

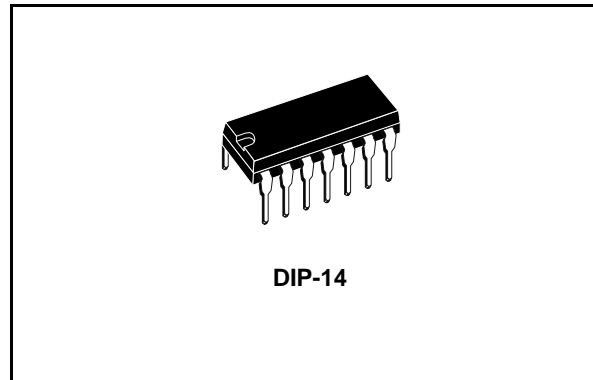


ST491A

Low power high speed
RS-485/RS-422 transceiver

General features

- Low supply current: 5mA max
- Designed for RS485 interface applications
- -7V to 12V common mode input voltage range
- 70mV typical input hysteresis
- Designed for 25Mbps operation
- Operate from a single 5V supply
- ± 4 kV ESD protection
- Current limiting and thermal shutdown for driver overload protection



Description

The ST491A is a low power transceiver for RS-485 and RS-422 communications. The device contains one driver and one receiver in full duplex configuration. The ST491A draws 5mA (typ.) of supply current when unloaded and operates from a single 5V supply.

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

Order code

| Part number | Temperature range | Package | Packaging |
|-------------|-------------------|---------|-----------------------------------|
| ST491ACN | 0 to 70 °C | DIP-14 | 25parts per tube / 40tube per box |
| ST491ABN | -40 to 85 °C | DIP-14 | 25parts per tube / 40tube per box |

Contents

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1 Pin configuration

Figure 1. Pin connections

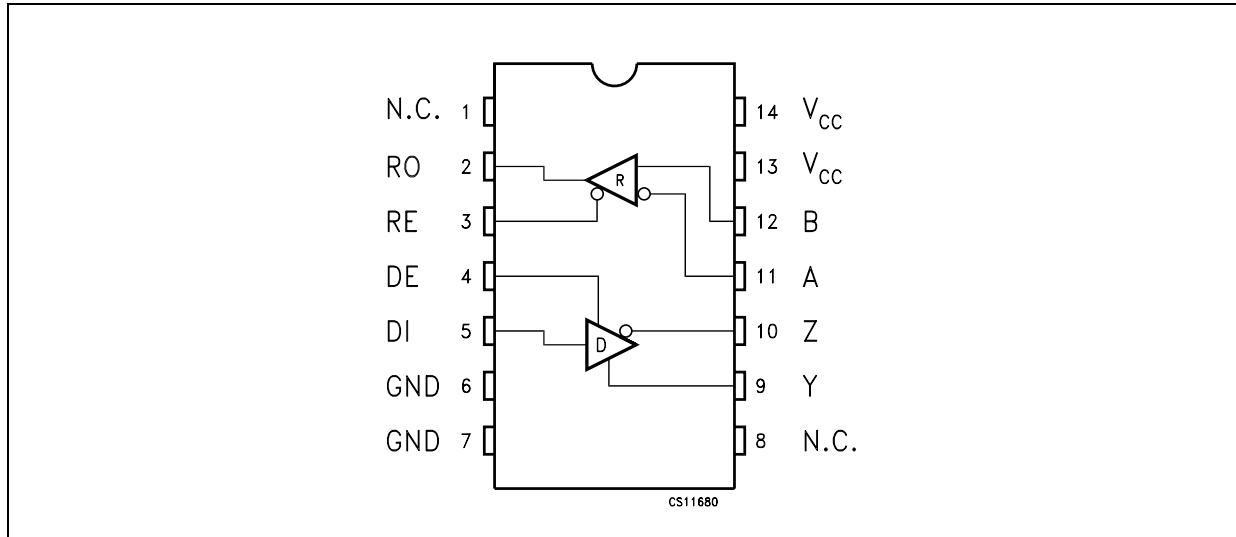


Table 1. Pin description

| Pin n° | Symbol | Name and function |
|--------|-----------------|------------------------------|
| 1 | NC | Not connected |
| 2 | RO | Receiver output. |
| 3 | RE | Receiver output enable |
| 4 | DE | Driver output enable |
| 5 | DI | Inverting driver input |
| 6 | GND | Ground |
| 7 | GND | Ground |
| 8 | NC | Not connected |
| 9 | Y | Non-inverting driver output |
| 10 | Z | Inverting driver output |
| 11 | A | Inverting receiver input |
| 12 | B | Non-inverting receiver input |
| 13 | V _{CC} | Supply voltage |
| 14 | V _{CC} | Supply voltage |

2 Truth tables

Table 2. Truth table (driver)

| Inputs | | Outputs | |
|--------|----|---------|---|
| DI | DE | Y | Z |
| L | H | L | H |
| H | H | H | L |
| X | L | Z | Z |

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

Table 3. Truth table (receiver)

| Inputs | | Outputs |
|---------------------------|----|---------|
| A-B | RE | RO |
| $\geq -0.2V$ | L | H |
| between $-0.2V$ to $0.2V$ | L | ? |
| $\leq -0.2V$ | L | L |
| OPEN | L | H |
| X | H | Z |

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

3 Maximum ratings

Table 4. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|------------|-------------------------|----------------------------|------|
| V_{CC} | Supply voltage | 7 | V |
| V_{DI} | Driver input voltage | -0.5 to 7 | V |
| V_Y, V_Z | Driver output voltage | -7.5 to 12.5 | V |
| V_A, V_B | Receiver input voltage | -7.5 to 12.5 | V |
| V_{RO} | Receiver output voltage | -0.3 to ($V_{CC} + 0.3$) | V |
| ESD | Human body model | 3.5 | KV |

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 5. Electrical characteristics

($V_{CC} = 4.5V$ to $5.5V$, $T_A = -40$ to $85^\circ C$, unless otherwise specified. Typical values are referred to $T_A=25^\circ C$)

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|--------------|---------------------------|------|------|------|------|
| I_{SUPPLY} | No load supply current | | 2 | 5 | mA |
| C_{IN} | Input capacitance | | 1.8 | | pF |
| C_{YZ} | Driver output capacitance | | 1.2 | | pF |
| C_{OUT} | Output capacitance | | 2.3 | | pF |

Table 6. Transmitter electrical characteristics

($V_{CC} = 4.5V$ to $5.5V$, $T_A = -40$ to $85^\circ C$, unless otherwise specified. Typical values are referred to $T_A=25^\circ C$)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|---|--|----------|------|-----------|---------|
| V_{OD1} | Differential drive output (no load) | | | | V_{CC} | V |
| V_{OD2} | Differential drive output (with load) | $R_L = 54\Omega$ (RS-422) (<i>Figure 1.</i>) | 1.5 | 2.6 | 5 | V |
| V_{OD3} | Differential drive output (with load) | $R_L = 100\Omega$ (RS-422) (<i>Figure 1.</i>) | 2 | 3 | | V |
| ΔV_{OD} | Change in magnitude of driver differential output voltage for complementary output states | $R_L = 54\Omega$ or 100Ω (<i>Figure 1.</i>) | | 0 | 0.2 | V |
| V_{OC} | Driver common mode output voltage | $R_L = 54\Omega$ (<i>Figure 1.</i>) | 1 | | 3 | V |
| ΔV_{OC} | Change in magnitude of driver common mode output voltage | $R_L = 54\Omega$ (<i>Figure 1.</i>) | | 0 | 0.2 | V |
| I_{OFF} | Power off output current | $V_{CC} = 0V$, $V_O = -7V$ to $12V$ | | | ± 100 | μA |
| I_{OSD} | Driver short circuit output current | $V_O = -7V$ to $12V$ | ± 35 | | ± 250 | mA |
| V_{IL} | Input logic threshold low | | | | 0.8 | V |
| V_{IH} | Input logic threshold high | | 2 | | | V |

Table 7. Receiver electrical characteristics

($V_{CC} = 4.5V$ to $5.5V$, $T_A = -40$ to $85^\circ C$, unless otherwise specified. Typical values are referred to $T_A=25^\circ C$)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit | |
|-----------------|---|---|--------------|------|-------|------------|----|
| I_{IN} | Input current (A, B) | Other input = 0V $V_{CC} = 0$ or $5.25V$ | $V_{IN}=12V$ | | 0.5 | 1 | mA |
| | | | $V_{IN}=-7V$ | | -0.35 | -0.8 | |
| V_{TH} | Receiver differential threshold voltage | $V_{CM} = -7V$ to $12V$ | -0.2 | | 0.2 | V | |
| ΔV_{TH} | Receiver input hysteresis | $V_{CM} = 0V$ | | 70 | | mV | |
| V_{OH} | Receiver output high voltage | $I_{OUT} = -8mA$, $V_{ID} = 200mV$ | 3.5 | 4.7 | | V | |
| V_{OL} | Receiver output low voltage | $I_{OUT} = 8mA$, $V_{ID} = -200mV$ | | 0.3 | 0.5 | V | |
| R_{RIN} | Receiver input resistance | $V_{CM} = -7V$ to $12V$ | 12 | 24 | | K Ω | |

Table 8. Driver switching characteristics

($V_{CC} = 4.5V$ to $5.5V$, $T_A = -40$ to $85^\circ C$, unless otherwise specified. Typical values are referred to $T_A=25^\circ C$)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|------------------------|-----------------------------------|---|------|------|------|------|
| D_R | Maximum data rate | Jitter <5% | 25 | 50 | | Mbps |
| t_{PLH} t_{PHL} | Propagation delay input to output | $R_L = 54\Omega$, $C_{L1}=C_{L2}=50pF$, (Figure 1.) | | 10 | 16 | ns |
| t_{SKEW} | Differential output delay skew | $R_L = 54\Omega$, $C_{L1}=C_{L2}=50pF$, (Figure 1.) | | 1 | 3 | ns |
| t_{TLH} t_{THL} | Rise or fall differential time | $R_L = 54\Omega$, $C_{L1}=C_{L2}=50pF$, (Figure 1.) | | 8 | 12 | ns |
| t_{PZL} | Output enable time | $C_L = 50pF$, S1 Closed | | 14 | 25 | ns |
| t_{PZH} | Output enable time | $C_L = 50pF$, S2 Closed | | 14 | 25 | ns |
| t_{PHZ} | Output disable time | $C_L = 15pF$, S2 Closed | | 10 | 25 | ns |
| t_{PLZ} | Output disable time | $C_L = 15pF$, S1 Closed | | 16 | 25 | ns |

Table 9. Receiver switching characteristics

($V_{CC} = 4.5V$ to $5.5V$, $T_A = -40$ to $85^\circ C$, unless otherwise specified. Typical values are referred to $T_A=25^\circ C$)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|------------------------|--|---------------------------------------|------|------|------|------|
| t_{PLH} t_{PHL} | Propagation delay input to output | $C_L = 15pF$, (Figure 2., Figure 4.) | | 19 | 30 | ns |
| t_{SKD} | $ t_{PLH} - t_{PHL} $ Receiver output skew | $C_L = 15pF$, (Figure 2., Figure 4.) | | 1 | 3 | ns |
| t_{TLH} t_{THL} | Rise or fall time | $C_L = 15pF$, (Figure 2., Figure 4.) | | 6 | | ns |
| t_{PZL} | Output enable time | $C_{RL} = 15pF$, S1 Closed | | 6 | 12 | ns |
| t_{PZH} | Output enable time | $C_{RL} = 15pF$, S2 Closed | | 7 | 12 | ns |
| t_{PHZ} | Output disable time | $C_{RL} = 15pF$, S2 Closed | | 6 | 12 | ns |
| t_{PLZ} | Output disable time | $C_{RL} = 15pF$, S1 Closed | | 6 | 12 | ns |

5 Test circuit and typical characteristics

Figure 2. Driver DC test load

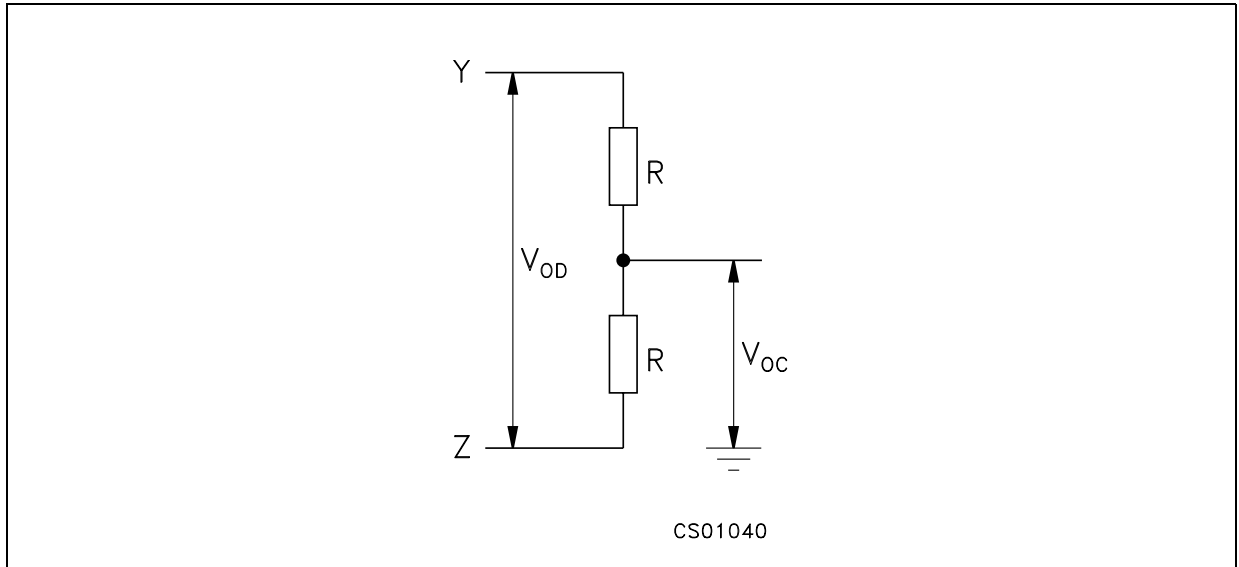


Figure 3. Receiver timing test load

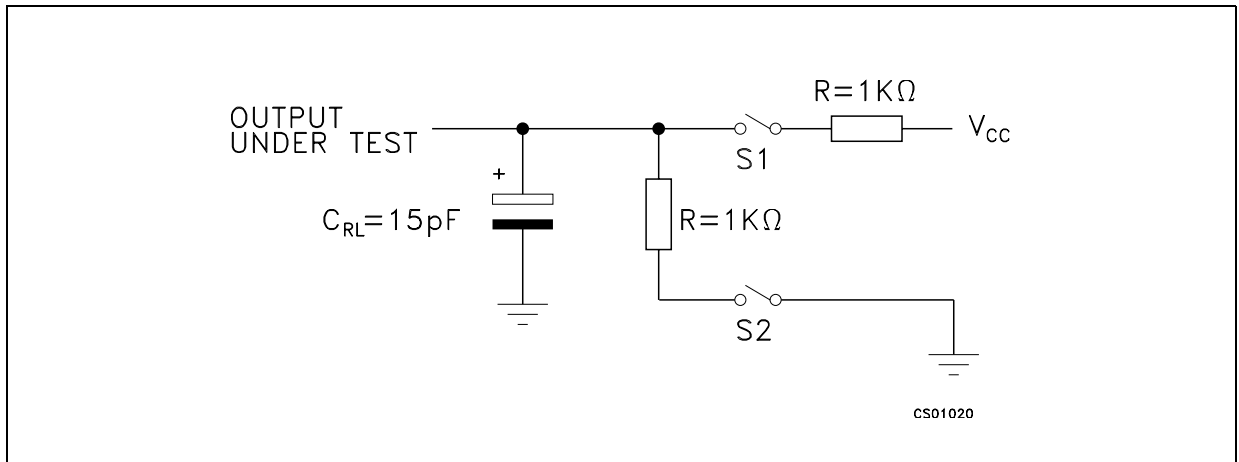


Figure 4. Driver/receiver timing test circuit

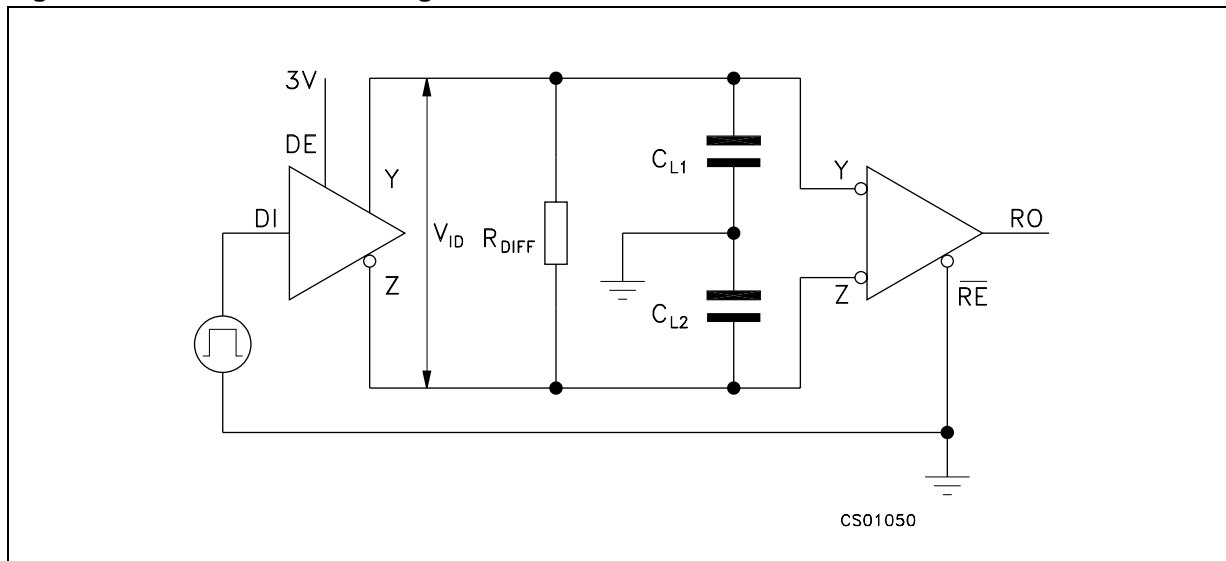


Figure 5. Driver timing test load

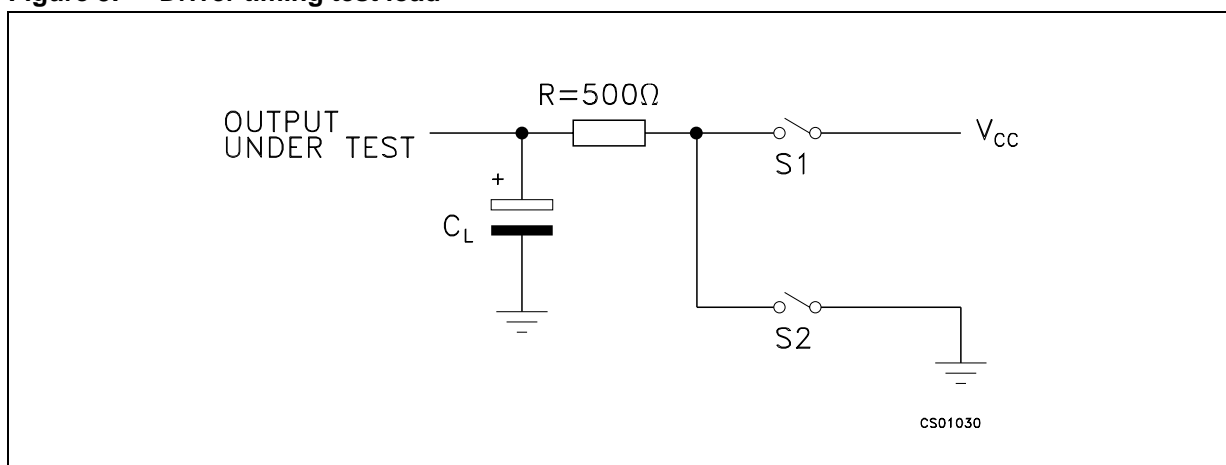


Figure 6. Driver propagation delay

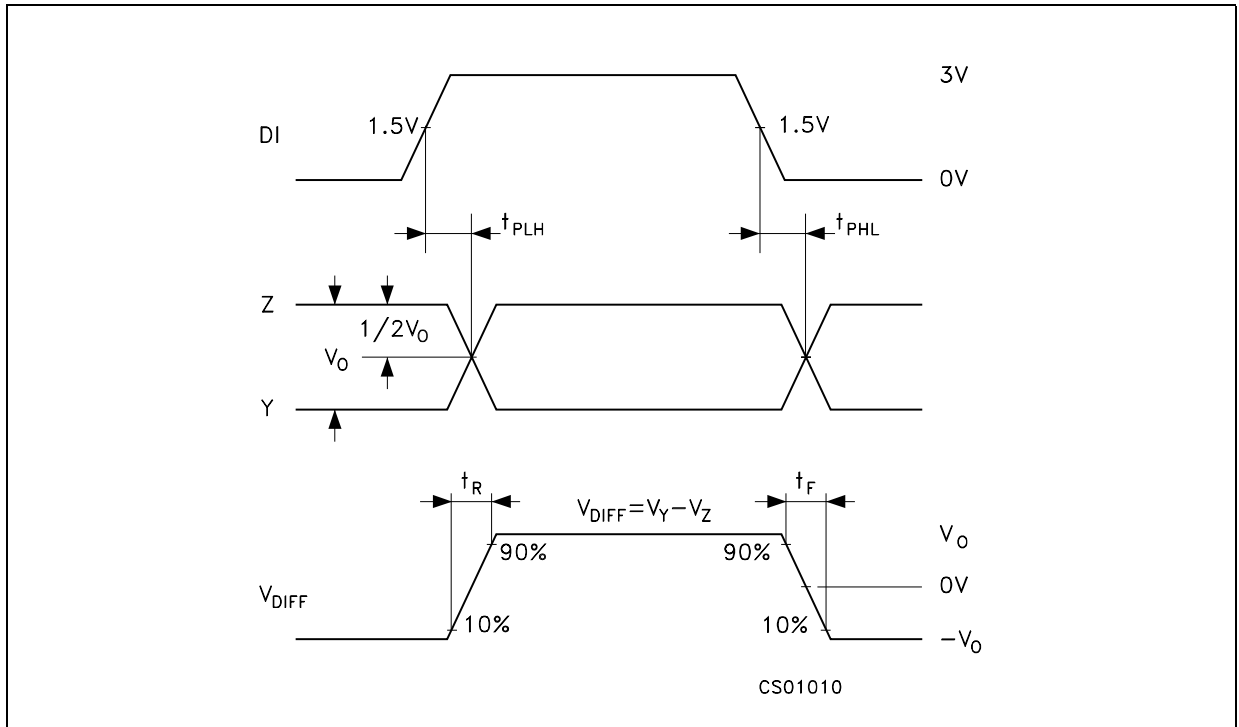


Figure 7. Receiver propagation delay

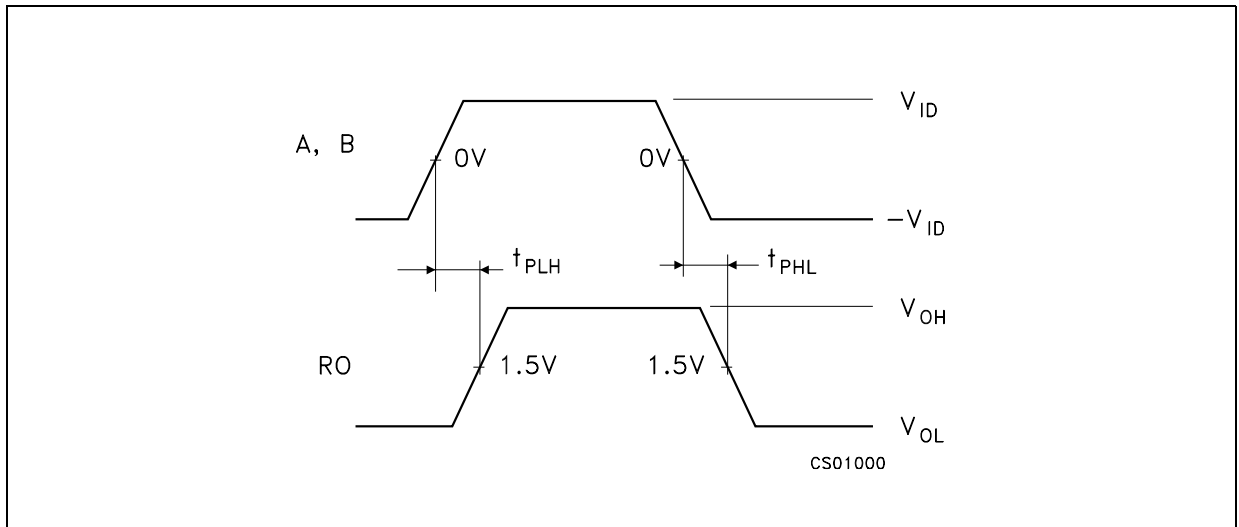


Figure 8. Receiver output current vs. output low voltage (output low)

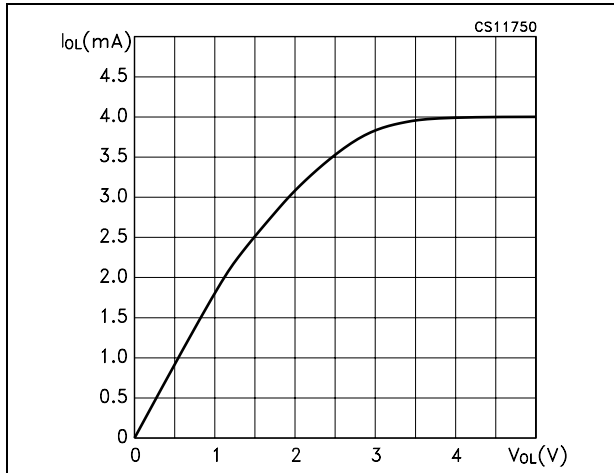


Figure 9. Receiver output current vs. output high voltage (output high)

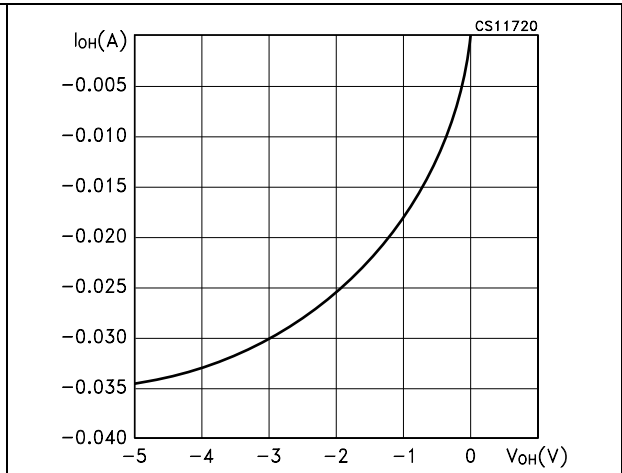


Figure 10. Driver diff. output voltage vs common mode voltage (diff. output low)

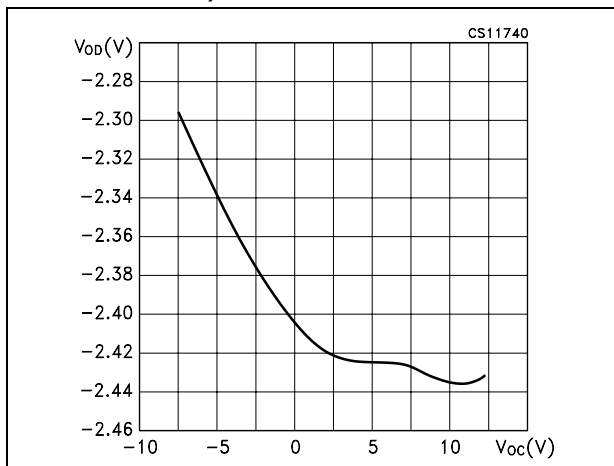


Figure 11. Driver diff. output voltage vs common mode voltage (diff. output high)

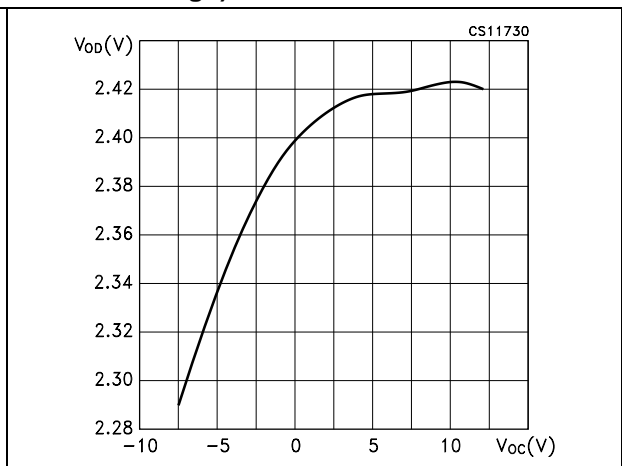


Figure 12. Driver short circuit current vs line voltage (output high)

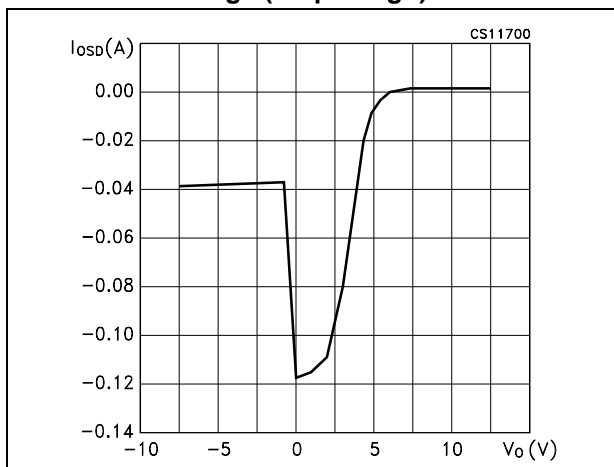


Figure 13. Receiver high level output voltage vs. temperature

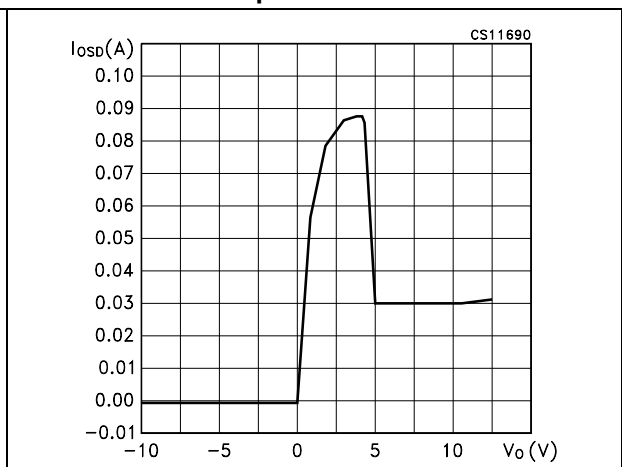
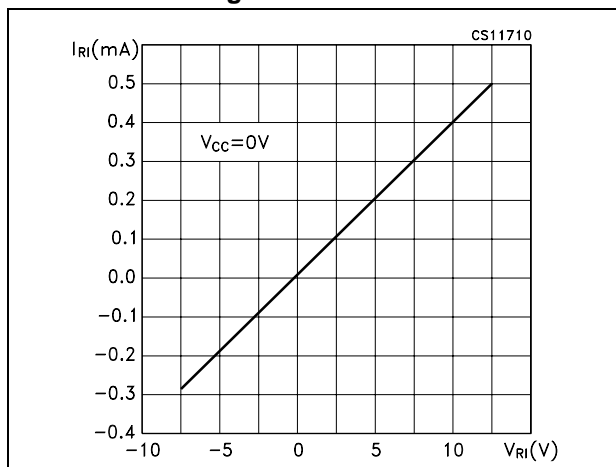


Figure 14. Receiver input current vs input voltage

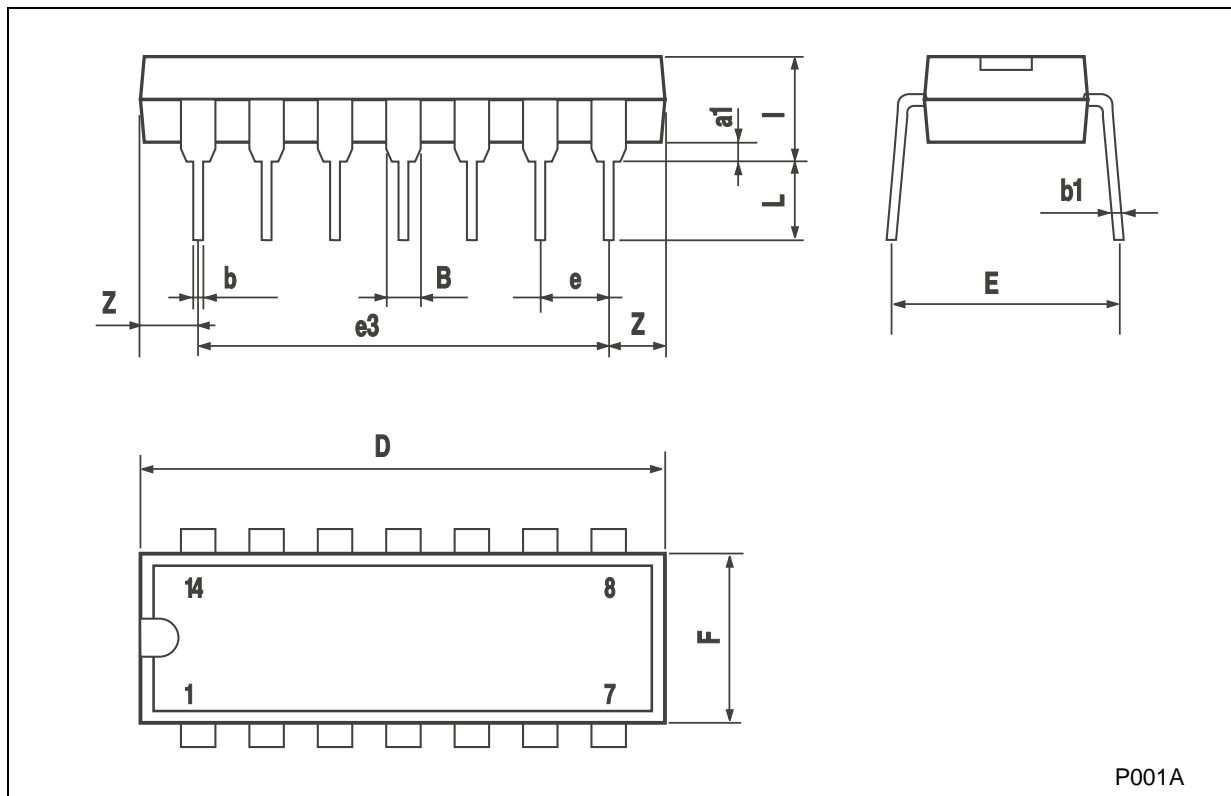


6 Package mechanical data

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

Plastic DIP-14 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 15.24 | | | 0.600 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | 1.27 | | 2.54 | 0.050 | | 0.100 |



7 Revision history

Table 10. Revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 10-May-2005 | 3 | Mistake on Figure 1. |
| 04-Jul-2005 | 4 | Mistake on Figure 1 and Table 1 (Pin 13). |
| 28-Apr-2006 | 5 | Order codes has been updated and new template. |

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