	-30	-200	μA	
V <sub>IC</sub>	Input Clamp Voltage	V <sub>CC</sub> = Min.	I <sub>IN</sub> = -12 mA		-1.5	V	

**DC CHARACTERISTICS over operating ranges unless otherwise specified**  
**EIA RS-423 Connection, Mode Voltage  $\geq 2.0$  V**

Parameter Symbol	Parameter Description	Test Conditions (Note 4)		Min.	Typ. (Note 1)	Max.	Unit
$V_O$	Output Voltage	$R_L = \infty$ (Note 3)	$V_{IN} = 2.4$ V	4.0	4.4	6.0	V
$\overline{V_O}$		$ V_{CC} = V_{EE} =4.75$ V	$V_{IN} = 0.4$ V	-4.0	-4.4	-6.0	
$\frac{V_T}{V_T}$	Output Voltage (Note 7)	$R_L = 450 \Omega$	$V_{IN} = 2.4$ V	3.6	4.1		V
$\overline{\frac{V_T}{V_T}}$		$ V_{CC} = V_{EE} =4.75$ V	$V_{IN} = 0.4$ V	-3.6	-4.1		
$ V_T  -  \overline{V_T} $	Output Unbalance (Note 7)	$ V_{CC} = V_{EE} =4.75$ V, $R_L = 450 \Omega$			0.02	0.4	V
$I_{X+}$	Output Leakage Power Off	$V_{CC} = V_{EE} = 0$ V	$V_O = 6.0$ V			100	$\mu$ A
$I_{X-}$			$V_O = -6.0$ V			-100	
$I_{S+}$	Output Short Circuit Current	$V_O = 0$ V	$V_{IN} = 2.4$ V	-20	-80	-150	mA
$I_{S-}$		$ V_{CC} = V_{EE} =Max.$ (Note 5)	$V_{IN} = 0.4$ V	20	80	150	
$I_{SLEW}$	Slew Control Current	$V_{SLEW} = V_{EE}$	$V_{IN} = 2.7$ V		-230		$\mu$ A
$I_{CC}$	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
$V_{IH}$	High Level Input Voltage	Note 6		2.0			V
$V_{IL}$	Low Level Input Voltage	Note 6				0.8	V
$I_{IH}$	High Level Input Current	$V_{IN} = 2.4$ V, $ V_{CC} = V_{EE} =Max.$				40	$\mu$ A
		$V_{IN} = 15$ V, $V_{CC} = 5.5$ V, $V_{EE} = -5.0$ V				100	
$I_{IL}$	Low Level Input Current	$V_{IN} = 0.4$ V, $ V_{CC} = V_{EE} =Max.$			-30	-200	$\mu$ A
$V_{IC}$	Input Clamp Voltage	$I_{IN} = -12$ mA, $V_{CC} = Min.$ , $V_{EE} = Max.$				-1.5	V

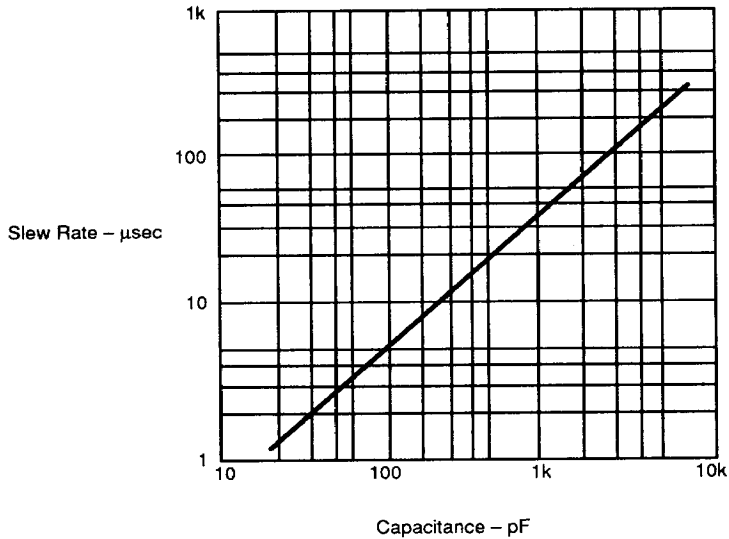
**Notes:**

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.  $R_L$  connected between each output and its complement.
5. Not more than one output should be shorted at a time. Duration of the short circuit test should not exceed one second.
6. Input thresholds are tested during DC tests and may be done in combination with testing of other DC parameters.
7. This parameter is tested by forcing an equivalent current.



**PERFORMANCE CURVE**

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



04600-006A

**SWITCHING CHARACTERISTICS**

**EIA RS-422 Connection,  $V_{CC} = 5.0\text{ V}$ ,  $V_{EE} = \text{GND}$ , Mode = 0.4 V,  $T_A = 25^\circ\text{C}$**

Parameter Symbol	Parameter Description	Test Conditions	Min.	Typ.	Max.	Unit
$t_r$	Differential Output Rise Time	Fig. 2, $R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$		120	200	ns
$t_f$	Differential Output Fall Time	Fig. 2, $R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$		120	200	ns
$t_{PDH}$	Output Propagation Delay	Fig. 2, $R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$		120	200	ns
$t_{PDL}$	Output Propagation Delay	Fig. 2, $R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$		120	200	ns
$t_{LZ}$	Output Enable to Output	$R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$ , $C_c = 0\ \text{pF}$ , Fig. 3		180	300	ns
$t_{HZ}$				200	300	
$t_{ZL}$		$R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$ , $C_c = 0\ \text{pF}$ , Fig. 3		200	300	
$t_{ZH}$				180	300	

**SWITCHING CHARACTERISTICS (Continued)****EIA RS-422 Connection,  $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ ,  $V_{EE} = \text{GND}$ , Mode = 0.4 V,  $T_A = 55^\circ\text{C to }125^\circ\text{C}$** 

Parameter Symbol	Parameter Description	Test Conditions	Min.	Typ.	Max.	Unit
$t_r$	Differential Output Rise Time	$R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$ see Rise Time Control for RS-422			300	ns
$t_f$	Differential Output Fall Time	$R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$ see Rise Time Control for RS-422			300	ns
$t_{PDH}$	Output Propagation Delay	$R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$ see Rise Time Control for RS-422			300	ns
$t_{PDL}$	Output Propagation Delay	$R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$ see Rise Time Control for RS-422			300	ns
$t_{LZ}$	Output Enable to Output	$R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$ , $C_c = 0\ \text{pF}$ see Rise Time Control for RS-422			400	ns
$t_{HZ}$		$R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$ , $C_c = 0\ \text{pF}$ see Rise Time Control for RS-422			400	ns
$t_{ZL}$		$R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$ , $C_c = 0\ \text{pF}$ see Rise Time Control for RS-422			400	ns
$t_{ZH}$		$R_L = 100\ \Omega$ , $C_L = 500\ \text{pF}$ , $C_c = 0\ \text{pF}$ see Rise Time Control for RS-422			400	ns

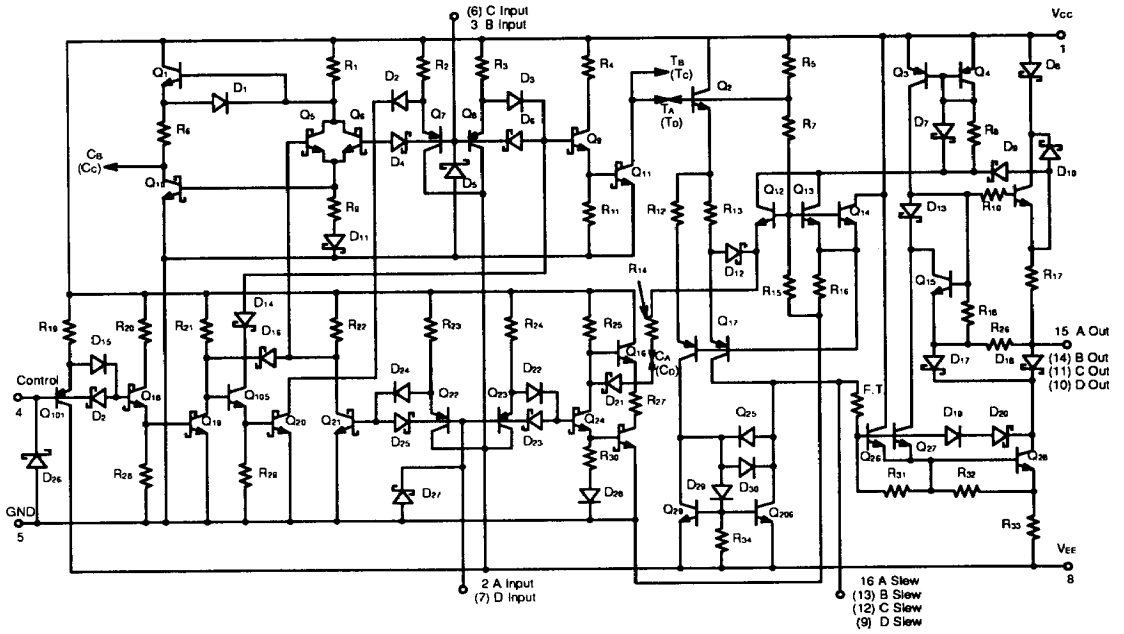
**SWITCHING CHARACTERISTICS****EIA RS-423 Connection,  $V_{CC} = 5.0\text{ V}$ ,  $V_{EE} = -5.0\text{ V}$ , Mode = 2.4 V,  $T_A = 25^\circ\text{C}$** 

Parameter Symbol	Parameter Description	Test Conditions	Min.	Typ.	Max.	Unit
$t_r$	Rise Time	Fig. 1, $R_L = 450\ \Omega$ , $C_L = 500\ \text{pF}$	$C_c = 50\ \text{pF}$		3.0	$\mu\text{s}$
			$C_c = 0$		120	300
$t_f$	Fall Time	Fig. 1, $R_L = 450\ \Omega$ , $C_L = 500\ \text{pF}$	$C_c = 50\ \text{pF}$		3.0	$\mu\text{s}$
			$C_c = 0$		120	300
Src	Slew Rate Coefficient	Fig. 1, $R_L = 450\ \Omega$ , $C_L = 500\ \text{pF}$		.06		$\mu\text{s/pF}$
$t_{PDH}$	Output Propagation Delay	Fig. 1, $R_L = 450\ \Omega$ , $C_L = 500\ \text{pF}$ , $C_c = 0$		180	300	ns
$t_{PDL}$	Output Propagation Delay	Fig. 1, $R_L = 450\ \Omega$ , $C_L = 500\ \text{pF}$ , $C_c = 0$		180	300	ns

**EIA RS-423 Connection,  $V_{CC} = 4.75\text{ V to }5.5\text{ V}$ ,  $V_{EE} = -4.75\text{ V to }-5.5\text{ V}$ , Mode = 2.4 V,  $T_A = -55^\circ\text{C to }125^\circ\text{C}$** 

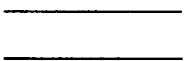
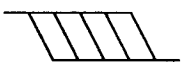
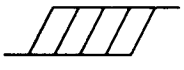
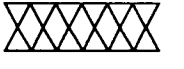
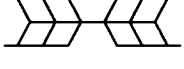
Parameter Symbol	Parameter Description	Test Conditions	Min.	Typ.	Max.	Unit
$t_r$	Rise Time	$R_L = 450\ \Omega$ , $C_L = 500\ \text{pF}$ , $C_c = 0\ \text{pF}$ see Rise Time Control for RS-423			450	ns
$t_f$	Fall Time	$R_L = 450\ \Omega$ , $C_L = 500\ \text{pF}$ , $C_c = 0\ \text{pF}$ see Rise Time Control for RS-423			450	ns
$t_{PDH}$	Output Propagation Delay	$R_L = 450\ \Omega$ , $C_L = 500\ \text{pF}$ , $C_c = 0\ \text{pF}$ see Rise Time Control for RS-423			450	ns
$t_{PDL}$	Output Propagation Delay	$R_L = 450\ \Omega$ , $C_L = 500\ \text{pF}$ , $C_c = 0\ \text{pF}$ see Rise Time Control for RS-423			450	ns

**Am26LS30 EQUIVALENT CIRCUIT**



04600-007A

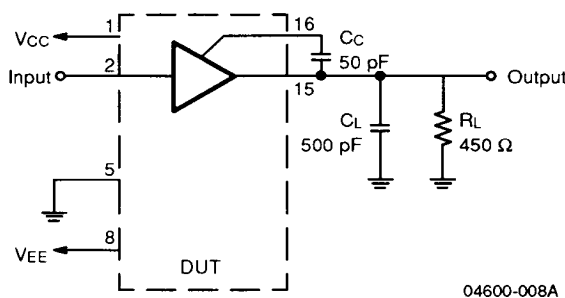
KEY TO SWITCHING WAVEFORMS

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

KS000010

EIA RS-423 CONNECTION

Switching Test Circuit (Mode Control = 0)



Switching Test Waveform

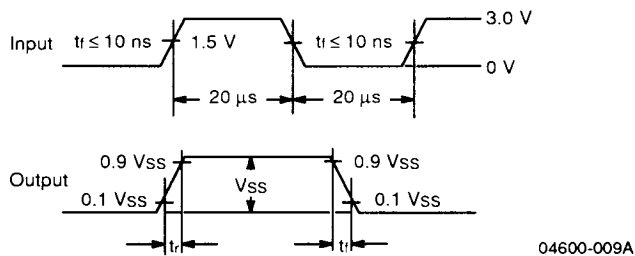
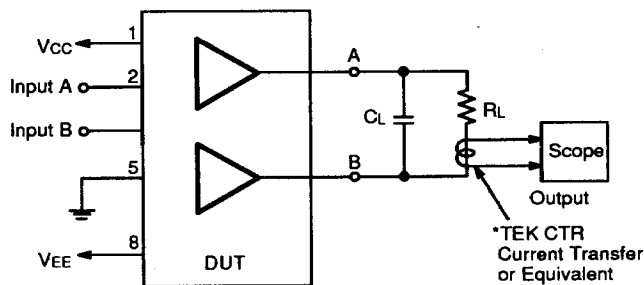


Figure 1. Rise Time Control for RS-423



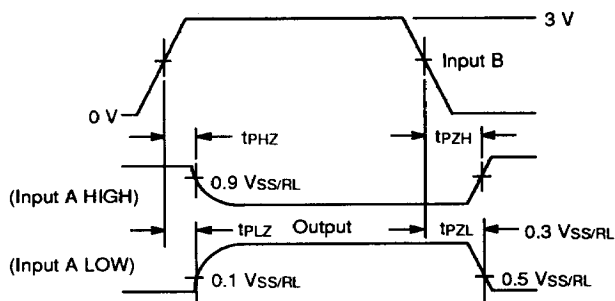
RS-422 CONNECTION (Continued)

Switching Test Circuit  
(Mode Control = 0)



04600-012A

Switching Test Waveform



04600-013A

\*Current probe is the easiest way to display a differential waveform

Figure 3. Three-State Delays