

May 1998

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

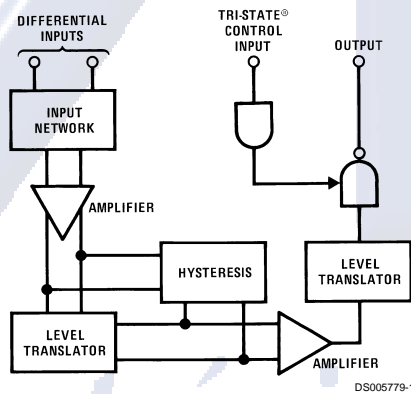
## General Description

National's 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.

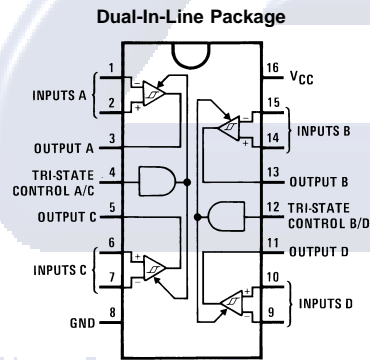
## Features

- 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

## Block and Connection Diagrams



DS005779-1



DS005779-2

Top View  
Order Number DS3486M or DS3486N  
See NS Package Number M16A or N16E

TRI-STATE® is a registered trademark of National Semiconductor Corp.

DS3486 Quad RS-422, RS-423 Line Receiver

**Absolute Maximum Ratings** (Note 2)

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

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 (Note 1) at $25^{\circ}C$	

Molded Dip Package  
SO Package

1362 mW  
1002 mW

**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

**Note 1:** Derate Dip molded package 10.2 mW/ $^{\circ}C$  above  $25^{\circ}C$ . Derate SO package 8.01 mW/ $^{\circ}C$  above  $25^{\circ}C$ .

**Electrical Characteristics** (Note 3)

(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	$-7V \leq V_{IC} \leq 7V$ , $V_{IH(3C)} = 2V$ , (Note 5)				
		$V_{OH}$	$I_O = -0.4$ mA, $V_{ID} = 0.4V$	2.7		V
		$V_{OL}$	$I_O = 8$ mA, $V_{ID} = -0.4V$		0.5	V
$I_{OZ}$	Output TRI-STATE Leakage Current	$V_{I(D)} = 3V$ , $V_{IL} = 0.8V$ , $V_{OL} = 0.5V$ $V_{I(D)} = -3V$ , $V_{IL} = 0.8V$ , $V_{OH} = 2.7V$			-40	$\mu A$
					40	$\mu A$
$I_{OS}$	Output Short-Circuit Current	$V_{I(D)} = 3V$ , $V_{IH}$ TRI-STATE = 2V, $V_O = 0V$ , (Note 4)	-15		-100	mA
$I_{IL}$	Input Current—Low Logic State (TRI-STATE Control)	$V_{IL} = 0.5V$			-100	$\mu A$
$I_{IH}$	Input Current—High Logic State (TRI-STATE Control)	$V_{IH} = 2.7V$ $V_{IH} = 5.25V$			20	$\mu A$
					100	$\mu A$
$V_{IC}$	Input Clamp Diode Voltage (TRI-STATE Control)	$I_{IN} = -10$ mA			-1.5	V
$I_{CC}$	Power Supply Current	All Inputs $V_{IL} = 0V$			85	mA

**Note 2:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. 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.

**Note 3:** All currents into device pins are shown as positive, out of device pins are negative. All voltages referenced to ground unless otherwise noted.

**Note 4:** Only one output at a time should be shorted.

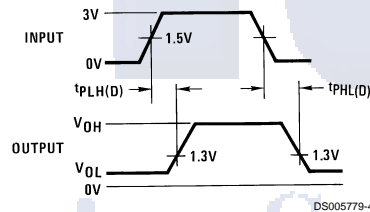
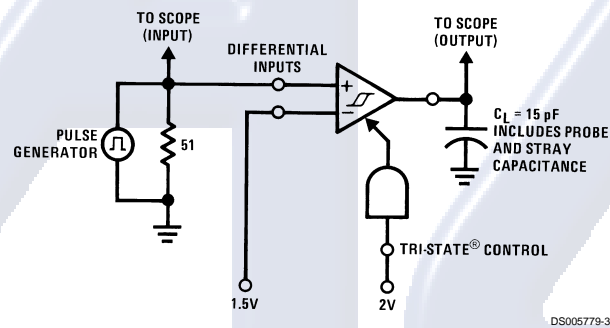
**Note 5:** Refer to EIA RS-422/3 for exact conditions.

## Switching Characteristics

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

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

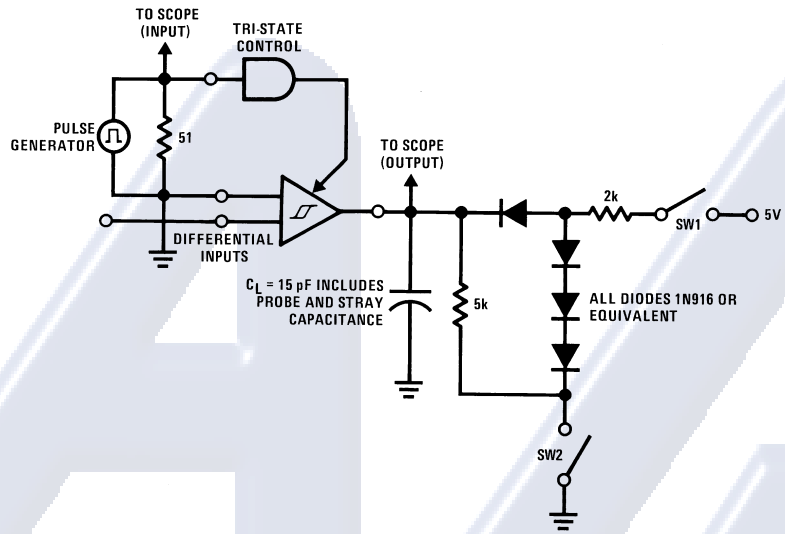
## AC Test Circuits and Switching Time Waveforms



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

FIGURE 1. Propagation Delay Differential Input to Output

AC Test Circuits and Switching Time Waveforms (Continued)



DS005779-5

1.5V for  $t_{PHZ}$  and  $t_{PLZ}$   
 1.5V for  $t_{PLZ}$  and  $t_{PZL}$   
 Input pulse characteristics:  
 $t_{TLH} = t_{THL} = 6$  ns (10% to 90%)  
 PRR = 1 MHz, 50% duty cycle

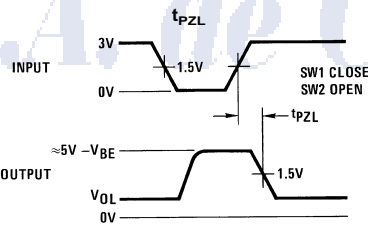
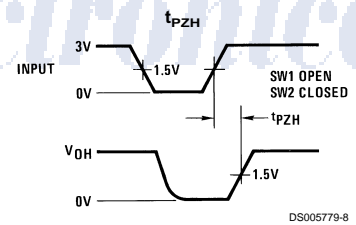
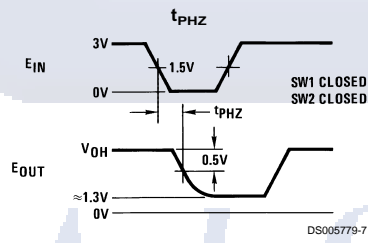
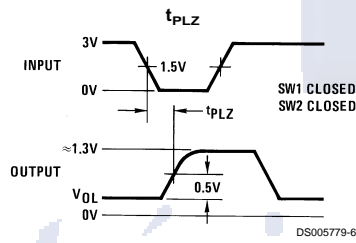
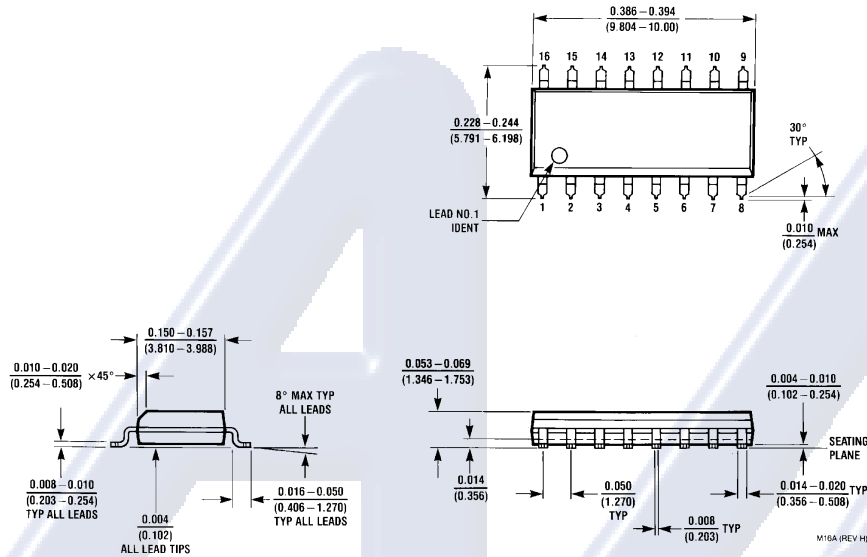
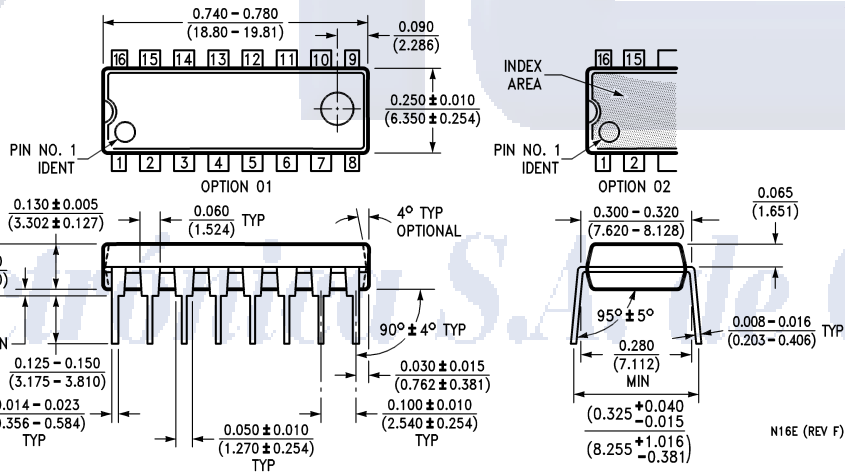


FIGURE 2. Propagation Delay TRI-STATE Control Input to Output

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



**SO Package (M)**  
Order Number DS3486M  
NS Package Number M16A



**Molded Dual-In-Line Package (N)**  
Order Number DS3486N  
NS Package Number N16E

DS3486 Quad RS-422, RS-423 Line Receiver

Notes



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