

National Semiconductor is now part of  
Texas Instruments.

Search <http://www.ti.com/> for the latest technical  
information and details on our current products and services.

# DS26C32AT/DS26C32AM

## Quad Differential Line Receiver

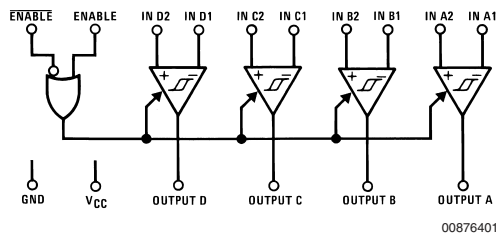
### General Description

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  $\pm 7V$ . 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<sup>®</sup> outputs with 6 mA source and sink capability. This product is pin compatible with the DS26LS32A and the AM26LS32.

### Features

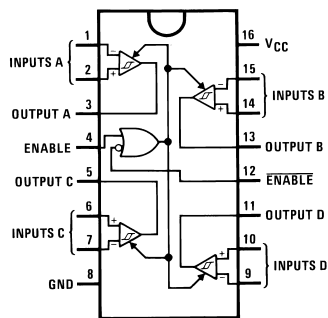
- CMOS design for low power
- $\pm 0.2V$  sensitivity over input common mode voltage range
- Typical propagation delays: 19 ns
- Typical input hysteresis: 60 mV
- Inputs won't load line when  $V_{CC} = 0V$
- Meets the requirements of EIA standard RS-422
- TRI-STATE outputs for connection to system buses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

### Logic Diagram



### Connection Diagrams

Dual-In-Line Package



00876402

Top View

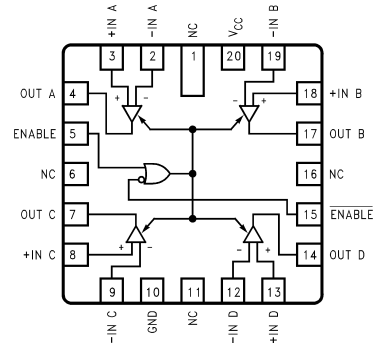
Order Number DS26C32ATM or DS26C32ATN  
See NS Package M16A or N16E

For Complete Military Product Specifications,  
refer to the appropriate SMD or MDS.

Order Number DS26C32AME/883, DS26C32AMJ/883 or  
DS26C32AMW/883

See NS Package E20A, J16A or W16A

20-Lead Ceramic Leadless Chip Carrier



00876412

TRI-STATE<sup>®</sup> is a registered trademark of National Semiconductor Corporation.

**Absolute Maximum Ratings** (Notes 2,

1)

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 ( $V_{CM}$ )	$\pm 14V$
Differential Input Voltage ( $V_{DIFF}$ )	$\pm 14V$
Enable Input Voltage ( $V_{IN}$ )	7V
Storage Temperature Range ( $T_{STG}$ )	$-65^{\circ}C$ to $+150^{\circ}C$
Lead Temperature (Soldering 4 sec.)	$260^{\circ}C$
Maximum Power Dissipation at $25^{\circ}C$ (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	$\pm 25$ 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	$^{\circ}C$
DS26C32AM	-55	+125	$^{\circ}C$
Enable Input Rise or Fall Times	500		ns

**DC Electrical Characteristics**

$V_{CC} = 5V \pm 10\%$  (unless otherwise specified) (Note 1)

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	$k\Omega$
			DS26C32AM	4.5	6.8	11	$k\Omega$
$I_{IN}$	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	$V_{CC} = \text{Min}$ , $V_{DIFF} = +1V$ $I_{OUT} = -6.0$ mA	3.8	4.2		V	
$V_{OL}$	Maximum Low Level Output Voltage	$V_{CC} = \text{Max}$ , $V_{DIFF} = -1V$ $I_{OUT} = 6.0$ 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 <sup>®</sup> Output Leakage Current	$V_{OUT} = V_{CC}$ or GND, ENABLE = $V_{IL}$ , $\overline{\text{ENABLE}} = V_{IH}$		$\pm 0.5$	$\pm 5.0$	$\mu A$	
$I_I$	Maximum Enable Input Current	$V_{IN} = V_{CC}$ or GND			$\pm 1.0$	$\mu A$	
$I_{CC}$	Quiescent Power Supply Current	$V_{CC} = \text{Max}$ , $V_{DIF} = +1V$	DS26C32AT		16	23	mA
			DS26C32AM		16	25	mA
$V_{HYST}$	Input Hysteresis	$V_{CM} = 0V$		60		mV	

**AC Electrical Characteristics**

$V_{CC} = 5V \pm 10\%$  (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

## AC Electrical Characteristics (Continued)

$V_{CC} = 5V \pm 10\%$  (Note 3)

Symbol	Parameter	Conditions	Min	Typ	Max		Units
					DS26C32AT	DS26C32AM	
$t_{RISE}$ , $t_{FALL}$	Output Rise and Fall Times	$C_L = 50 \text{ pF}$ $V_{DIFF} = 2.5V$ $V_{CM} = 0V$		4	9	9	ns
$t_{PLZ}$ , $t_{PHZ}$	Propagation Delay ENABLE to Output	$C_L = 50 \text{ pF}$ $R_L = 1000\Omega$ $V_{DIFF} = 2.5V$		13	22	29	ns
$t_{PZL}$ , $t_{PZH}$	Propagation Delay ENABLE to Output	$C_L = 50 \text{ pF}$ $R_L = 1000\Omega$ $V_{DIFF} = 2.5V$		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  $T_A = 25^\circ C$ .

**Note 4:** ESD Rating: HBM (1.5 kΩ, 100 pF)

Inputs  $\geq 2000V$

All other pins  $\geq 1000V$

EIAJ (0Ω, 200 pF)  $\geq 350V$

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

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

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

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

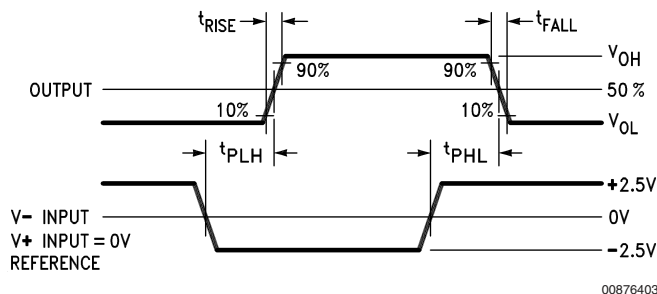
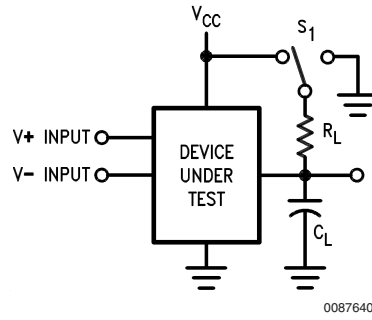


FIGURE 1. Propagation Delay

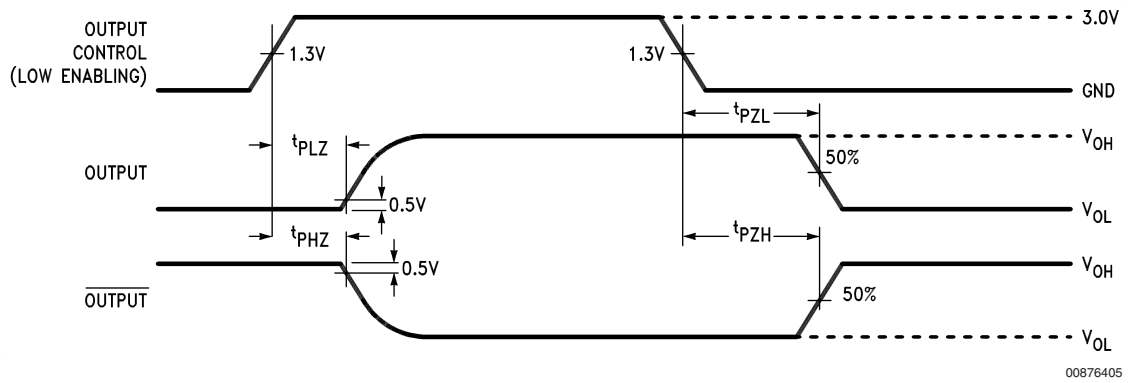
## Test and Switching Waveforms (Continued)



00876404

$C_L$  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.

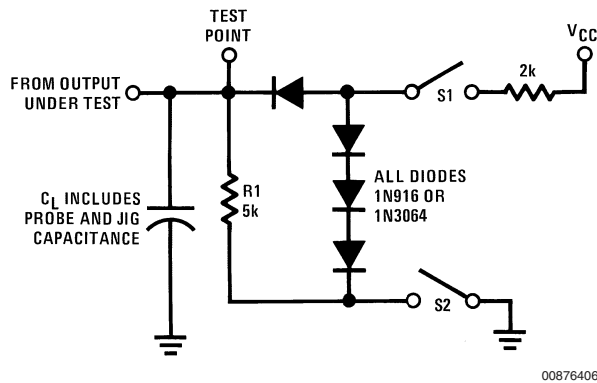
FIGURE 2. Test Circuit for TRI-STATE Output Tests



00876405

FIGURE 3. TRI-STATE® Output Enable and Disable Waveforms

## AC Test Circuit and Switching Time Waveforms



00876406

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

## AC Test Circuit and Switching Time Waveforms (Continued)

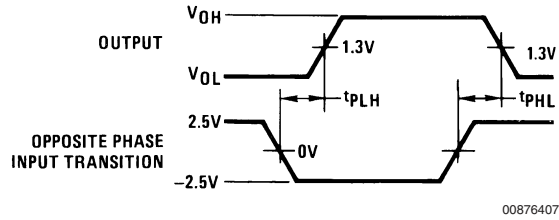


FIGURE 5. Propagation Delay for “LS-Type” Load (Notes 7, 9)

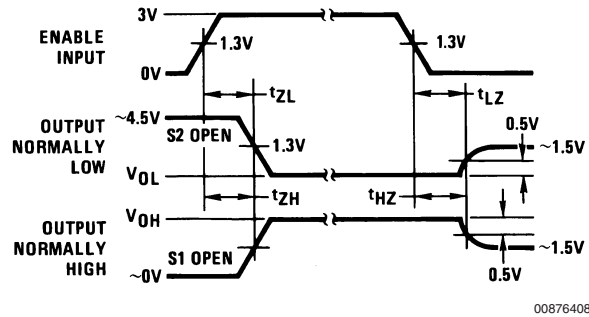


FIGURE 6. Enable and Disable Times for “LS-Type” Load (Notes 8, 9)

**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  $\leq 1.0$  MHz;  $Z_O = 50\Omega$ ;  $t_r \leq 15$  ns;  $t_f \leq 6.0$  ns.

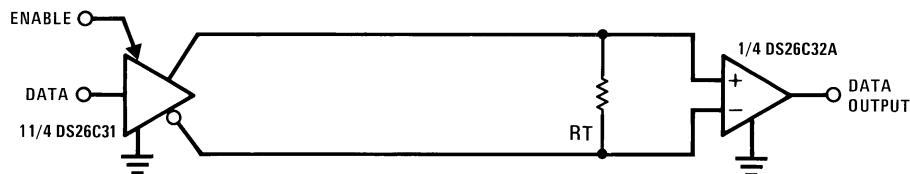
## Truth Table

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

Z = TRI-STATE

## Typical Applications

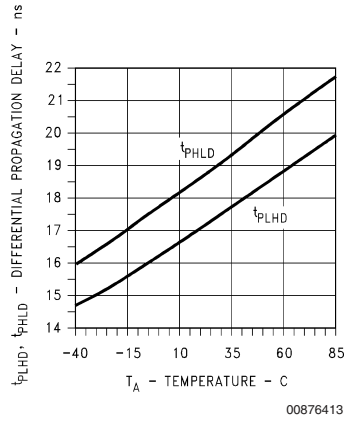
### Two-Wire Balanced Systems, RS-422



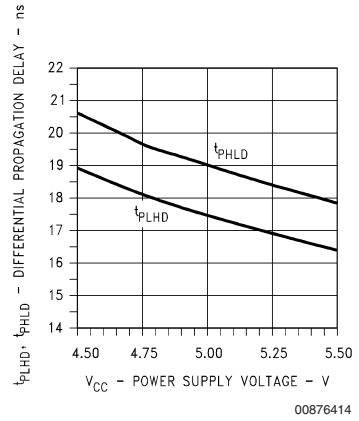
00876409

# Typical Performance Characteristics

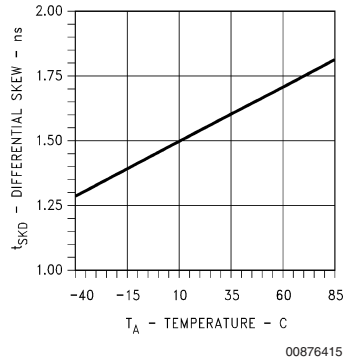
**Differential Propagation Delay vs Temperature**



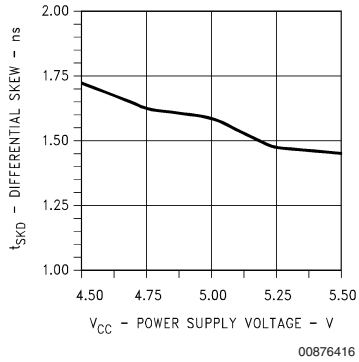
**Differential Propagation Delay vs Power Supply Voltage**



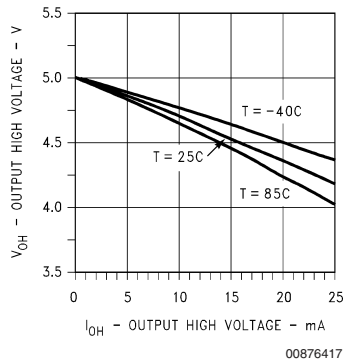
**Differential Skew vs Temperature**



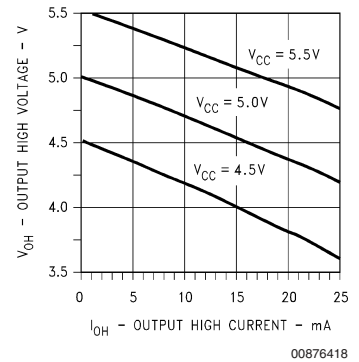
**Differential Skew vs Power Supply Voltage**



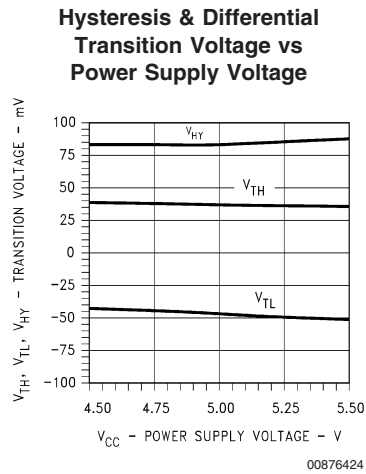
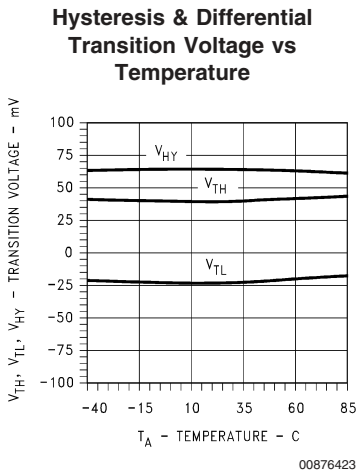
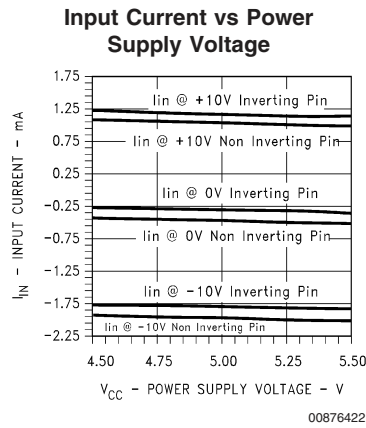
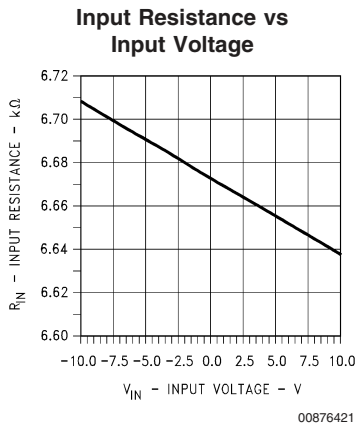
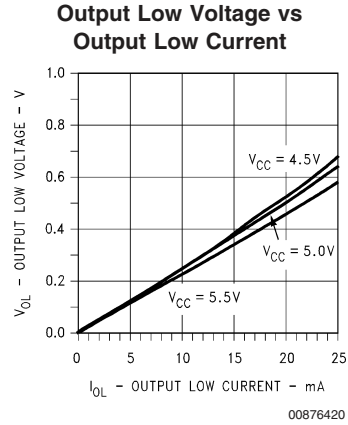
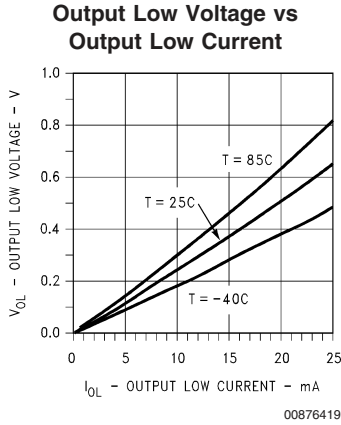
**Output High Voltage vs Output High Current**



**Output High Voltage vs Output High Current**



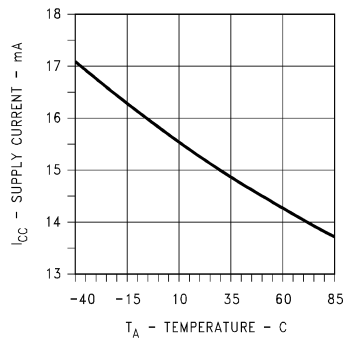
Typical Performance Characteristics (Continued)





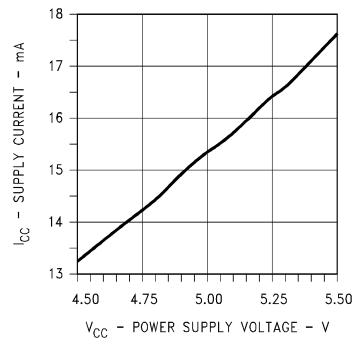
Typical Performance Characteristics (Continued)

Supply Current vs Temperature



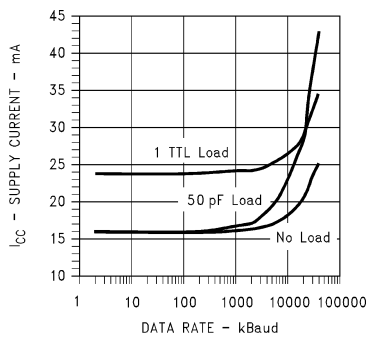
00876425

Disabled Supply Current vs Power Supply Voltage



00876426

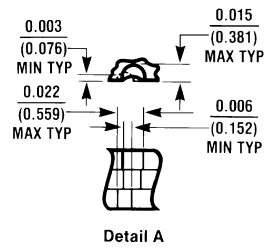
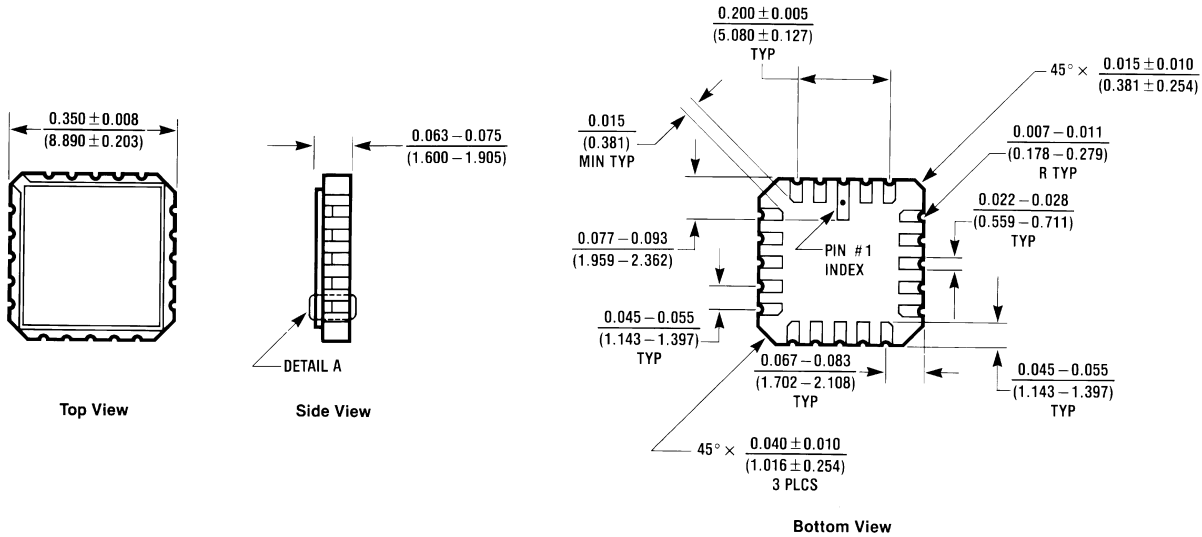
Supply Current vs Data Rate



00876427

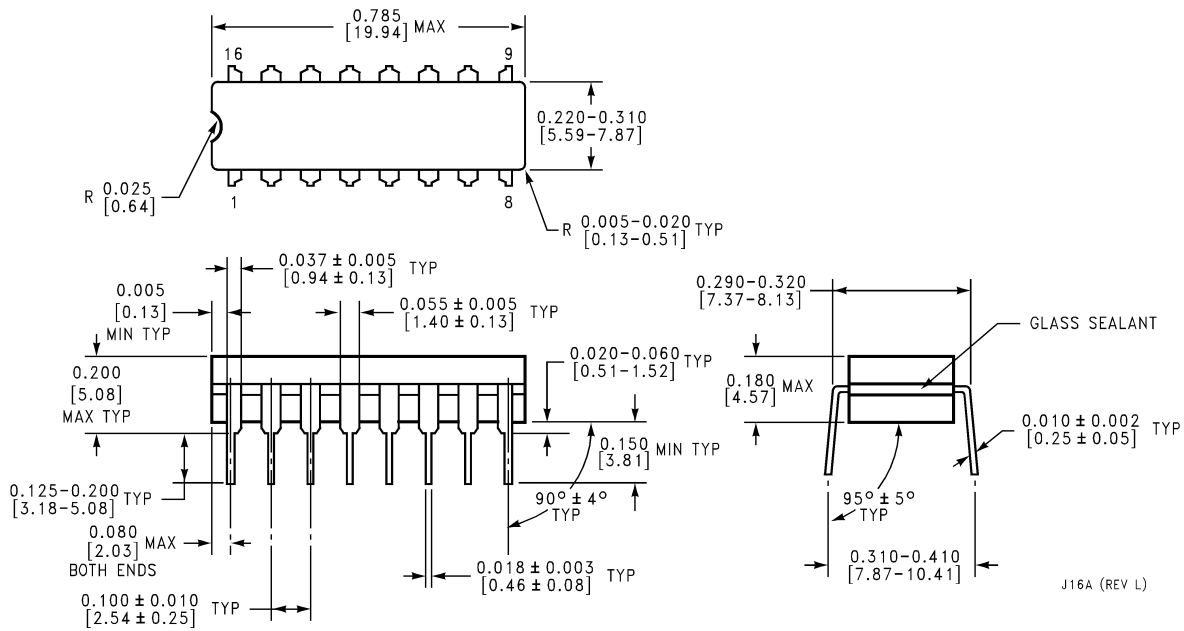
**Physical Dimensions** inches (millimeters)

unless otherwise noted



E20A (REV D)

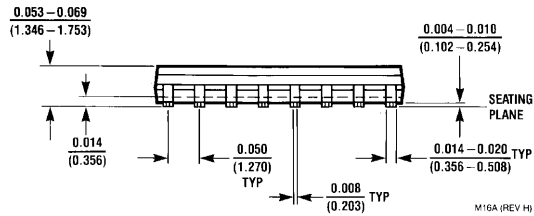
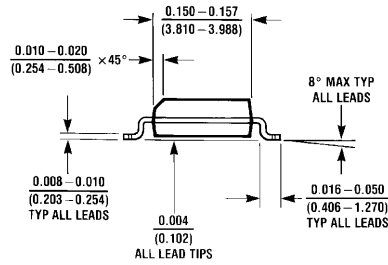
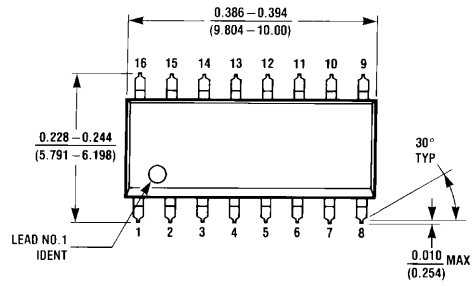
**20-Lead Ceramic Leadless Chip Carrier (E)**  
 Order Number DS26C32AME/883  
 NS Package Number E20A



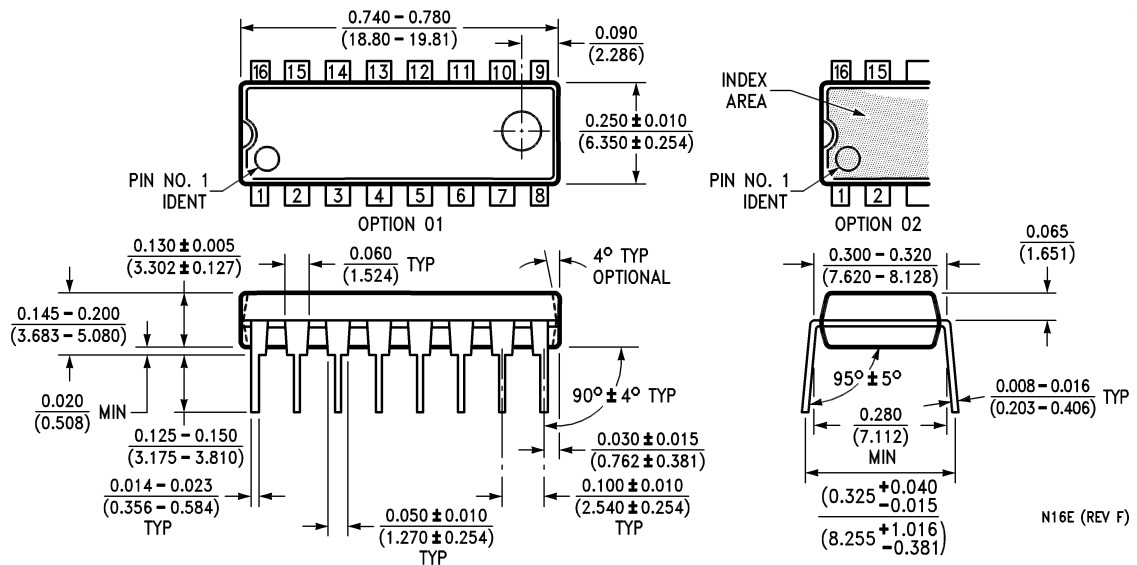
J16A (REV L)

**16-Lead Ceramic Dual-In-Line Package (J)**  
 Order Number DS26C32AMJ/883  
 NS Package Number J16A

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)

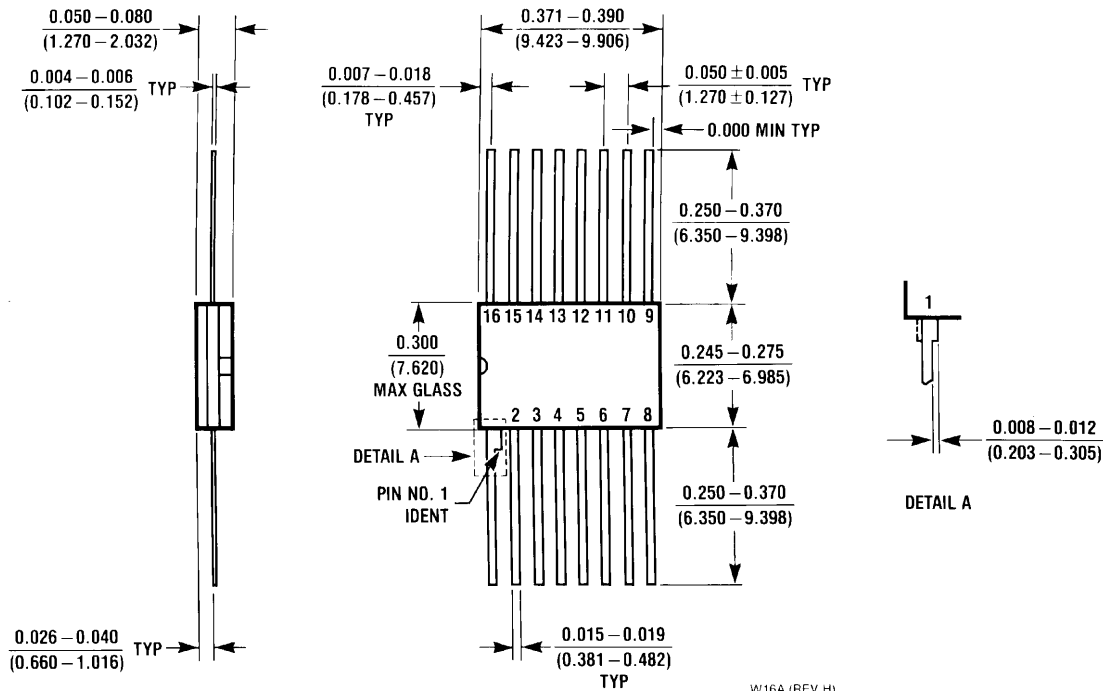


**16-Lead Molded Small Outline Package (M)**  
**Order Number DS26C32ATM**  
**NS Package Number M16A**



**16-Lead Molded Dual-In-Line Package (N)**  
**Order Number DS26C32ATN**  
**NS Package Number N16E**

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**16-Lead Ceramic FlatPak (W)**  
**Order Number DS26C32AMW/883**  
**NS Package Number W16A**

W16A (REV H)

**LIFE SUPPORT POLICY**

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

**BANNED SUBSTANCE COMPLIANCE**

National Semiconductor certifies that the products and packing materials meet the provisions of the Customer Products Stewardship Specification (CSP-9-111C2) and the Banned Substances and Materials of Interest Specification (CSP-9-111S2) and contain no "Banned Substances" as defined in CSP-9-111S2.



**National Semiconductor**  
**Americas Customer Support Center**  
 Email: new.feedback@nsc.com  
 Tel: 1-800-272-9959

**National Semiconductor**  
**Europe Customer Support Center**  
 Fax: +49 (0) 180-530 85 86  
 Email: europe.support@nsc.com  
 Deutsch Tel: +49 (0) 69 9508 6208  
 English Tel: +44 (0) 870 24 0 2171  
 Français Tel: +33 (0) 1 41 91 8790

**National Semiconductor**  
**Asia Pacific Customer Support Center**  
 Email: ap.support@nsc.com

**National Semiconductor**  
**Japan Customer Support Center**  
 Fax: 81-3-5639-7507  
 Email: jpn.feedback@nsc.com  
 Tel: 81-3-5639-7560

www.national.com



## DS26C32AM - CMOS Quad Differential Line Receivers



[Datasheet](#)   [Packaging](#)   [Samples & Pricing](#)   [Reliability](#)   [Knowledge Base](#)

### Features

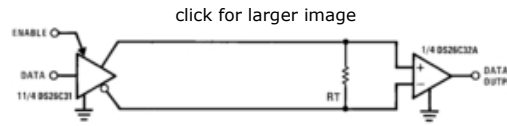
- CMOS design for low power
- $\pm 0.2V$  sensitivity over input common mode voltage range
- Typical propagation delays: 19 ns
- Typical input hysteresis: 60 mV
- Inputs won't load line when  $V_{CC} = 0V$
- Meets the requirements of EIA standard RS-422
- TRI-STATE<sup>®</sup> outputs for connection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

### 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  $\pm 7V$ . [More...](#)

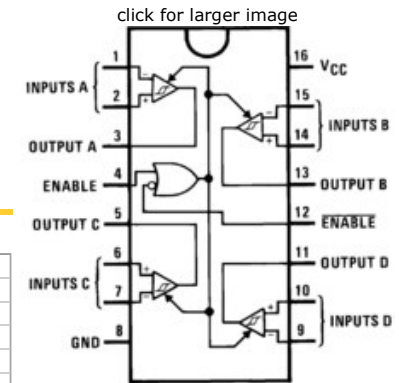
### Typical Application



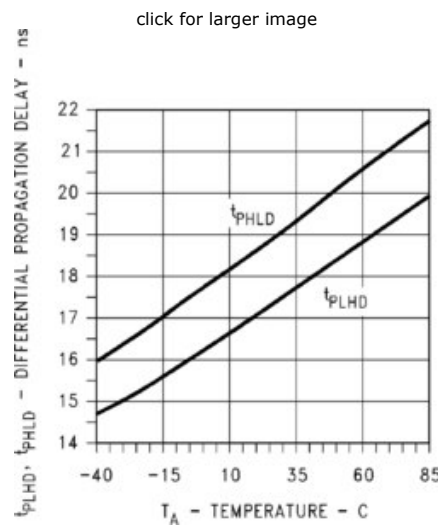
### Parametric Table [expand](#)

Standard	RS-232
Drivers	0
Receivers	4
Supply Voltage	5 Volt
Process	CMOS
Temperature Min	-55 deg C
Temperature Max	125 deg C
Function	1:n Repeater



### Connection Diagram



### Typical Performance



Datasheet

 RoHS Compliant <a href="#">RoHS Compliance Information</a>	Size in Kbytes	Date	 <a href="#">Download</a>
DS26C32AT/DS26C32AM Quad Differential Line Receiver	360 Kbytes	22-Sep-04	<a href="#">Download</a>
DS26C32AM Mil-Aero Datasheet MNDS26C32AM-X	355 Kbytes		<a href="#">Download</a>

If you have trouble printing or viewing PDF file(s), see [Printing Problems](#).

Package Availability, Models, Samples & Pricing

Part Number	Package							Factory Lead Time		Models	Samples & Electronic Orders	Budgetary Pricing		Std Pack Size	Package Marking Format
	Type	Pins	Spec.	MSL Rating	Peak Reflow	RoHS Report	CAD Symbols	Weeks	Qty			Qty	\$US each		
DS26C32A MD8	Unpackaged Die							Full production N/A 15000		N/A		CALL	tray of N/A	-	
5962-9164001M2A (DS26C32AME/883)	LCC	20				RoHS	Download	Full production 8 weeks 500		N/A	<a href="#">Buy Now</a>	50+	\$22.10	rail of 50	NS Q ZSSXXYYA DS26C32AME /883 5962-9164001M2A
5962-9164001MEA (DS26C32AMJ/883)	CERDIP	16				RoHS	Download	Full production 6 weeks 500		N/A	<a href="#">Buy Now</a>	50+	\$11.60	rail of 25	NSZSSXXYYA DS26C32AMJ/883 Q 5962-9164001MEA
5962-9164001MFA (DS26C32AMW/883)	CERPACK	16				RoHS	Download	Full production 27 weeks 500		N/A	<a href="#">Buy Now</a>	50+	\$14.90	rail of 19	NSZSSXXYYA DS26C32AMW /883 Q 5962-9164001MFA
DS26C32AMWG/883	CERPACK	16	STD	1	NA	RoHS	Download	Full production 10 weeks 500		N/A	<a href="#">Buy Now</a>	50+	\$21.40	tray of 42	NSZSSXXYYA DS26C32AMWG/ 883 Q 5962 9164001MXA

Obsolete Versions

Obsolete Part	Alternate Part or Supplier	Source	Last Time Buy Date
DS26C32AMJ-MLS	DS26C32AMJ/883	NATIONAL SEMICONDUCTOR	09/08/98
DS26C32AMW-MLS	DS26C32AMW/883	NATIONAL SEMICONDUCTOR	09/08/98

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.

Reliability Metrics

Part Number	Process	EFR Reject	EFR Sample Size	PPM *	LTA Rejects	LTA Device Hours	FITS	MTTF (Hours)
DS26C32A MD8	CS200*	0	9850	0	0	3375000	2	957665465
DS26C32AME/883	CS200*	0	9850	0	0	3375000	2	957665465
DS26C32AMJ/883	CS200*	0	9850	0	0	3375000	2	957665465
DS26C32AMW/883	CS200*	0	9850	0	0	3375000	2	957665465
DS26C32AMWG/883	CS200*	0	9850	0	0	3375000	2	957665465

Note: The Early Failure Rates were calculated as point estimates. The Long Term Failure Rates were calculated at 60% confidence using the Arrhenius equation at 0.7eV activation energy and derating the assumed stress temperature of 150 °C to an application temperature of 55 °C.

For more information on Reliability Metrics, please click [here](#).

[Information as of 23-Mar-2009]