National Semiconductor

DS26C32AT/DS26C32AM
Quad Differential Line Receiver

General Description

The DS26C32A is a quad differential line receiver designed to meet the RS-422, RS-423, and Federal Standards 1020 and 1030 for balanced and unbalanced digital data transmission, while retaining the low power characteristics of CMOS.

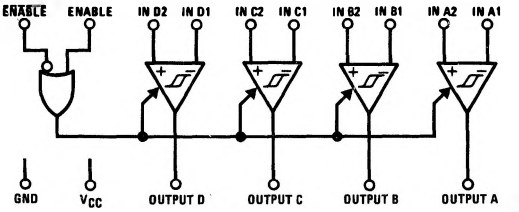
The DS26C32A has an input sensitivity of 200 mV over the common mode input voltage range of ±7V. The DS26C32A features internal pull-up and pull-down resistors which prevent output oscillation on unused channels.

The DS26C32A provides an enable and disable function common to all four receivers, and features TRI-STATE® outputs with 6 mA source and sink capability. This product is pin compatible with the DS26LS32A and the AM26LS32.

Features

- CMOS design for low power
- ±0.2V sensitivity over input common mode voltage range
- Typical propagation delays: 19 ns
- Typical input hysteresis: 60 mV
- Inputs won't load line when V_{CC} = 0V
- Meets the requirements of EIA standard RS-422
- TRI-STATE outputs for connection to system buses
- Available in Surface Mount
- Mil-Std-883C compliant

Logic Diagram



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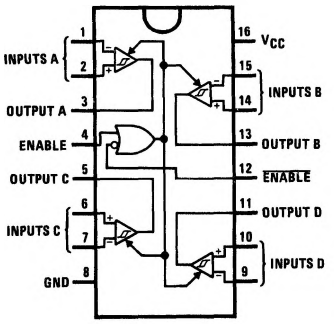
Connection Diagrams

Dual-In-Line Package



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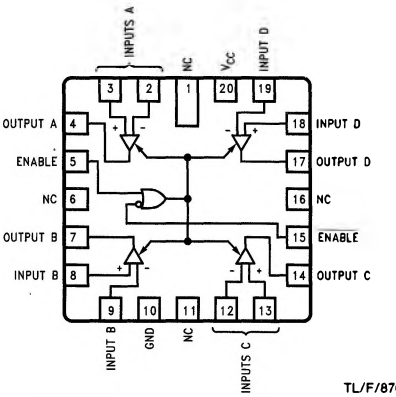
Top View

Order Number DS26C32ATJ, DS26C32ATM or DS26C32ATN
See NS Package J16A, M16A or N16E

For Complete Military 883 Specifications, See RETS Data Sheet.

Order Number DS26C32AME/883, DS26C32AMJ/883 or DS26C32AMW/883
See NS Package E20A, J16A or W16A

20-Lead Ceramic Leadless Chip Carrier



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Truth Table

ENABLE	$\overline{\text{ENABLE}}$	Input	Output
L	H	X	Z
All Other Combinations of Enable Inputs		$V_{ID} \geq V_{TH}$ (Max)	H
		$V_{ID} \leq V_{TH}$ (Min)	L
		Open	H

Z = TRI-STATE

Absolute Maximum Ratings (Notes 1 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{CC})	7V
Common Mode Range (V_{CM})	±14V
Differential Input Voltage (V_{DIFF})	±14V
Enable Input Voltage (V_{IN})	7V
Storage Temperature Range (T_{STG})	−65°C to +150°C
Lead Temperature (Soldering 4 sec.)	260°C
Maximum Power Dissipation at 25°C (Note 5)	
Ceramic "J" Pkg.	2308 mW
Plastic "N" Pkg.	1645 mW
SOIC "M" Pkg.	1190 mW
Ceramic "E" Pkg.	2108 mW
Ceramic "W" Pkg.	1215 mW
Maximum Current Per Output	±25 mA

This device does not meet 2000V ESD rating. (Note 4)

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})	4.50	5.50	V
Operating Temperature Range (T_A)			
DS26C32AT	−40	+85	°C
DS26C32AM	−55	+125	°C
Enable Input Rise or Fall Times		500	ns

DC Electrical Characteristics V_{CC} = 5V ±10% (unless otherwise specified) (Note 3)

Symbol	Parameter	Conditions		Min	Typ	Max	Units
V_{TH}	Minimum Differential Input Voltage	$V_{OUT} = V_{OH}$ or V_{OL} $-7V < V_{CM} < +7V$		−200	35	+200	mV
R_{IN}	Input Resistance	$V_{IN} = -7V, +7V$ (Other Input = GND)	DS26C32AT	5.0	6.8	10	kΩ
			DS26C32AM	4.5	6.8	11	kΩ
I_{IN}	Input Current	$V_{IN} = +10V$, Other Input = GND	DS26C32AT		+1.1	+1.5	mA
			DS26C32AM		+1.1	+1.8	mA
		$V_{IN} = -10V$, Other Input = GND	DS26C32AT		−2.0	−2.5	mA
			DS26C32AM		−2.0	−2.7	mA
V_{OH}	Minimum High Level Output Voltage	V_{CC} = Min, $V_{DIFF} = +1V$ $I_{OUT} = -6.0$ mA		3.8	4.2		V
V_{OL}	Maximum Low Level Output Voltage	V_{CC} = Max, $V_{DIFF} = -1V$ I_{OUT} = 6.0 mA			0.2	0.3	V
V_{IH}	Minimum Enable High Input Level Voltage			2.0			V
V_{IL}	Maximum Enable Low Input Level Voltage					0.8	V
I_{OZ}	Maximum TRI-STATE Output Leakage Current	$V_{OUT} = V_{CC}$ or GND, $\overline{ENABLE} = V_{IL}$, $ENABLE = V_{IH}$			±0.5	±5.0	μA
I_I	Maximum Enable Input Current	$V_{IN} = V_{CC}$ or GND				±1.0	μA
I_{CC}	Quiescent Power Supply Current	V_{CC} = Max, $V_{DIF} = +1V$	DS26C32AT		16	23	mA
			DS26C32AM		16	25	mA
V_{HYST}	Input Hysteresis	V_{CM} = 0V			60		mV

AC Electrical Characteristics V_{CC} = 5V ±10% (Note 3)

Symbol	Parameter	Conditions	Min	Typ	Max		Units
					DS26C32AT	DS26C32AM	
t_{PLH}, t_{PHL}	Propagation Delay Input to Output	C_L = 50 pF V_{DIFF} = 2.5V V_{CM} = 0V	10	19	30	35	ns
t_{RISE}, t_{FALL}	Output Rise and Fall Times	C_L = 50 pF V_{DIFF} = 2.5V V_{CM} = 0V		4	9	9	ns
t_{PLZ}, t_{PHZ}	Propagation Delay ENABLE to Output	C_L = 50 pF R_L = 1000Ω V_{DIFF} = 2.5V		13	22	29	ns
t_{PZL}, t_{PZH}	Propagation Delay ENABLE to Output	C_L = 50 pF R_L = 1000Ω V_{DIFF} = 2.5V		13	23	29	ns

Note 1: Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: Unless otherwise specified, all voltages are referenced to ground.

Note 3: Unless otherwise specified, Min/Max limits apply over recommended operating conditions. All typicals are given for V_{CC} = 5V and T_A = 25°C.

Note 4: ESD Rating: HBM (1.5 kΩ, 100 pF)
Inputs ≥2000V
All other pins ≥1000V
EIAJ (0Ω, 200 pF) ≥350V

Note 5: Ratings apply to ambient temperature at 25°C. Above this temperature derate N Package 13.16 mW/°C, J Package 15.38 mW/°C, M Package 9.52 mW/°C, E Package 12.04 mW/°C, and W package 6.94 mW/°C.

Comparison Table of Switching Characteristics into "LS-Type" Load

(*Figures 4, 5,* and *6*) (Note 6)

Symbol	Parameter	Conditions	DS26C32A	DS26LS32A	Units
			Typ	Typ	
t_{PLH}	Input to Output	C_L = 15 pF	17	23	ns
t_{PHL}			19	23	ns
t_{LZ}	ENABLE to Output	C_L = 5 pF	13	15	ns
t_{HZ}			12	20	ns
t_{ZL}	ENABLE to Output	C_L = 15 pF	13	14	ns
t_{ZH}			13	15	ns

Note 6: This table is provided for comparison purposes only. The values in this table for the DS26C32A reflect the performance of the device, but are not tested or guaranteed.

Test and Switching Waveforms

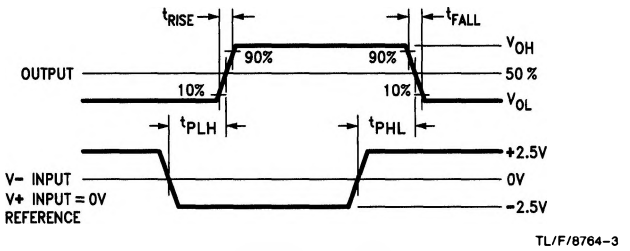
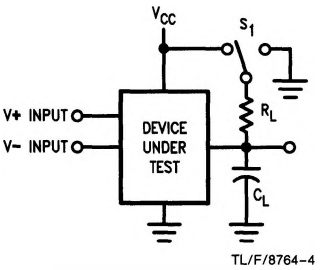


FIGURE 1. Propagation Delay



C_L includes load and test jig capacitance.

S_1 = V_{CC} for t_{PZL}, and t_{PLZ} measurements.

S_1 = Gnd for t_{PZH} and t_{PHZ} measurements.

FIGURE 2. Test Circuit for TRI-STATE Output Tests

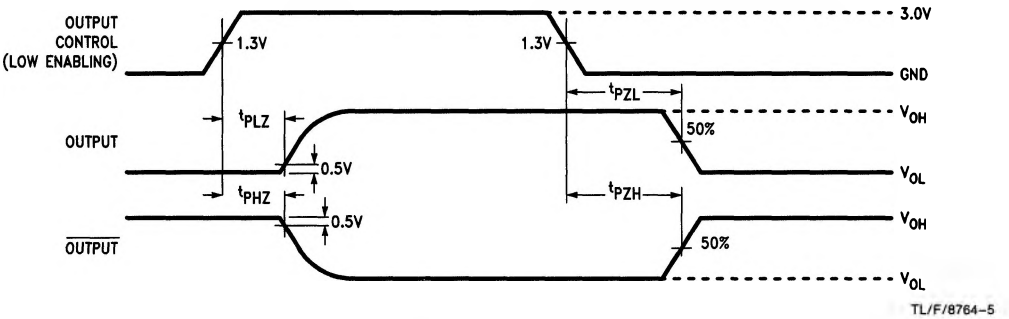


FIGURE 3. TRI-STATE Output Enable and Disable Waveforms

AC Test Circuit and Switching Time Waveforms

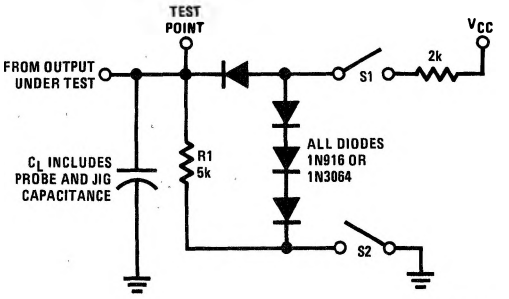


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FIGURE 4. Load Test Circuit for TRI-STATE Outputs for "LS-Type" Load

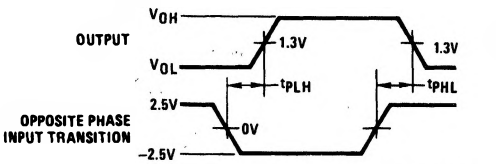

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FIGURE 5. Propagation Delay for "LS-Type" Load (Notes 7, 9)

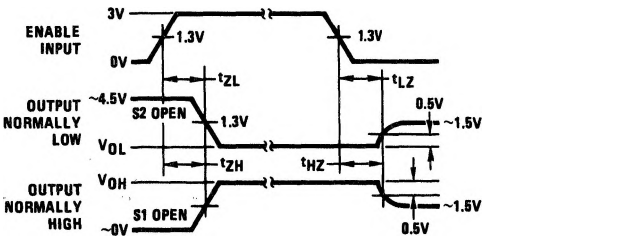

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FIGURE 6. Enable and Disable Times for "LS-Type" Load (Notes 8, 9)

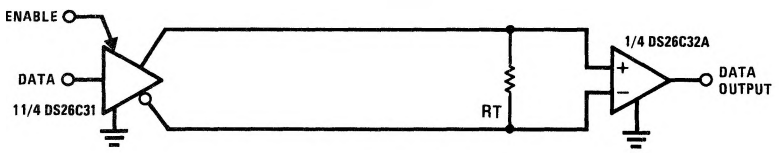
Note 7: Diagram shown for $\overline{\text{ENABLE}}$ low.

Note 8: S1 and S2 of load circuit are closed except where shown.

Note 9: Pulse generator for all pulses: Rate ≤ 1.0 MHz; $Z_O = 50\Omega$; $t_r \leq 15$ ns; $t_f \leq 6.0$ ns.

Typical Applications

Two-Wire Balanced Systems, RS-422



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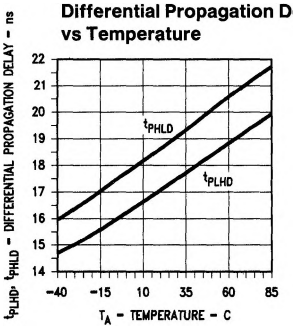
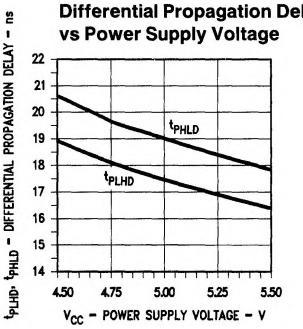
Typical Performance Characteristics

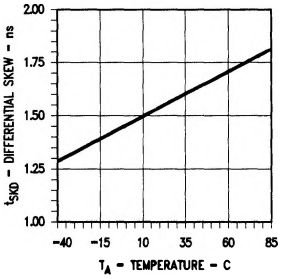
Differential Propagation Delay vs Temperature



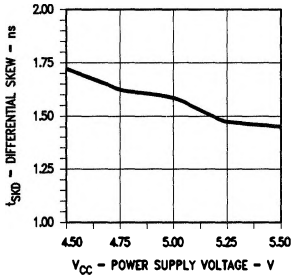
Differential Propagation Delay vs Power Supply Voltage



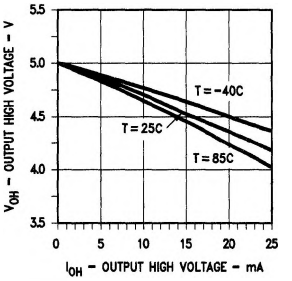
Differential Skew vs Temperature



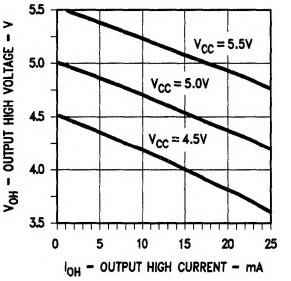
Differential Skew vs Power Supply Voltage



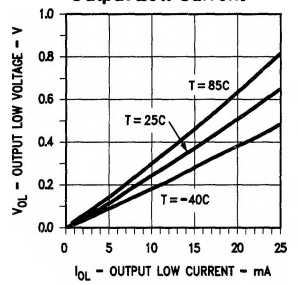
Output High Voltage vs Output High Current



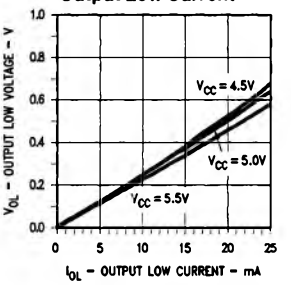
Output High Voltage vs Output High Current



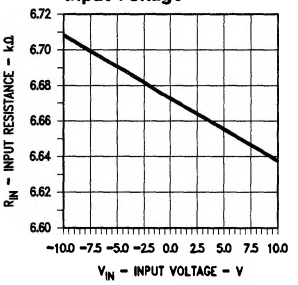
Output Low Voltage vs Output Low Current



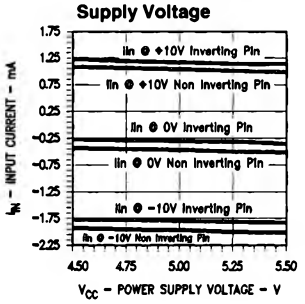
Output Low Voltage vs Output Low Current



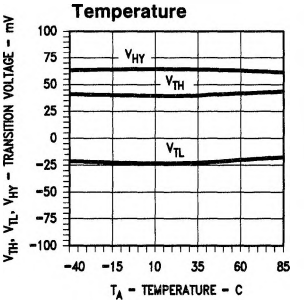
Input Resistance vs Input Voltage



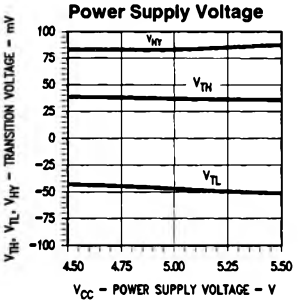
Input Current vs Power Supply Voltage



Hysteresis & Differential Transition Voltage vs Temperature



Hysteresis & Differential Transition Voltage vs Power Supply Voltage



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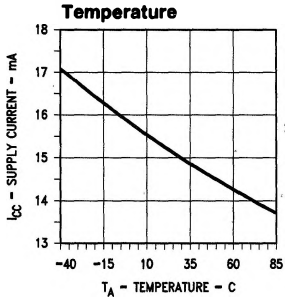
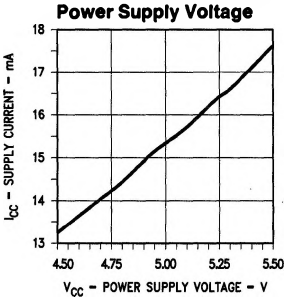
Typical Performance Characteristics (Continued)

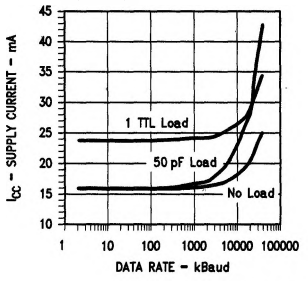
Supply Current vs Temperature



Disabled Supply Current vs Power Supply Voltage



Supply Current vs Data Rate



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