

## DS34C86T Quad CMOS Differential Line Receiver

### General Description

The DS34C86T 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 DS34C86T has an input sensitivity of 200 mV over the common mode input voltage range of  $\pm 7V$ . Hysteresis is provided to improve noise margin and discourage output instability for slowly changing input waveforms.

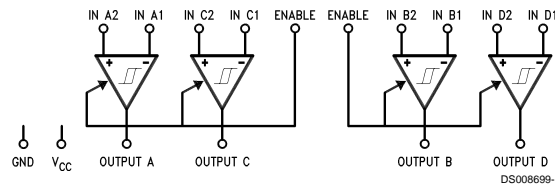
The DS34C86T features internal pull-up and pull-down resistors which prevent output oscillation on unused channels.

Separate enable pins allow independent control of receiver pairs. The TRI-STATE® outputs have 6 mA source and sink capability. The DS34C86T is pin compatible with the DS3486.

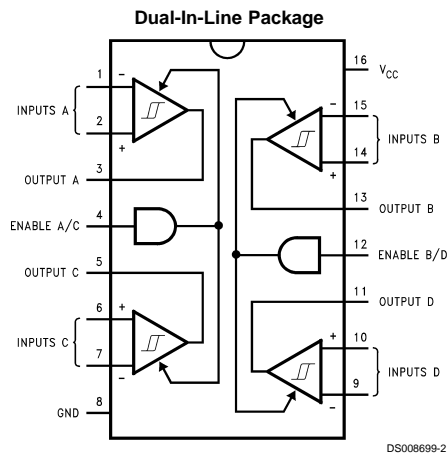
### Features

- CMOS design for low power
- $\pm 0.2V$  sensitivity over the 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 system bus compatibility
- Available in surface mount
- Open input Failsafe feature, output high for open input

### Logic Diagram



### Connection Diagram



Top View  
Order Number DS34C86TM, and DS34C86TN  
See NS Package Number M16A and N16E

### Truth Table

| Enable | Input                      | Output |
|--------|----------------------------|--------|
| L      | X                          | Z      |
| H      | $V_{ID} \geq V_{TH} (Max)$ | H      |
| H      | $V_{ID} \leq V_{TH} (Min)$ | L      |
| H      | Open*                      | H      |

\*Open, not terminated  
Z = TRI-STATE

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### 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                                |
| Input 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)

|                     |             |
|---------------------|-------------|
| Plastic "N" Package | 1645 mW     |
| SOIC Package        | 1190 mW     |
| Current Per Output  | $\pm 25$ mA |

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

### Operating Conditions

|                                       | Min  | Max  | Unit        |
|---------------------------------------|------|------|-------------|
| Supply Voltage ( $V_{CC}$ )           | 4.50 | 5.50 | V           |
| Operating Temperature Range ( $T_A$ ) | -40  | +85  | $^{\circ}C$ |
| Enable Input Rise or Fall Times       | 500  |      | ns          |

### DC Electrical Characteristics (Note 3)

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

| Symbol     | Parameter                                | Conditions   | Min  | Typ          | Max          | Units      |
|------------|--|--|------|--------------|--------------|------------|
| $V_{TH}$   | Minimum Differential Input Voltage       | $V_{OUT} = V_{OH}$ or $V_{OL}$<br>$-7V < V_{CM} < +7V$                     | -200 | 35           | +200         | mV         |
| $R_{IN}$   | Input Resistance                         | $V_{IN} = -7V, +7V$<br>(Other Input = GND)                                 | 5.0  | 6.8          | 10           | k $\Omega$ |
| $I_{IN}$   | Input Current<br>(Under Test)            | $V_{IN} = +10V$ , Other Input = GND<br>$V_{IN} = -10V$ , Other Input = GND |      | +1.1<br>-2.0 | +1.5<br>-2.5 | mA         |
| $V_{OH}$   | Minimum High Level Output Voltage        | $V_{CC} = \text{Min.}$ , $V_{(DIFF)} = +1V$<br>$I_{OUT} = -6.0$ mA         | 3.8  | 4.2          |              | V          |
| $V_{OL}$   | Maximum Low Level Output Voltage         | $V_{CC} = \text{Max.}$ , $V_{(DIFF)} = -1V$<br>$I_{OUT} = 6.0$ 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,<br>TRI-STATE Control = $V_{IL}$                 |      | $\pm 0.5$    | $\pm 5.0$    | $\mu A$    |
| $I_I$      | Maximum Enable Input Current             | $V_{IN} = V_{CC}$ or GND   |      |              | $\pm 1.0$    | $\mu A$    |
| $I_{CC}$   | Quiescent Power Supply Current           | $V_{CC} = \text{Max.}$ , $V_{(DIFF)} = +1V$                                |      | 16           | 23           | mA         |
| $V_{HYST}$ | Input Hysteresis                         | $V_{CM} = 0V$  |      | 60           |              | mV         |

### AC Electrical Characteristics (Note 3)

$V_{CC} = 5V \pm 10\%$  (unless otherwise specified) (Figures 1, 2, 3)

| Symbol                     | Parameter                             | Conditions   | Min | Typ | Max | Units |
|----------------------------|---------------------------------------|--|-----|-----|-----|-------|
| $t_{PLH}$ ,<br>$t_{PHL}$   | Propagation Delay<br>Input to Output  | $C_L = 50$ pF<br>$V_{DIFF} = 2.5V$<br>$V_{CM} = 0V$      |     | 19  | 30  | ns    |
| $t_{RISE}$ ,<br>$t_{FALL}$ | Output Rise and<br>Fall Times         | $C_L = 50$ pF<br>$V_{DIFF} = 2.5V$<br>$V_{CM} = 0V$      |     | 4   | 9   | ns    |
| $t_{PLZ}$ ,<br>$t_{PHZ}$   | Propagation Delay<br>ENABLE to Output | $C_L = 50$ pF<br>$R_L = 1000\Omega$<br>$V_{DIFF} = 2.5V$ |     | 13  | 18  | ns    |

## AC Electrical Characteristics (Note 3) (Continued)

$V_{CC} = 5V \pm 10\%$  (unless otherwise specified) (Figures 1, 2, 3)

| Symbol                   | Parameter                             | Conditions   | Min | Typ | Max | Units |
|--------------------------|---------------------------------------|--|-----|-----|-----|-------|
| $t_{PZL}$ ,<br>$t_{PZH}$ | Propagation Delay<br>ENABLE to Output | $C_L = 50 \text{ pF}$<br>$R_L = 1000\Omega$<br>$V_{DIFF} = 2.5V$ |     | 13  | 21  | 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 across the operating temperature range.

All typicals are given for  $V_{CC} = 5V$  and  $T_A = 25^\circ\text{C}$ .

**Note 4:** ESD Rating; HBM (1.5k $\Omega$ , 100 pF)

Inputs  $\geq 2000V$

All other pins  $\geq 1000V$

EIAJ (0 $\Omega$ , 200 pF)  $\geq 350V$

**Note 5:** Ratings apply to ambient temperature at  $25^\circ\text{C}$ . Above this temperature derate N Package 13.16 mW/ $^\circ\text{C}$ , and M Package 9.52 mW/ $^\circ\text{C}$ .

## Comparison Table of Switching Characteristics into "LS-Type" Load (Note 6)

$V_{CC} = 5V$ ,  $T_A = 25^\circ\text{C}$  (Figures 4, 5)

| Symbol       | Parameter                                    | DS34C86 |     | DS3486 |     | Units |
|--------------|--|---------|-----|--------|-----|-------|
|              |  | Typ     | Max | Typ    | Max |       |
| $t_{PHL(D)}$ | Propagation Delay Time<br>Output High to Low | 17      |     | 19     |     | ns    |
| $t_{PLH(D)}$ | Propagation Delay Time<br>Output Low to High | 19      |     | 19     |     | ns    |
| $t_{PLZ}$    | Output Low to TRI-STATE                      | 13      |     | 23     |     | ns    |
| $t_{PHZ}$    | Output High to TRI-STATE                     | 12      |     | 25     |     | ns    |
| $t_{PZH}$    | Output TRI-STATE to High                     | 13      |     | 18     |     | ns    |
| $t_{PZL}$    | Output TRI-STATE to Low                      | 13      |     | 20     |     | ns    |

**Note 6:** This Table is provided for comparison purposes only. The values in this table for the DS34C86 reflect the performance of the device but are not tested or guaranteed.

## Test and Switching Waveforms

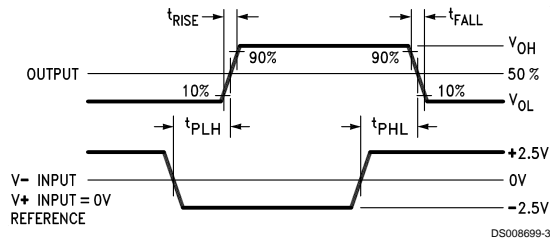
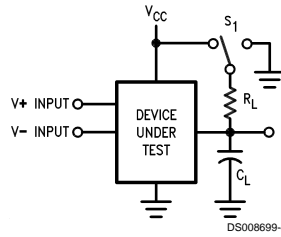


FIGURE 1. Propagation Delays

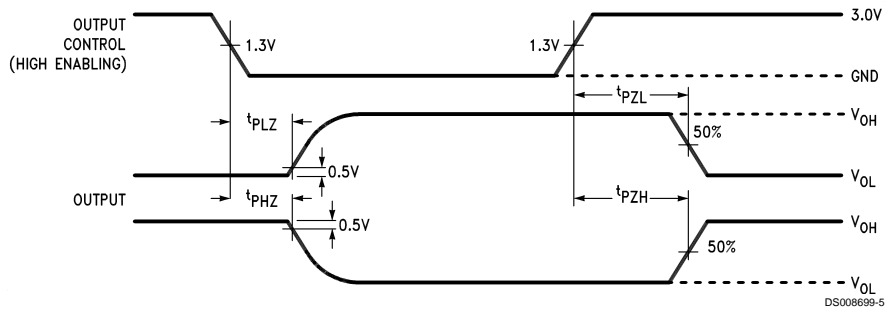
## Test and Switching Waveforms (Continued)



DS008699-4

$C_L$  Includes load and test jig capacitance.  
 $S1 = V_{CC}$  for  $t_{PZL}$  and  $t_{PLZ}$  measurements.  
 $S1 = GND$  for  $t_{PZH}$  and  $t_{PHZ}$  measurements.

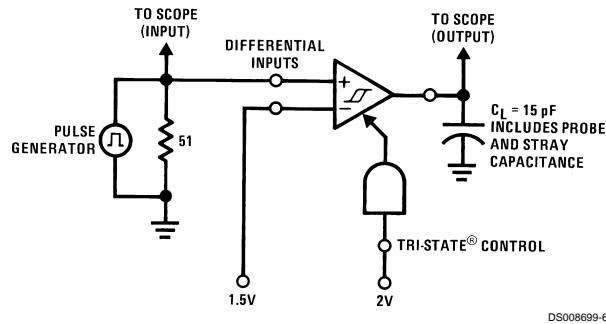
FIGURE 2. Test Circuit for TRI-STATE Output Tests



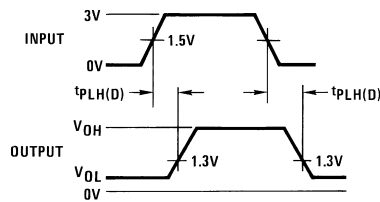
DS008699-5

FIGURE 3. TRI-STATE Output Enable and Disable Waveforms

## AC Test Circuits and Switching Time Waveforms



DS008699-6

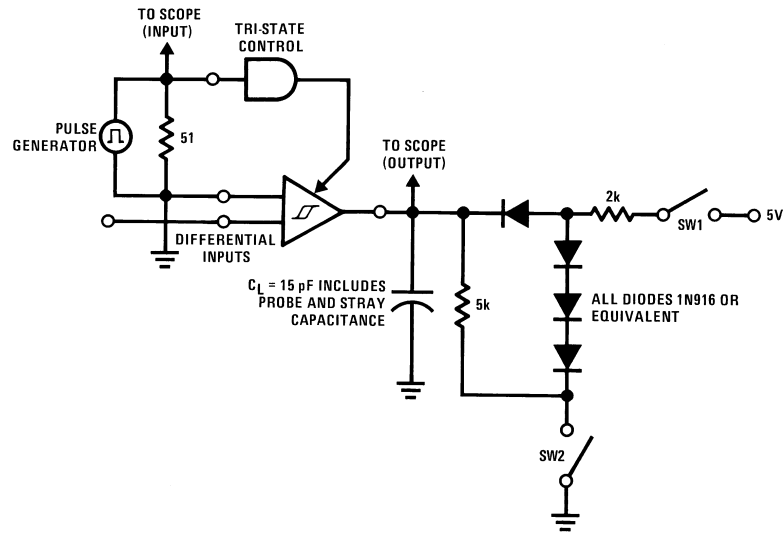


DS008699-7

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

FIGURE 4. Propagation Delay Differential Input to Output for "LS-Type" Load

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



DS008699-8

1.5V for  $t_{PHZ}$  and  $t_{PLZ}$   
 -1.5V for  $t_{PLZ}$  and  $t_{PZL}$   
 Input Pulse Characteristics:  
 $t_{LH} = t_{HL} = 6 \text{ ns}$  (10% to 90%)  
 PRR = 1 MHz, 50% duty cycle

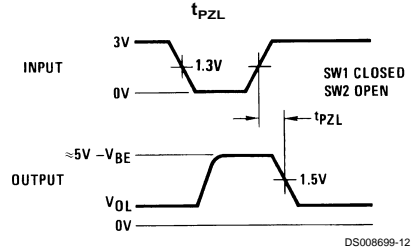
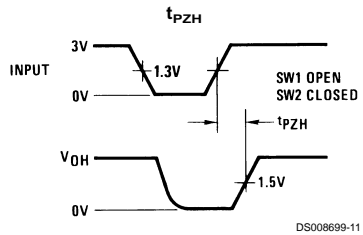
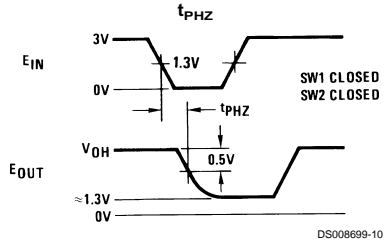
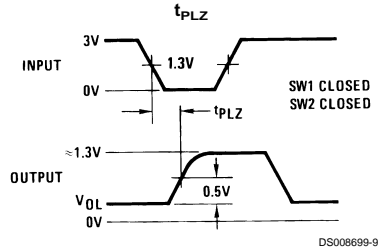
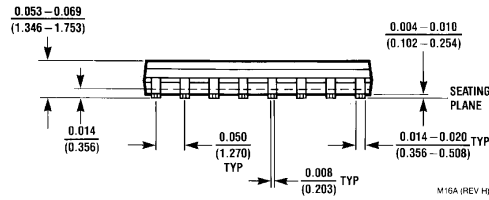
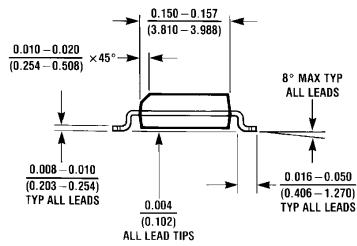
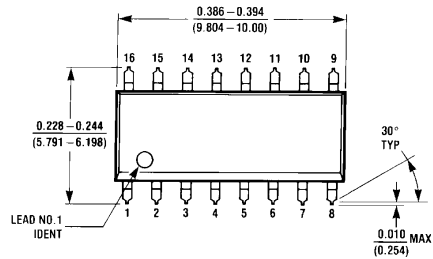


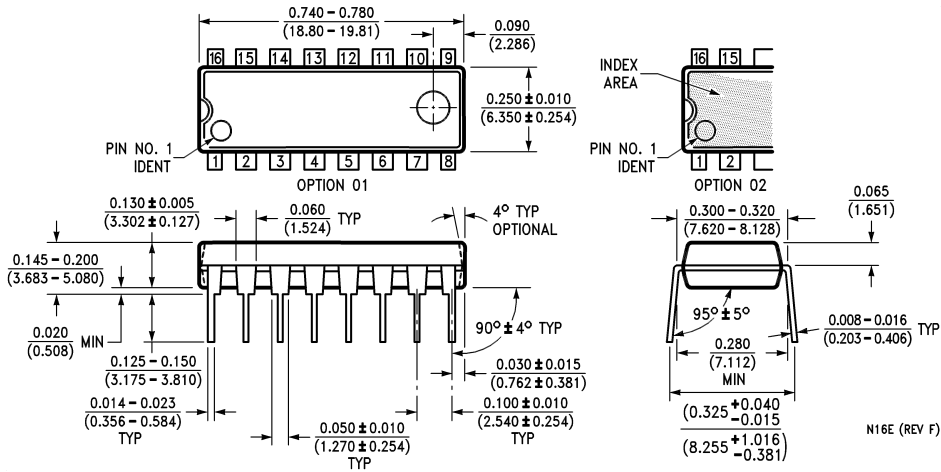
FIGURE 5. Propagation Delay TRI-STATE Control Unit to Output for "LS-Type" Load



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



**16-Lead Molded Small Outline Package (M)**  
**Order Number DS34C86TM**  
**NS Package Number M16A**



**16-Lead Dual-In-Line Package (N)**  
**Order Number DS34C86TN**  
**NS Package Number N16E**

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