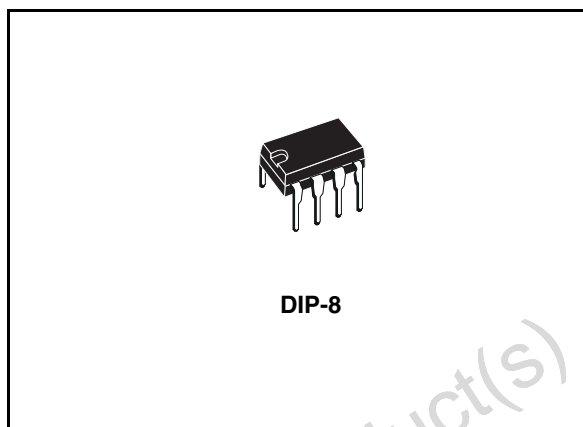


## Low power RS-485/RS-422 transceiver

### Features

- Low quiescent current: 300 mA
- Designed for RS-485 interface applications
- -7 V to 12 V common mode input voltage range
- Driver maintains high impedance in 3-state or with the power OFF
- 70 mV typical input hysteresis
- 30 ns propagation delays, 5 ns skew
- Operate from a single 5 V supply
- Current limiting and thermal shutdown for driver overload protection
- Allows up to 32 transceivers on the bus
- BiCMOS technology



The ST75C176B/C is designed for bidirectional data communications on multipoint bus transmission line (half-duplex applications).

### Description

The ST75C176B/C is a low power transceiver for RS-485 and RS-422 communication. Each part contains one driver and one receiver.

This transceiver draws 300 mA (typ.) of supply current when unloaded or fully loaded with disabled drivers.

It operates from a single 5 V supply.

Driver is short-circuit current limited and is protected against excessive power dissipation by thermal shutdown circuitry that places the driver outputs into a high-impedance state. The receiver input has a fail-safe feature that guarantees a logic-high output if the input is open circuit.

**Table 1. Device summary**

| Order code | Temperature range | Package | Packaging                         |
|------------|-------------------|---------|-----------------------------------|
| ST75C176CN | 0 to 70 °C        | DIP-8   | 50parts per tube / 40tube per box |
| ST75C176BN | -40 to 85 °C      | DIP-8   | 50parts per tube / 40tube per box |

## Contents

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# 1 Pin configuration

Figure 1. Pin connections

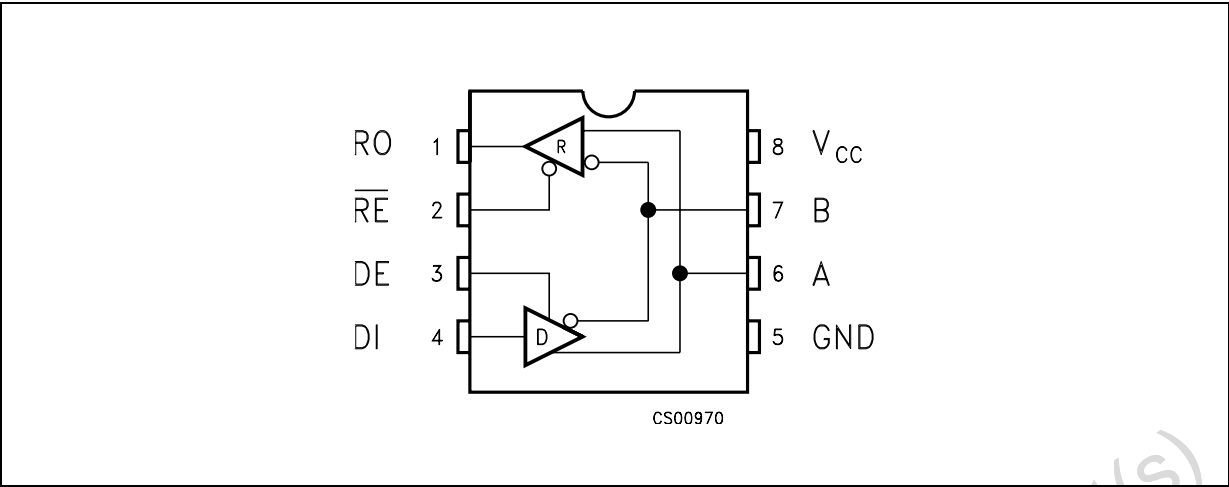


Table 2. Pin description

| Pin n° | Symbol          | Name and function  |
|--------|-----------------|--|
| 1      | RO              | Receiver output  |
| 2      | RE              | Receiver output enable                                       |
| 3      | DE              | Driver output enable   |
| 4      | DI              | Driver input   |
| 5      | GND             | Ground   |
| 6      | A               | Non-inverting receiver input and non-inverting driver output |
| 7      | B               | Inverting receiver input and inverting driver output         |
| 8      | V <sub>CC</sub> | Supply voltage   |

## 2 Truth tables

**Table 3. Truth table (driver)**

| Inputs |    |    | Outputs |   |
|--------|----|----|---------|---|
| RE     | DE | DI | B       | A |
| X      | H  | H  | L       | H |
| X      | H  | L  | H       | L |
| X      | L  | X  | Z       | Z |

Note: X= Don't care; Z=High impedance

**Table 4. Truth table (receiver)**

| Inputs |    |              | Output |
|--------|----|--------------|--------|
| RE     | DE | A-B          | RO     |
| L      | L  | $\geq +0.2V$ | H      |
| L      | L  | $\leq -0.2V$ | L      |
| L      | L  | INPUTS OPEN  | H      |
| H      | L  | X            | Z      |

Note: X= Don't care; Z=High impedance

### 3 Maximum ratings

**Table 5. Absolute maximum ratings**

| Symbol   | Parameter                                     | Value                      | Unit |
|----------|---|----------------------------|------|
| $V_{CC}$ | Supply voltage                                | 7                          | V    |
| $V_I$    | Control input voltage ( $\overline{RE}$ , DE) | -0.5 to ( $V_{CC} + 0.5$ ) | V    |
| $V_{DI}$ | Driver input voltage (DI)                     | -0.5 to ( $V_{CC} + 0.5$ ) | V    |
| $V_{DO}$ | Driver output voltage (A, B)                  | $\pm 14$                   | V    |
| $V_{RI}$ | Receiver input voltage (A, B)                 | $\pm 14$                   | V    |
| $V_{RO}$ | Receiver output voltage (RO)                  | -0.5 to ( $V_{CC} + 0.5$ ) | V    |

**Note:** *Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.*

## 4 Electrical characteristics

**Table 6. DC electrical characteristics**

( $V_{CC} = 5\text{ V} \pm 5\%$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise specified. Typical values are referred to  $T_A = 25\text{ °C}$ ) (See [Note 1](#))

| Symbol          | Parameter   | Test conditions  | Min. | Typ.       | Max.       | Unit                           |
|-----------------|---|--|------|------------|------------|--------------------------------|
| $V_{OD1}$       | Differential driver output (no load)  |  |      |            | 5          | V                              |
| $V_{OD2}$       | Differential driver output (with load)  | $R_L = 27\Omega$ (RS-485), (See <a href="#">Figure 2.</a> )<br>$R_L = 50\Omega$ (RS-422), (See <a href="#">Figure 2.</a> ) | 1.5  |            | 5<br>5     | V<br>V                         |
| $\Delta V_{OD}$ | Change in magnitude of driver differential output voltage for complementary output states | $R_L = 27\Omega$ or $50\Omega$ (See <a href="#">Figure 2.</a> )  |      |            | 0.2        | V                              |
| $V_{OC}$        | Driver common-mode output voltage   | $R_L = 27\Omega$ or $50\Omega$ (See <a href="#">Figure 2.</a> )  |      |            | 3          | V                              |
| $\Delta V_{OC}$ | Change in magnitude of driver common-mode output voltage for complementary output states  | $R_L = 27\Omega$ or $50\Omega$ (See <a href="#">Figure 2.</a> )  |      |            | 0.2        | V                              |
| $V_{IH}$        | Input high voltage  | $\overline{RE}$ , DE, DI   | 2.0  |            |            | V                              |
| $V_{IL}$        | Input low voltage   | $\overline{RE}$ , DE, DI   |      |            | 0.8        | V                              |
| $I_{IN1}$       | Input current   | $\overline{RE}$ , DE, DI   |      |            | $\pm 2$    | $\mu\text{A}$                  |
| $I_{IN2}$       | Input current (A, B)  | $V_{CM} = 0\text{V}$ or $5.25\text{V}$ , $V_{DE} = 0\text{V}$<br>$V_{IN} = 12\text{V}$<br>$V_{IN} = -7\text{V}$            |      |            | 1<br>-0.8  | mA<br>mA                       |
| $V_{TH}$        | Receiver differential threshold voltage   | $V_{CM} = -7$ to $12\text{V}$  | -0.2 |            | 0.2        | V                              |
| $\Delta V_{TH}$ | Receiver input hysteresis   | $V_{CM} = 0\text{V}$   |      | 70         |            | mV                             |
| $V_{OH}$        | Receiver output high voltage  | $I_O = -4\text{mA}$ , $V_{ID} = 200\text{mV}$  | 3.5  |            |            | V                              |
| $V_{OL}$        | Receiver output low voltage   | $I_O = 4\text{mA}$ , $V_{ID} = -200\text{mV}$  |      |            | 0.4        | V                              |
| $I_{OZR}$       | 3-State (high impedance) output current at receiver                                       | $V_O = 0.4$ to $2.4\text{V}$   |      |            | $\pm 1$    | $\mu\text{A}$                  |
| $R_{IN}$        | Receiver input resistance   | $V_{CM} = -7$ to $12\text{V}$  | 12   |            |            | KW                             |
| $I_{CC}$        | No load supply current ( <a href="#">Note 2</a> )   | $V_{RE} = 0\text{V}$ or $V_{CC}$<br>$V_{DE} = V_{CC}$<br>$V_{DE} = 0\text{V}$  |      | 400<br>300 | 900<br>500 | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{OSD1}$      | Driver short-circuit current, $V_O = \text{High}$   | $V_O = -7$ to $12\text{V}$ ( <a href="#">Note 3</a> )  | 35   |            | 250        | mA                             |

**Table 6. DC electrical characteristics (continued)**

( $V_{CC} = 5\text{ V} \pm 5\%$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise specified. Typical values are referred to  $T_A = 25\text{ }^{\circ}\text{C}$ ) (See [Note 1](#))

| Symbol     | Parameter   | Test conditions   | Min. | Typ. | Max. | Unit |
|------------|---|---|------|------|------|------|
| $I_{OSD2}$ | Driver short-circuit current,<br>$V_O = \text{Low}$ | $V_O = -7\text{ to }12\text{ V}$ ( <a href="#">Note 3</a> ) | 35   |      | 250  | mA   |
| $I_{OSR}$  | Receiver short-circuit current                      | $V_O = 0\text{ V to }V_{CC}$                                | 7    |      | 95   | mA   |

- 1 All currents into device pins are positive; all cuts out of device pins are negative; all voltages are referenced to device ground unless specified.
- 2 Supply current specification is valid for loaded transmitters when  $V_{DE} = 0\text{ V}$
- 3 Applies to peak current. See typical operating characteristics.

**Table 7. Driver switching characteristics**

( $V_{CC} = 5\text{ V} \pm 5\%$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise specified. Typical values are referred to  $T_A = 25\text{ }^{\circ}\text{C}$ ) (See [Note 1](#))

| Symbol                 | Parameter                         | Test Conditions   | Min. | Typ. | Max. | Unit |
|------------------------|-----------------------------------|---|------|------|------|------|
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay input to output | $R_{DIFF} = 54\Omega$ , $C_{L1} = C_{L2} = 100\text{ pF}$<br>(See <a href="#">Figure 4</a> and <a href="#">Figure 6</a> ) | 10   | 30   | 60   | ns   |
| $t_{SK}$               | Output skew to output             | $R_{DIFF} = 54\Omega$ , $C_{L1} = C_{L2} = 100\text{ pF}$<br>(See <a href="#">Figure 4</a> and <a href="#">Figure 6</a> ) |      | 5    | 10   | ns   |
| $t_{TLH}$<br>$t_{THL}$ | Rise or fall time                 | $R_{DIFF} = 54\Omega$ , $C_{L1} = C_{L2} = 100\text{ pF}$<br>(See <a href="#">Figure 4</a> and <a href="#">Figure 6</a> ) | 3    | 15   | 40   | ns   |
| $t_{PZH}$              | Output enable time                | $C_L = 100\text{ pF}$ , $S2 = \text{Closed}$<br>(See <a href="#">Figure 5</a> and <a href="#">Figure 7</a> )              |      | 40   | 70   | ns   |
| $t_{PZL}$              | Output enable time                | $C_L = 100\text{ pF}$ , $S1 = \text{Closed}$<br>(See <a href="#">Figure 5</a> and <a href="#">Figure 7</a> )              |      | 40   | 70   | ns   |
| $t_{PLZ}$              | Output disable time               | $C_L = 15\text{ pF}$ , $S1 = \text{Closed}$<br>(See <a href="#">Figure 5</a> and <a href="#">Figure 7</a> )               |      | 40   | 70   | ns   |
| $t_{PHZ}$              | Output disable time               | $C_L = 15\text{ pF}$ , $S2 = \text{Closed}$<br>(See <a href="#">Figure 5</a> and <a href="#">Figure 7</a> )               |      | 40   | 70   | ns   |

Note: 1 All currents into device pins are positive; all cuts out of device pins are negative; all voltages are referenced to device ground unless specified.

**Table 8. Receiver switching characteristics**

( $V_{CC} = 5V \pm 5\%$ ,  $T_A = T_{MIN}$  to  $T_{MAX}$ , unless otherwise specified. Typical values are referred to  $T_A = 25^\circ C$ ) (See Note 1)

| Symbol                 | Parameter                         | Test Conditions   | Min. | Typ. | Max. | Unit |
|------------------------|-----------------------------------|---|------|------|------|------|
| $t_{PLH}$<br>$t_{PHL}$ | Propagation delay input to output | $R_{DIFF} = 54\Omega$ , $C_{L1} = C_{L2} = 100pF$<br>(See <a href="#">Figure 4</a> and <a href="#">Figure 8</a> ) | 20   | 130  | 210  | ns   |
| $t_{SKD}$              | Differential receiver skew        | $R_{DIFF} = 54\Omega$ , $C_{L1} = C_{L2} = 100pF$<br>(See <a href="#">Figure 4</a> and <a href="#">Figure 8</a> ) |      | 13   |      | ns   |
| $t_{PZH}$              | Output enable time                | $C_{RL} = 15pF$ , S1 = Closed<br>(See <a href="#">Figure 3</a> and <a href="#">Figure 9</a> )                     |      | 20   | 50   | ns   |
| $t_{PZL}$              | Output enable time                | $C_{RL} = 15pF$ , S2 = Closed<br>(See <a href="#">Figure 3</a> and <a href="#">Figure 9</a> )                     |      | 20   | 50   | ns   |
| $t_{PLZ}$              | Output disable time               | $C_{RL} = 15pF$ , S1 = Closed<br>(See <a href="#">Figure 3</a> and <a href="#">Figure 9</a> )                     |      | 20   | 50   | ns   |
| $t_{PHZ}$              | Output disable time               | $C_{RL} = 15pF$ , S2 = Closed<br>(See <a href="#">Figure 3</a> and <a href="#">Figure 9</a> )                     |      | 20   | 50   | ns   |
| $f_{MAX}$              | Maximum data rate                 |   | 2.5  |      |      | Mbps |

**Note:** All currents into device pins are positive; all cuts out of device pins are negative; all voltages are referenced to device ground unless specified.



## 5 Test circuits and typical characteristics

Figure 2. Driver DC test load

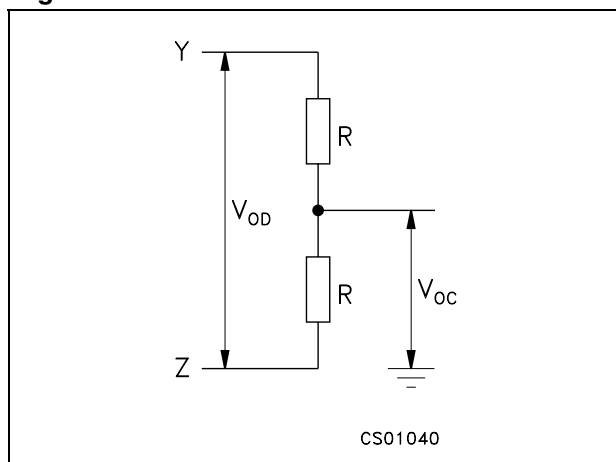


Figure 3. Receiver timing test load

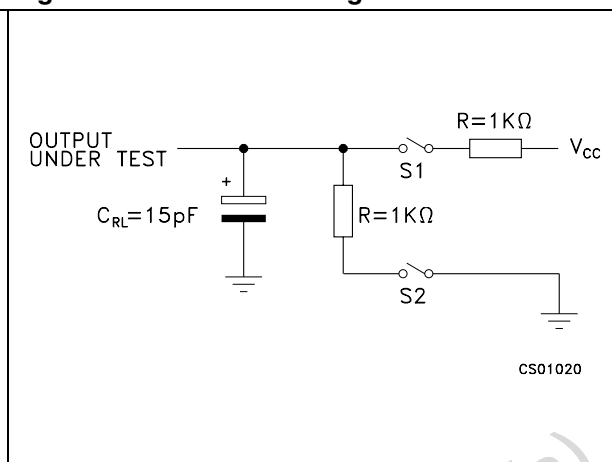


Figure 4. Drive/receiver timing test circuit

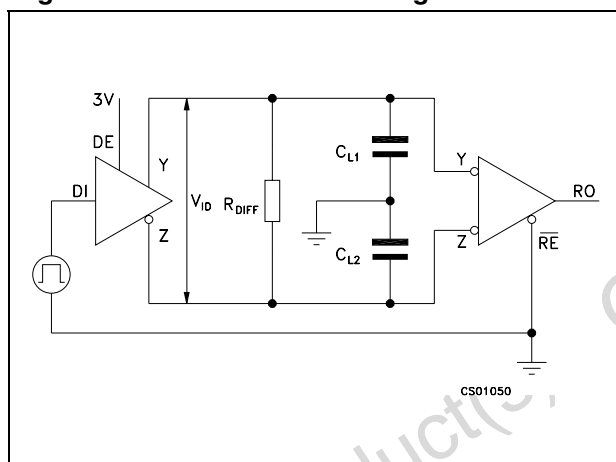
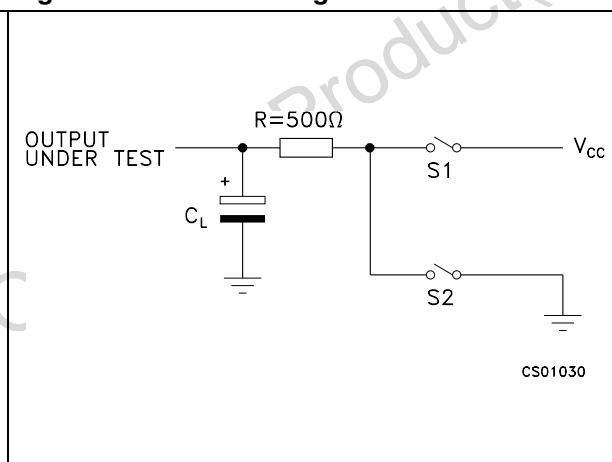


Figure 5. Driver timing test load



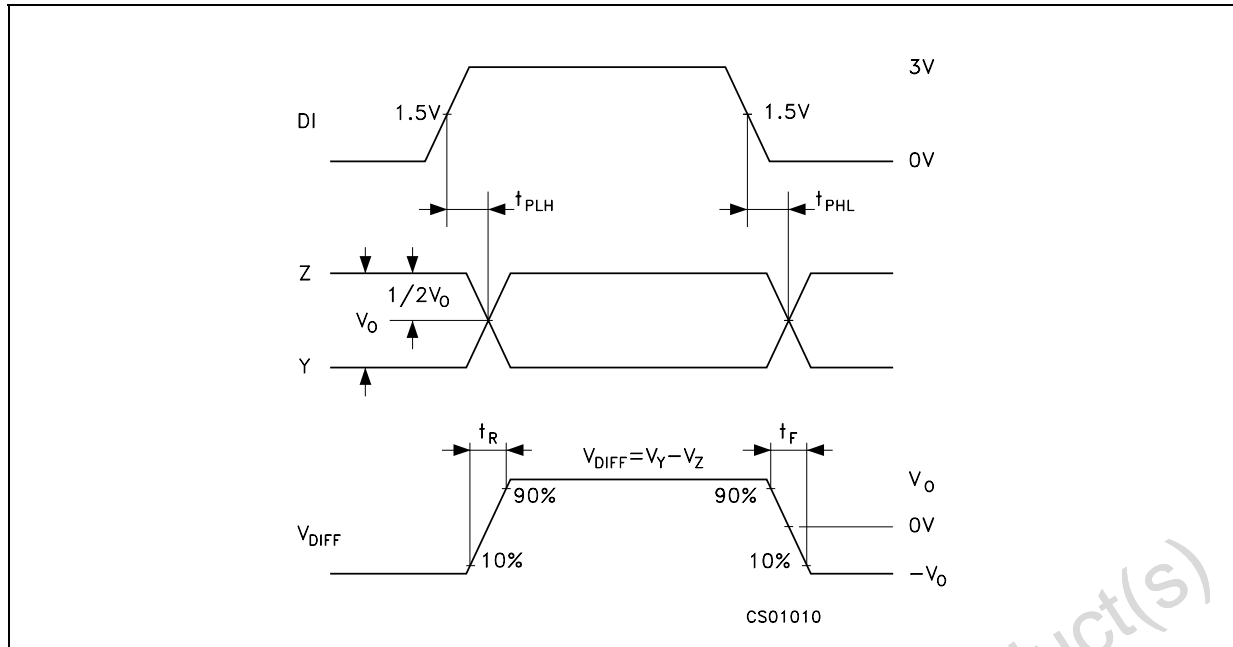
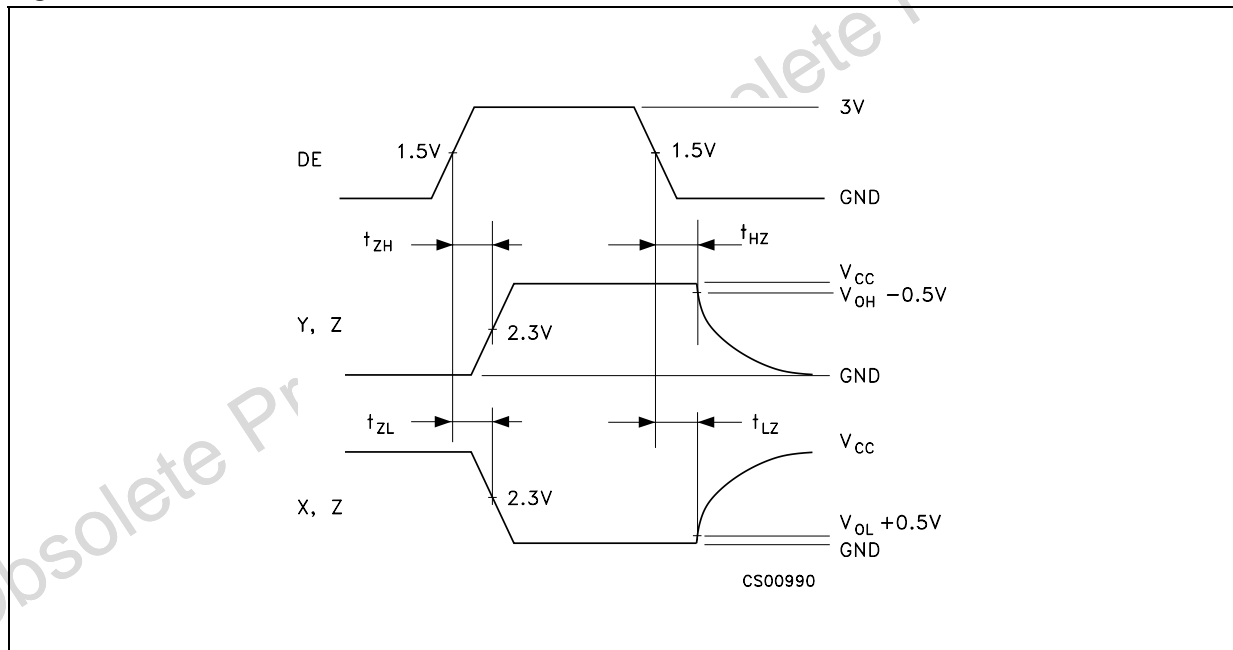
**Figure 6. Driver propagation delay****Figure 7. Driver enable and disable time**

Figure 8. Receiver propagation delay

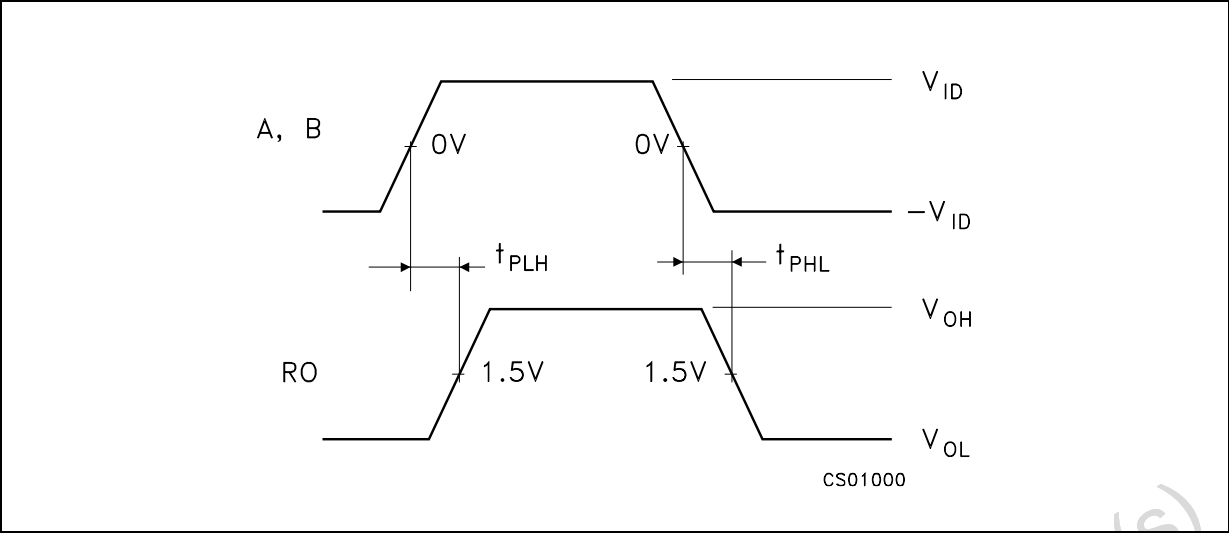
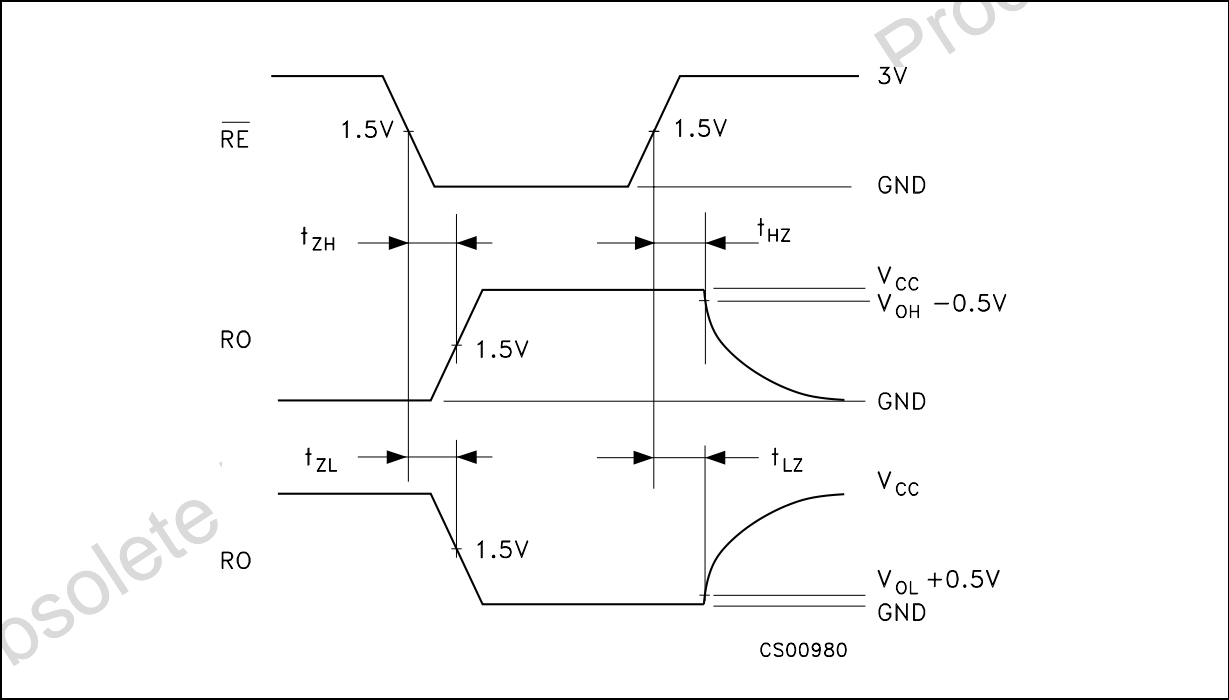


Figure 9. Receiver enable and disable time



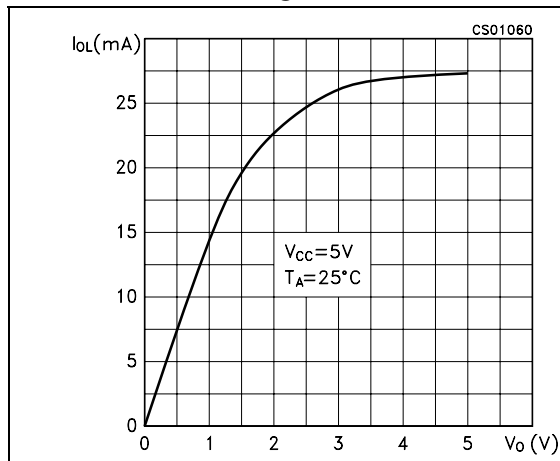
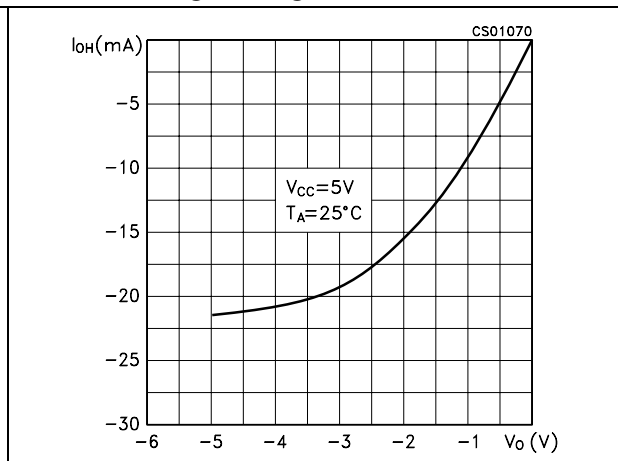
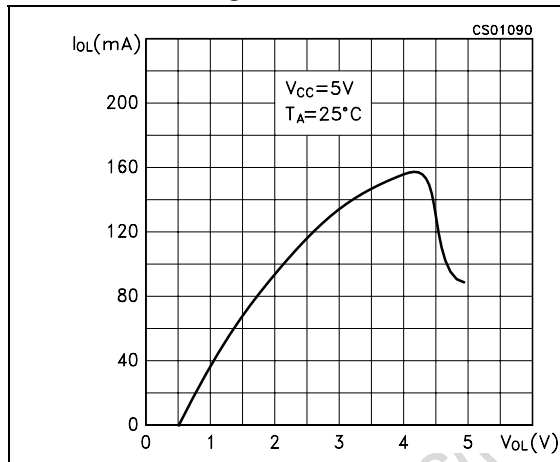
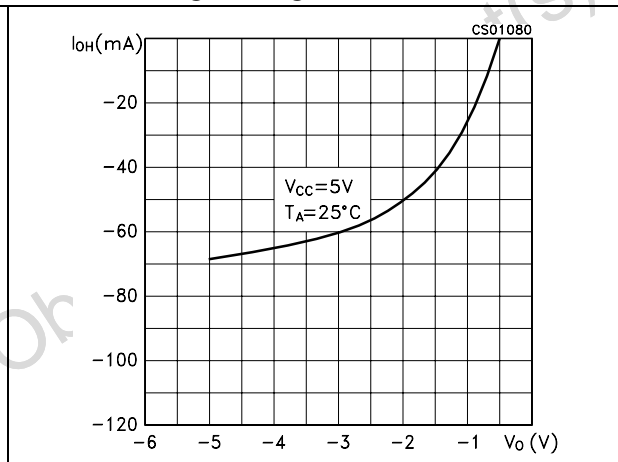
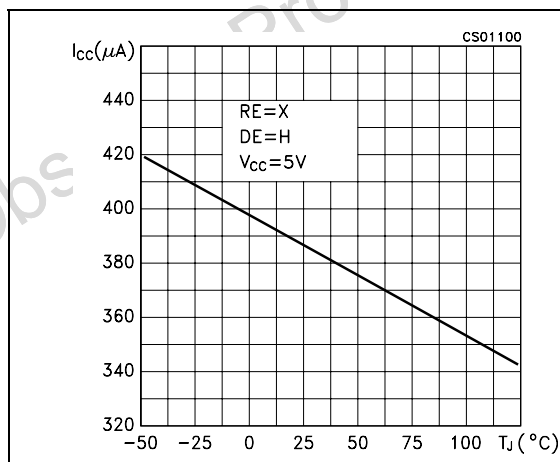
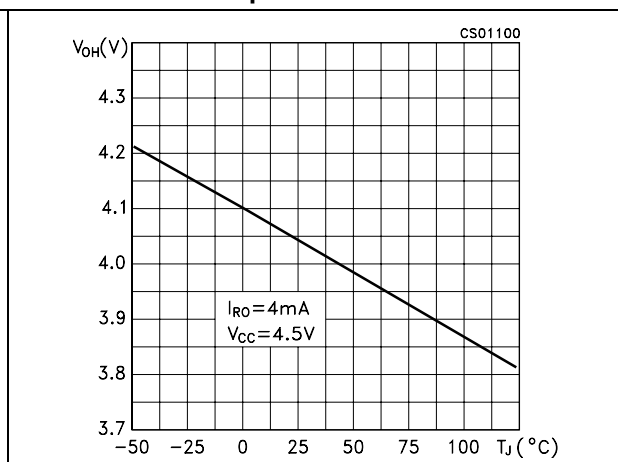
**Figure 10. Receiver output current vs output low voltage****Figure 11. Receiver output current vs output high voltage****Figure 12. Driver output current vs output low voltage****Figure 13. Driver output current vs output high voltage****Figure 14. Supply current vs temperature****Figure 15. Receiver high level output voltage vs temperature**

Figure 16. Receiver low level output voltage vs temperature

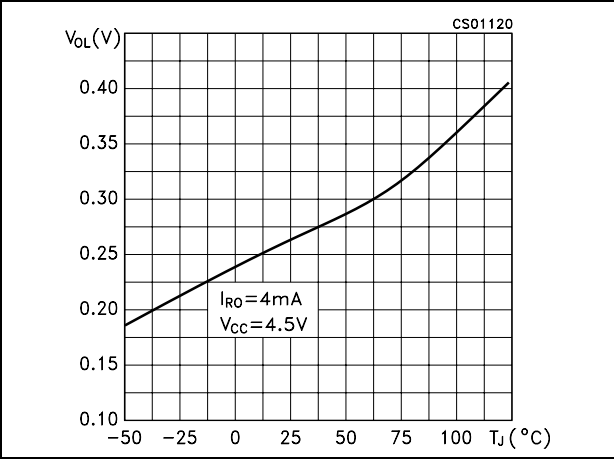
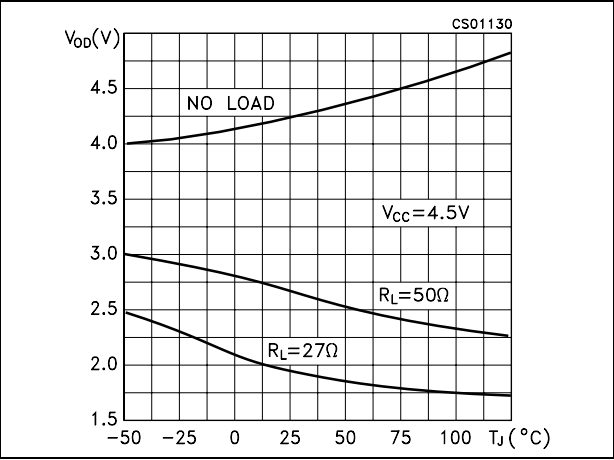


Figure 17. Differential driver output voltage vs temperature



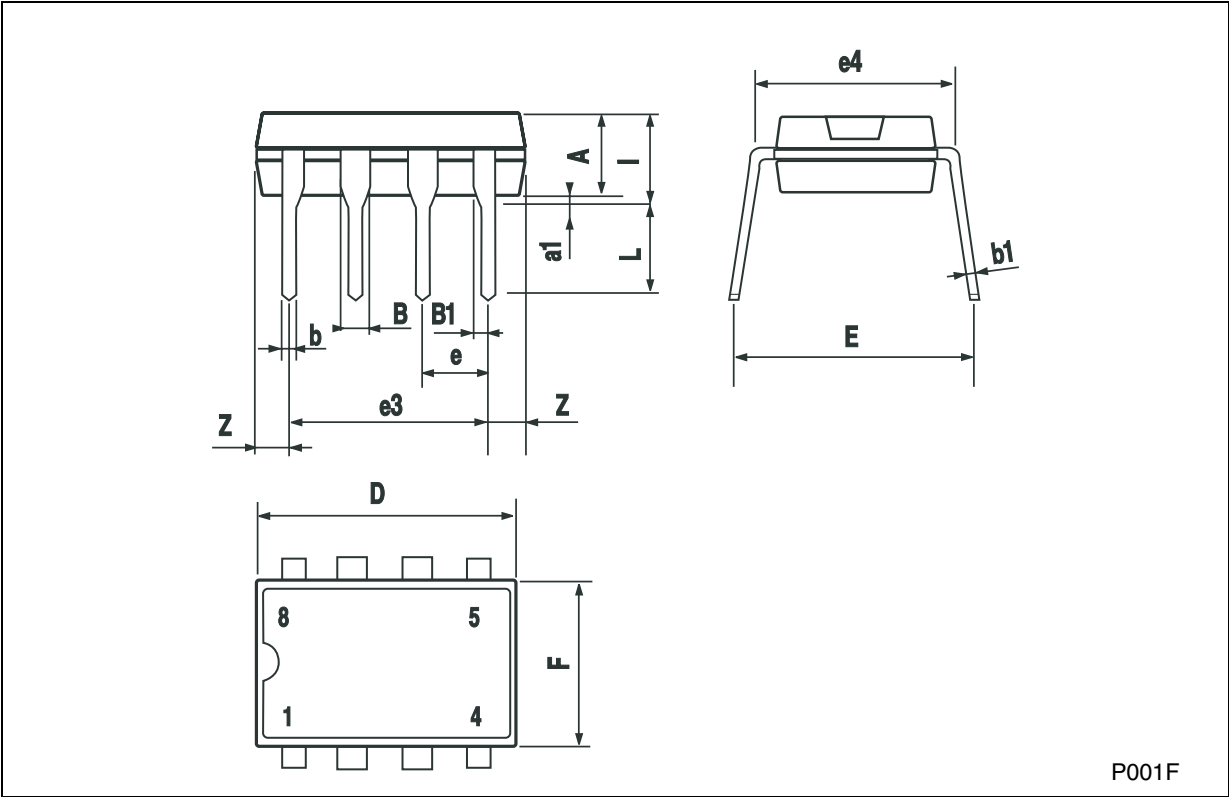
## 6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

Obsolete Product(s) - Obsolete Product(s)

Plastic DIP-8 MECHANICAL DATA

| DIM. | mm.  |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP  | MAX. | MIN.  | TYP.  | MAX.  |
| A    |      | 3.3  |      |       | 0.130 |       |
| a1   | 0.7  |      |      | 0.028 |       |       |
| B    | 1.39 |      | 1.65 | 0.055 |       | 0.065 |
| B1   | 0.91 |      | 1.04 | 0.036 |       | 0.041 |
| b    |      | 0.5  |      |       | 0.020 |       |
| b1   | 0.38 |      | 0.5  | 0.015 |       | 0.020 |
| D    |      |      | 9.8  |       |       | 0.386 |
| E    |      | 8.8  |      |       | 0.346 |       |
| e    |      | 2.54 |      |       | 0.100 |       |
| e3   |      | 7.62 |      |       | 0.300 |       |
| e4   |      | 7.62 |      |       | 0.300 |       |
| F    |      |      | 7.1  |       |       | 0.280 |
| I    |      |      | 4.8  |       |       | 0.189 |
| L    |      | 3.3  |      |       | 0.130 |       |
| Z    | 0.44 |      | 1.6  | 0.017 |       | 0.063 |



## 7 Revision history

**Table 9.** Document revision history

| Date        | Revision | Changes                         |
|-------------|----------|---------------------------------|
| 04-May-2006 | 3        | Order codes updated.            |
| 07-Nov-2007 | 4        | Added <a href="#">Table 1</a> . |

Obsolete Product(s) - Obsolete Product(s)



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