

## DS3486 Quad RS-422, RS-423 Line Receiver

 Check for Samples: [DS3486](#)

### FEATURES

- Four Independent Receivers
- TRI-STATE Outputs
- Internal Hysteresis –140 mV (typ)
- Fast Propagation Times –19 ns (typ)
- TTL Compatible Outputs
- 5V Supply
- Pin Compatible and Interchangeable with MC3486

### DESCRIPTION

Texas Instruments' quad RS-422, RS-423 receiver features four independent receivers which comply with EIA Standards for the electrical characteristics of balanced/unbalanced voltage digital interface circuits. Receiver outputs are 74LS compatible, TRI-STATE structures which are forced to a high impedance state when the appropriate output control pin reaches a logic zero condition. A PNP device buffers each output control pin to assure minimum loading for either logic one or logic zero inputs. In addition, each receiver has internal hysteresis circuitry to improve noise margin and discourage output instability for slowly changing input waveforms.

### Block and Connection Diagrams

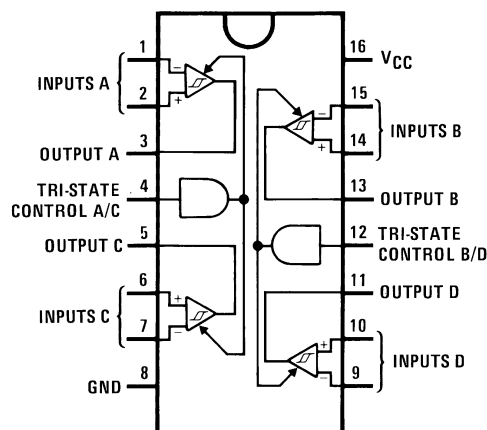
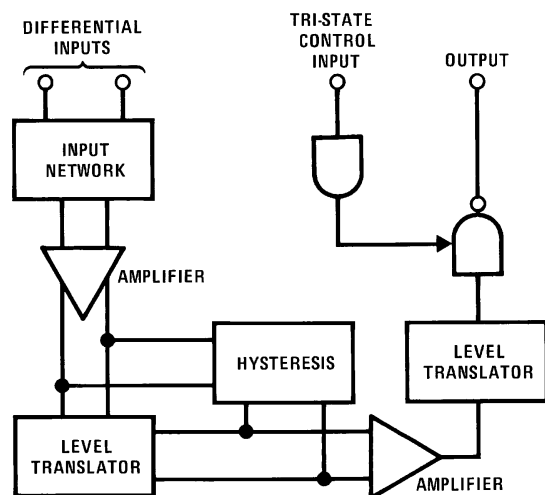


Figure 1. Dual-In-Line Package  
 Top View  
 D-16 (SOIC) Package or NFG0016E (PDIP)  
 Package



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These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### Absolute Maximum Ratings<sup>(1)(2)</sup>

Power Supply Voltage, $V_{CC}$	8V
Input Common-Mode Voltage, $V_{ICM}$	$\pm 25V$
Input Differential Voltage, $V_{ID}$	$\pm 25V$
TRI-STATE Control Input Voltage, $V_I$	8V
Output Sink Current, $I_O$	50 mA
Storage Temperature, $T_{STG}$	$-65^{\circ}C$ to $+150^{\circ}C$
Maximum Power Dissipation <sup>(3)</sup> at $25^{\circ}C$	
Molded PDIP Package	1362 mW
SOIC Package	1002 mW
SOIC Package Thermal Resistance	
$\theta_{JA}$	$+124.5^{\circ}C/W$
$\theta_{JC}$	$+41.2^{\circ}C/W$

- (1) "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be ensured. They are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.
- (2) If Military/Aerospace specified devices are required, please contact the TI Sales Office/Distributors for availability and specifications.
- (3) Derate PDIP molded package 10.2 mW/ $^{\circ}C$  above  $25^{\circ}C$ . Derate SOIC package 8.01 mW/ $^{\circ}C$  above  $25^{\circ}C$ .

### Operating Conditions

	Max	Min	Units
Power Supply Voltage, $V_{CC}$	4.75	5.25	V
Operating Temperature, $T_A$	0	70	$^{\circ}C$
Input Common-Mode Voltage Range, $V_{ICR}$	$-7.0$	7.0	V

### Electrical Characteristics<sup>(1)</sup>

(Unless otherwise noted, minimum and maximum limits apply over recommended temperature and power supply voltage ranges. Typical values are for  $T_A = 25^{\circ}C$ ,  $V_{CC} = 5V$  and  $V_{IC} = 0V$ .)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$V_{IH}$	Input Voltage—High Logic State (TRI-STATE Control)		2.0			V
$V_{IL}$	Input Voltage—Low Logic State (TRI-STATE Control)				0.8	V
$V_{TH(D)}$	Differential Input Threshold Voltage	$-7V \leq V_{IC} \leq 7V$ , $V_{IH}$ TRI-STATE = 2V $I_O = -0.4$ mA, $V_{OH} \geq 2.7V$		0.070	0.2	V
		$I_O = 8$ mA, $V_{OL} \geq 0.5V$		0.070	-0.2	V
$I_{IB(D)}$	Input Bias Current	$V_{CC} = 0V$ or $5.25V$ , Other Inputs at 0V				
		$V_I = -10V$			-3.25	mA
		$V_I = -3V$			-1.50	mA
		$V_I = 3V$			1.50	mA
		$V_I = 10V$			3.25	mA
	Input Balance	$-7V \leq V_{IC} \leq 7V$ , $V_{IH(3C)} = 2V$ , (2)				
		$I_O = -0.4$ mA, $V_{ID} = 0.4V$	2.7			V
		$I_O = 8$ mA, $V_{ID} = -0.4V$			0.5	V

- (1) All currents into device pins are shown as positive, out of device pins are negative. All voltages referenced to ground unless otherwise noted.
- (2) Refer to EIA RS-422/3 for exact conditions.

### Electrical Characteristics <sup>(1)</sup> (continued)

(Unless otherwise noted, minimum and maximum limits apply over recommended temperature and power supply voltage ranges. Typical values are for  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 5\text{V}$  and  $V_{IC} = 0\text{V}$ .)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$I_{OZ}$	Output TRI-STATE Leakage Current	$V_{I(D)} = 3\text{V}$ , $V_{IL} = 0.8\text{V}$ , $V_{OL} = 0.5\text{V}$			-40	$\mu\text{A}$
		$V_{I(D)} = -3\text{V}$ , $V_{IL} = 0.8\text{V}$ , $V_{OH} = 2.7\text{V}$			40	$\mu\text{A}$
$I_{OS}$	Output Short-Circuit Current	$V_{I(D)} = 3\text{V}$ , $V_{IH\text{TRI-STATE}} = 2\text{V}$ , $V_O = 0\text{V}$ , <sup>(3)</sup>	-15		-100	$\text{mA}$
$I_{IL}$	Input Current—Low Logic State (TRI-STATE Control)	$V_{IL} = 0.5\text{V}$			-100	$\mu\text{A}$
$I_{IH}$	Input Current—High Logic State (TRI-STATE Control)	$V_{IH} = 2.7\text{V}$			20	$\mu\text{A}$
		$V_{IH} = 5.25\text{V}$			100	$\mu\text{A}$
$V_{IC}$	Input Clamp Diode Voltage (TRI-STATE Control)	$I_{IN} = -10\text{mA}$			-1.5	V
$I_{CC}$	Power Supply Current	All Inputs $V_{IL} = 0\text{V}$			85	$\text{mA}$

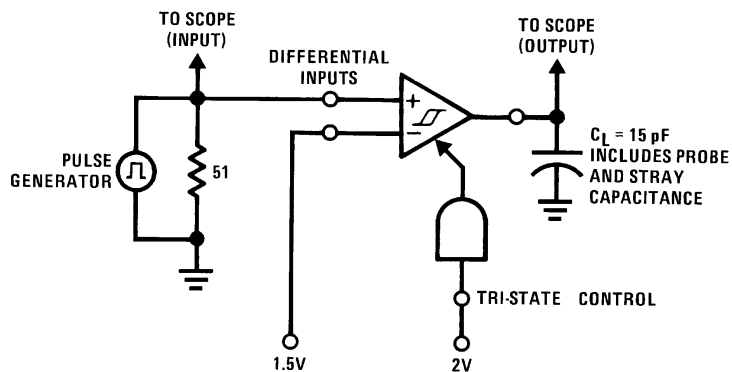
(3) Only one output at a time should be shorted.

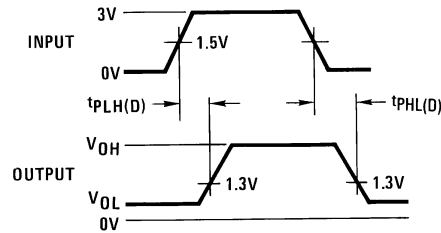
### Switching Characteristics

(Unless otherwise noted,  $V_{CC} = 5\text{V}$  and  $T_A = 25^\circ\text{C}$ .)

Symbol	Parameter	Min	Typ	Max	Units
$t_{PHL(D)}$	Propagation Delay Time—Differential Inputs to Output Output High to Low		19	35	ns
$t_{PLH(D)}$	Output Low to High		19	30	ns
$t_{PLZ}$	TRI-STATE Control to Output Output Low to TRI-STATE		23	35	ns
$t_{PHZ}$	Output High to TRI-STATE		25	35	ns
$t_{PZH}$	Output TRI-STATE to High		18	30	ns
$t_{PZL}$	Output TRI-STATE to Low		20	30	ns

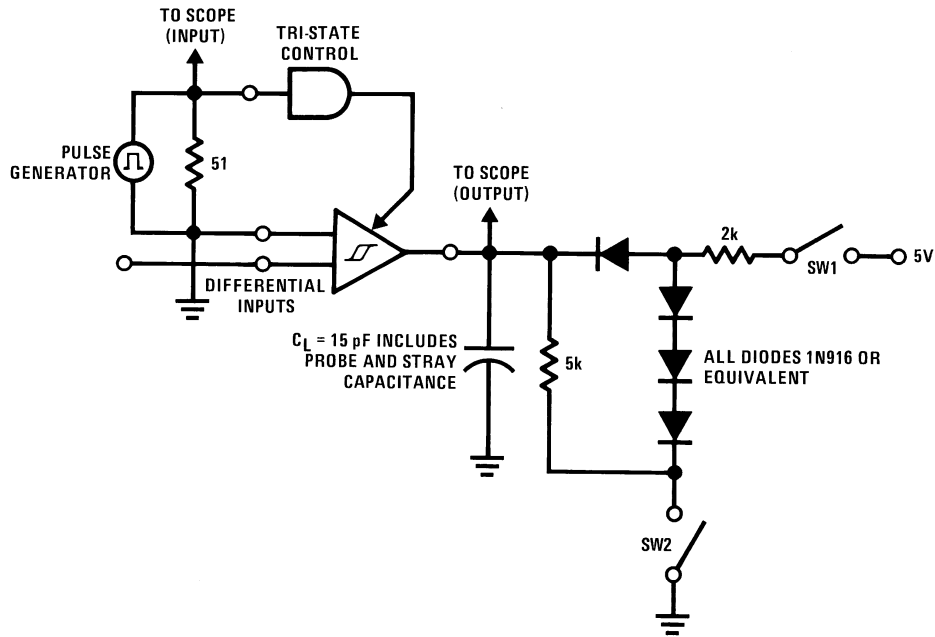
### AC TEST CIRCUIT AND SWITCHING TIME WAVEFORMS



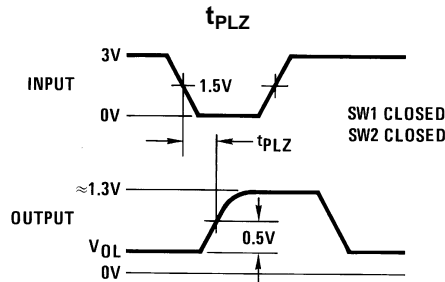


Input pulse characteristics:  
 $t_{TLH} = t_{THL} = 6 \text{ ns}$  (10% to 90%)  
 PRR = 1 MHz, 50% duty cycle

Figure 2. Propagation Delay Differential Input to Output



1.5V for  $t_{pHZ}$  and  $t_{pLZ}$   
 1.5V for  $t_{pLZ}$  and  $t_{pZL}$   
 Input pulse characteristics:  
 $t_{TLH} = t_{THL} = 6 \text{ ns}$  (10% to 90%)  
 PRR = 1 MHz, 50% duty cycle



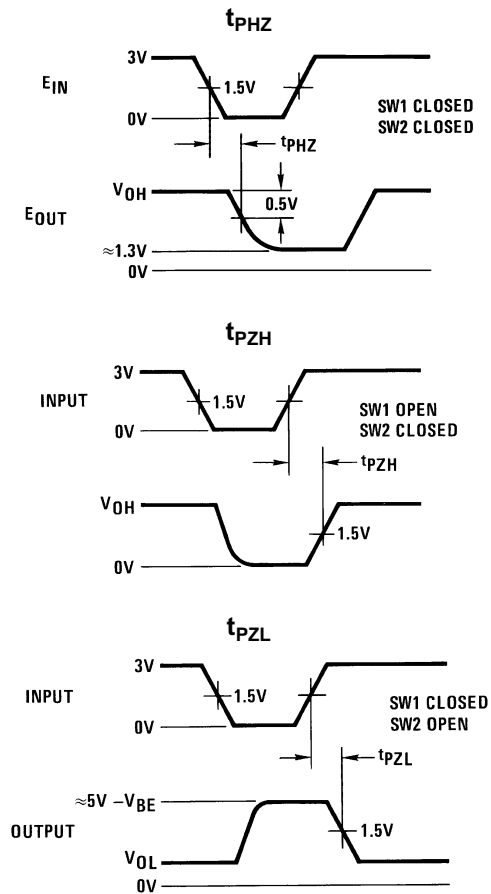


Figure 3. Propagation Delay TRI-STATE Control Input to Output

## REVISION HISTORY

Changes from Revision C (April 2013) to Revision D	Page
• Changed layout of National Data Sheet to TI format .....	<a href="#">5</a>

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
DS3486M	NRND	SOIC	D	16	48	TBD	Call TI	Call TI	0 to 70	DS3486M	
DS3486M/NOPB	ACTIVE	SOIC	D	16	48	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	0 to 70	DS3486M	<b>Samples</b>
DS3486MX/NOPB	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU SN   Call TI	Level-1-260C-UNLIM	0 to 70	DS3486M	<b>Samples</b>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
DS3486MX/NOPB	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.3	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DS3486MX/NOPB	SOIC	D	16	2500	367.0	367.0	35.0

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.

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