

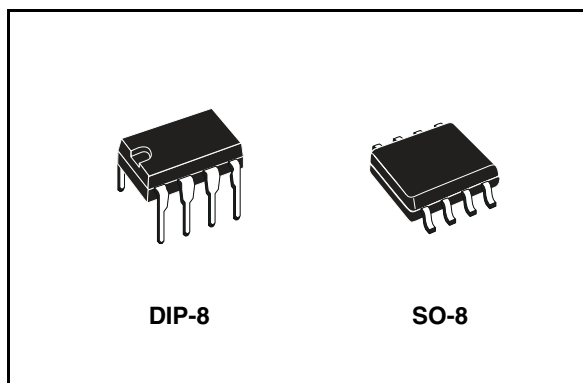


ST490AB

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

Features

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



Description

The ST490A 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 ST490A draws 5 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 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.

Table 1. Device summary

| Order code | Temperature range | Package | Packaging |
|------------|-------------------|----------------------|-------------------------------------|
| ST490ABN | -40 to 85 °C | DIP-8 | 50 parts per tube / 40 tube per box |
| ST490ABDR | -40 to 85 °C | SO-8 (tape and reel) | 2500 parts per reel |

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1 Pin configuration

Figure 1. Pin connections

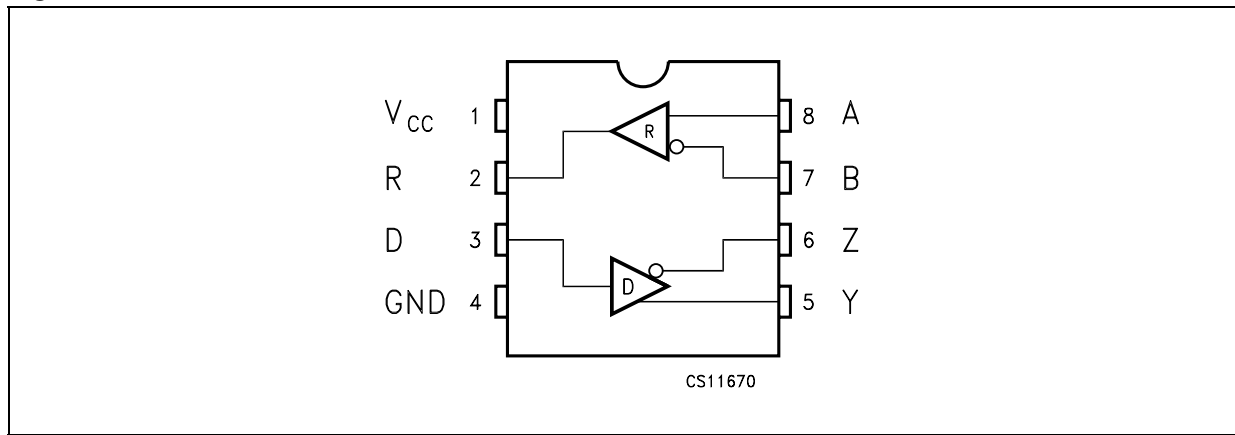


Table 2. Pin description

| Pin n° | Symbol | Name and function |
|--------|----------|------------------------------|
| 1 | V_{CC} | Supply voltage |
| 2 | RO | Receiver output |
| 3 | DI | Driver input |
| 4 | GND | Ground |
| 5 | Y | Non-inverting driver output |
| 6 | Z | Inverting driver output |
| 7 | B | Inverting receiver input |
| 8 | A | Non-inverting receiver input |

2 Truth tables

Table 3. Truth table (driver)

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

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

Table 4. Truth table (receiver)

| Differential inputs | Outputs |
|---------------------------|---------|
| A-B | RO |
| $\geq -0.2V$ | H |
| between $-0.2V$ to $0.2V$ | ? |
| $\leq 0.2V$ | L |
| OPEN | H |

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_{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 6. Electrical characteristics

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

| 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 7. Transmitter electrical characteristics

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

| 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 | $V_{CC} = 0\text{V}$, $V_O = -7\text{V to }12\text{V}$ | | | ± 100 | μA |
| I_{OSD} | Driver short circuit output current | $V_O = -7\text{V to }12\text{V}$ | ± 35 | | ± 250 | mA |
| V_{IL} | Input logic threshold low | | | | 0.8 | V |
| V_{IH} | Input logic threshold high | | 2 | | | V |

Table 8. Receiver electrical characteristics

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

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit | |
|-----------------|---|---|---------------------|------|-----------|---------------|----|
| I_{IN1} | Logic input current | | | | ± 2.0 | μA | |
| I_{IN2} | Input current (A, B) | Other input=0V $V_{CC} = 0\text{ or }5.25\text{V}$ | $V_{IN}=12\text{V}$ | | 0.5 | 1 | mA |
| | | | $V_{IN}=-7\text{V}$ | | -0.35 | -0.8 | mA |
| V_{TH} | Receiver differential threshold voltage | $V_{CM} = -7\text{V to }12\text{V}$ | -0.2 | | 0.2 | V | |
| ΔV_{TH} | Receiver input hysteresis | $V_{CM} = 0\text{V}$ | | 70 | | mV | |
| V_{OH} | Receiver output high voltage | $I_{OUT} = -8\text{mA}$, $V_{ID} = 200\text{mV}$ | 3.5 | 4.7 | | V | |
| V_{OL} | Receiver output low voltage | $I_{OUT} = 8\text{mA}$, $V_{ID} = -200\text{mV}$ | | 0.2 | 0.4 | V | |
| R_{RIN} | Receiver input resistance | $V_{CM} = -7\text{V to }12\text{V}$ | 12 | 24 | | k Ω | |
| I_{OSR} | Receiver short-circuit current | $V_O = 0\text{V to }V_{CC}$ | 7 | | 95 | mA | |

Table 9. Driver switching characteristics

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

| 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 | $R_L = 54\Omega$, $C_{L1}=C_{L2}=50\text{pF}$, (Figure 1) | | 10 | 16 | ns |
| t_{SKEW} | Differential output delay skew | $R_L = 54\Omega$, $C_{L1}=C_{L2}=50\text{pF}$, (Figure 1) | | 1 | 3 | ns |
| t_{TLH} t_{THL} | Rise or fall differential time | $R_L = 54\Omega$, $C_{L1}=C_{L2}=50\text{pF}$, (Figure 1) | | 8 | 12 | ns |

Table 10. Receiver switching characteristics

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

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|------------------------|--|--|------|------|------|------|
| t_{PLH} t_{PHL} | Propagation delay input to output | $C_L = 15\text{pF}$, (Figure 2, Figure 4) | | 19 | 30 | ns |
| t_{SKD} | $ t_{PLH} - t_{PHL} $ Receiver output skew | $C_L = 15\text{pF}$, (Figure 2, Figure 4) | | 1 | 3 | ns |
| t_{TLH} t_{THL} | Rise or fall time | $C_L = 15\text{pF}$, (Figure 2, Figure 4) | | 8 | | ns |

5 Test circuit and typical characteristics

Figure 2. Driver DC test load

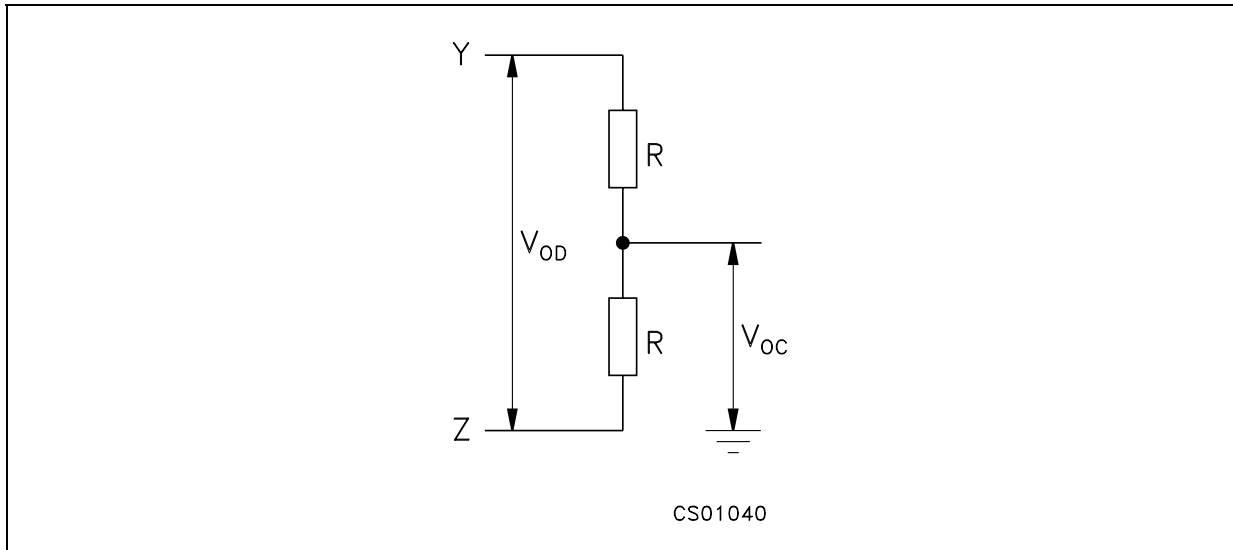


Figure 3. Drive/receiver timing test circuit

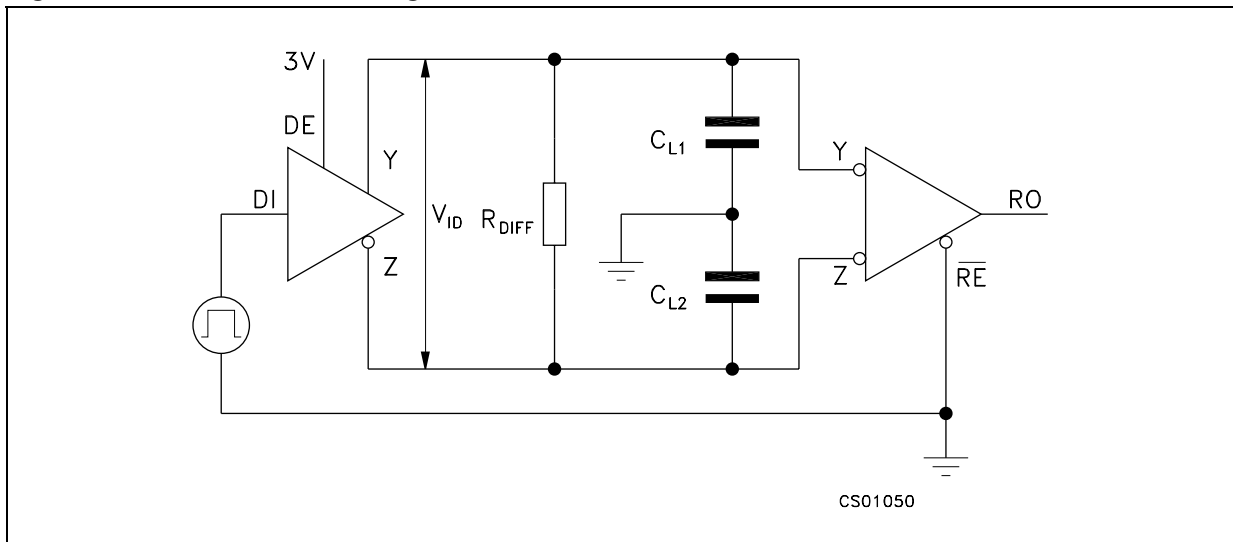


Figure 4. Driver propagation delay

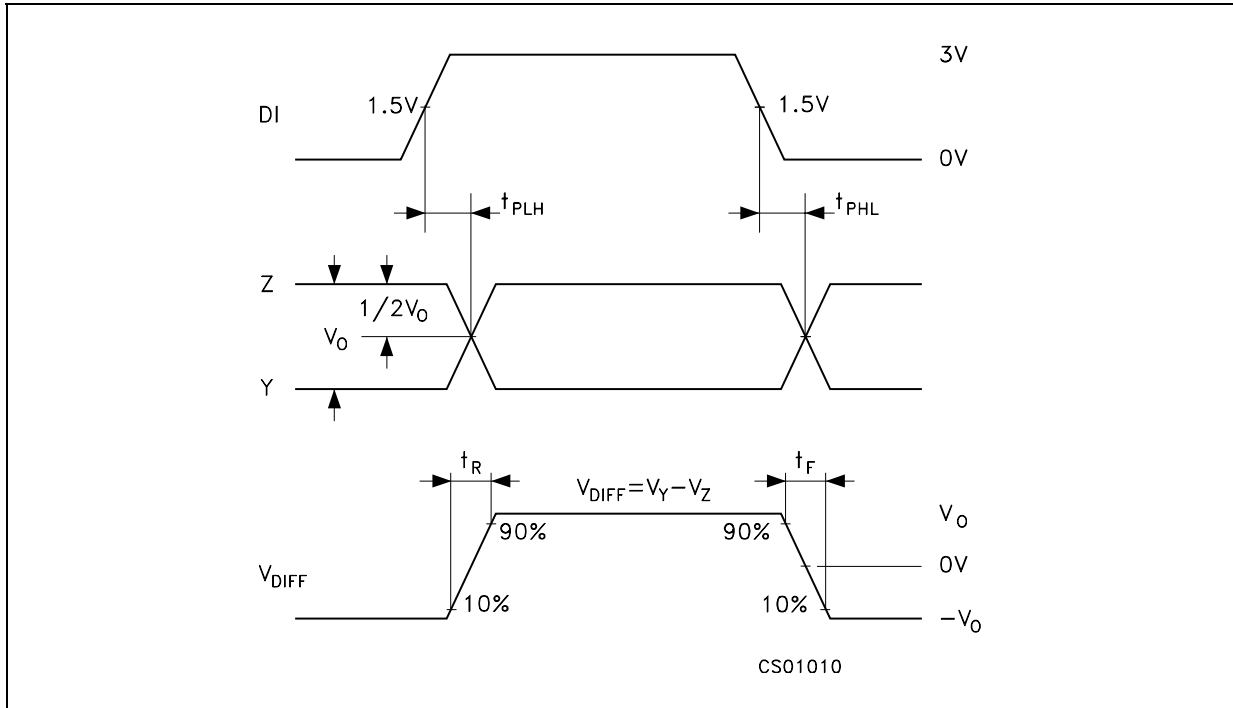


Figure 5. Receiver propagation delay

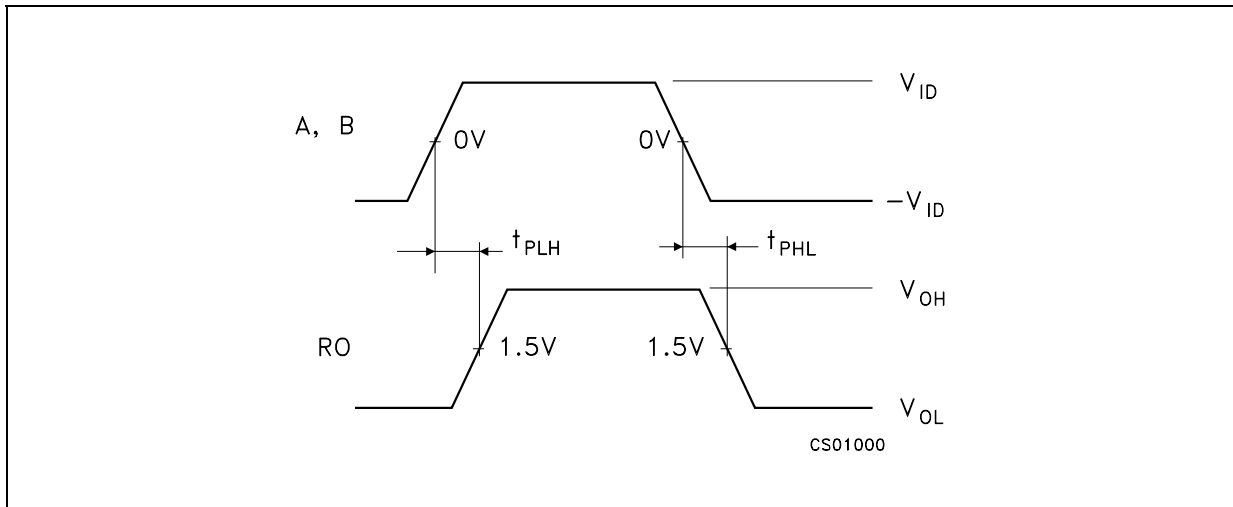


Figure 6. Receiver output current vs. output low voltage (output low)

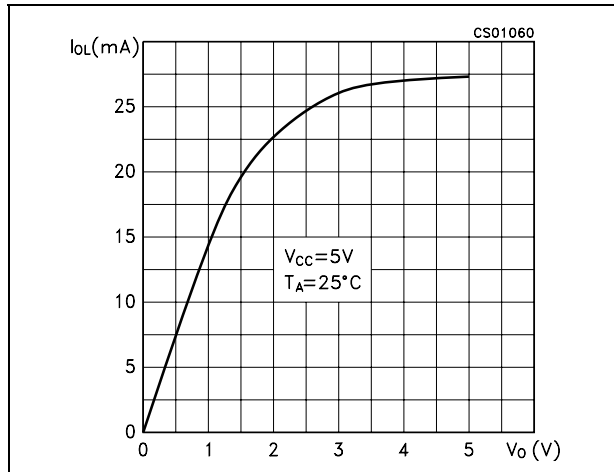


Figure 7. Receiver output current vs. output high voltage (output high)

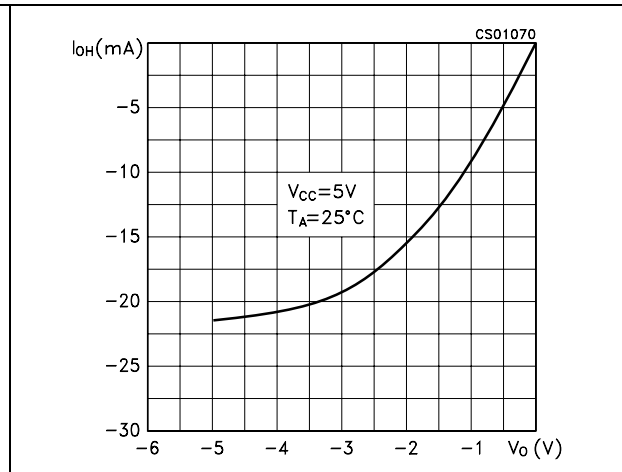


Figure 8. Driver diff. output voltage vs common mode voltage (diff. output low)

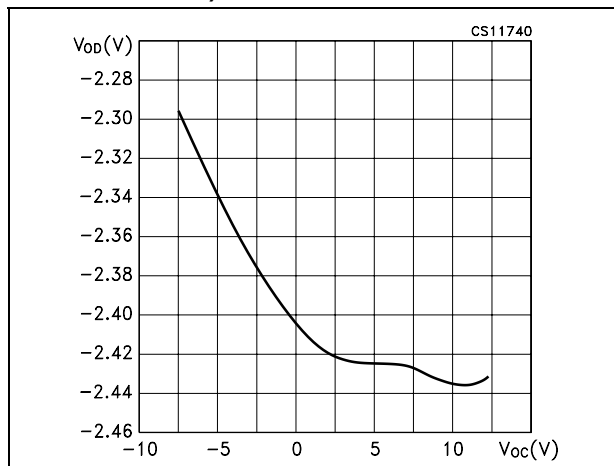


Figure 9. Driver diff. output voltage vs common mode voltage (diff. output high)

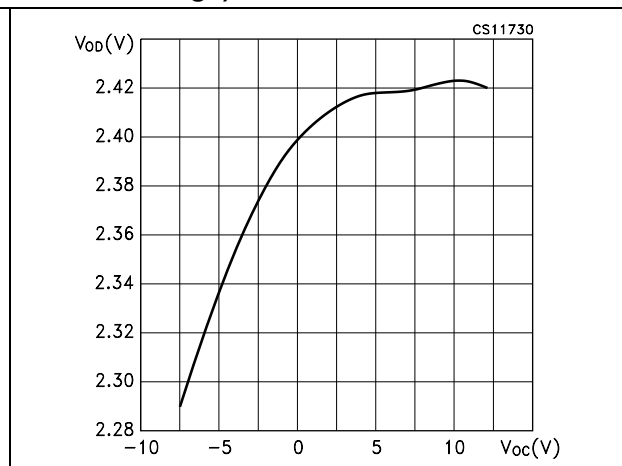


Figure 10. driver short circuit current vs line voltage (output high)

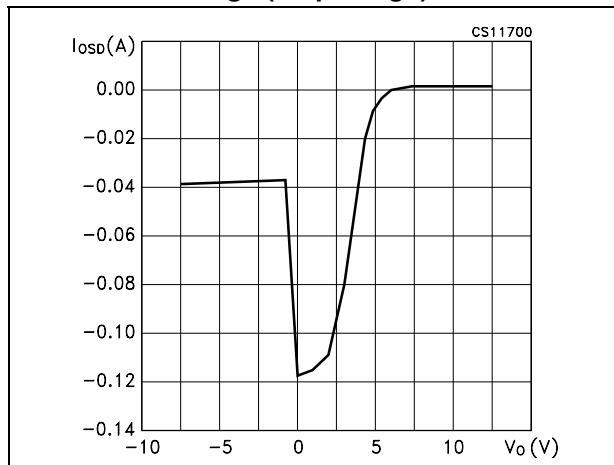


Figure 11. Receiver high level output voltage vs. temperature

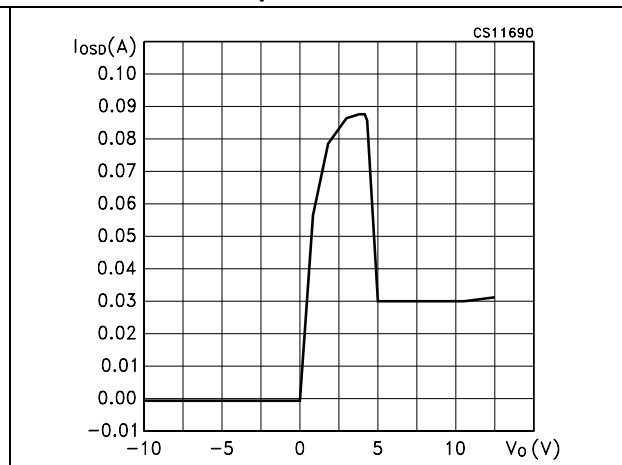
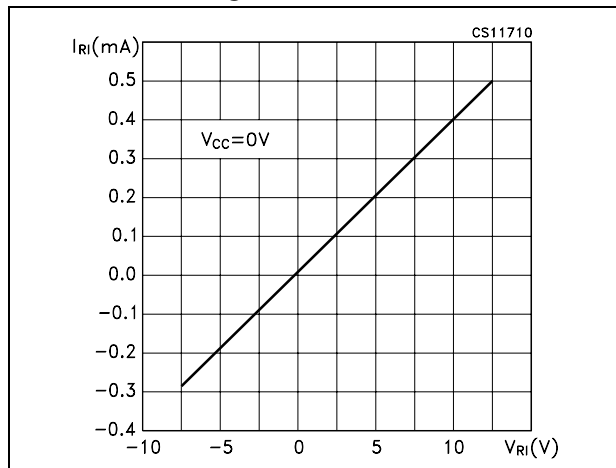


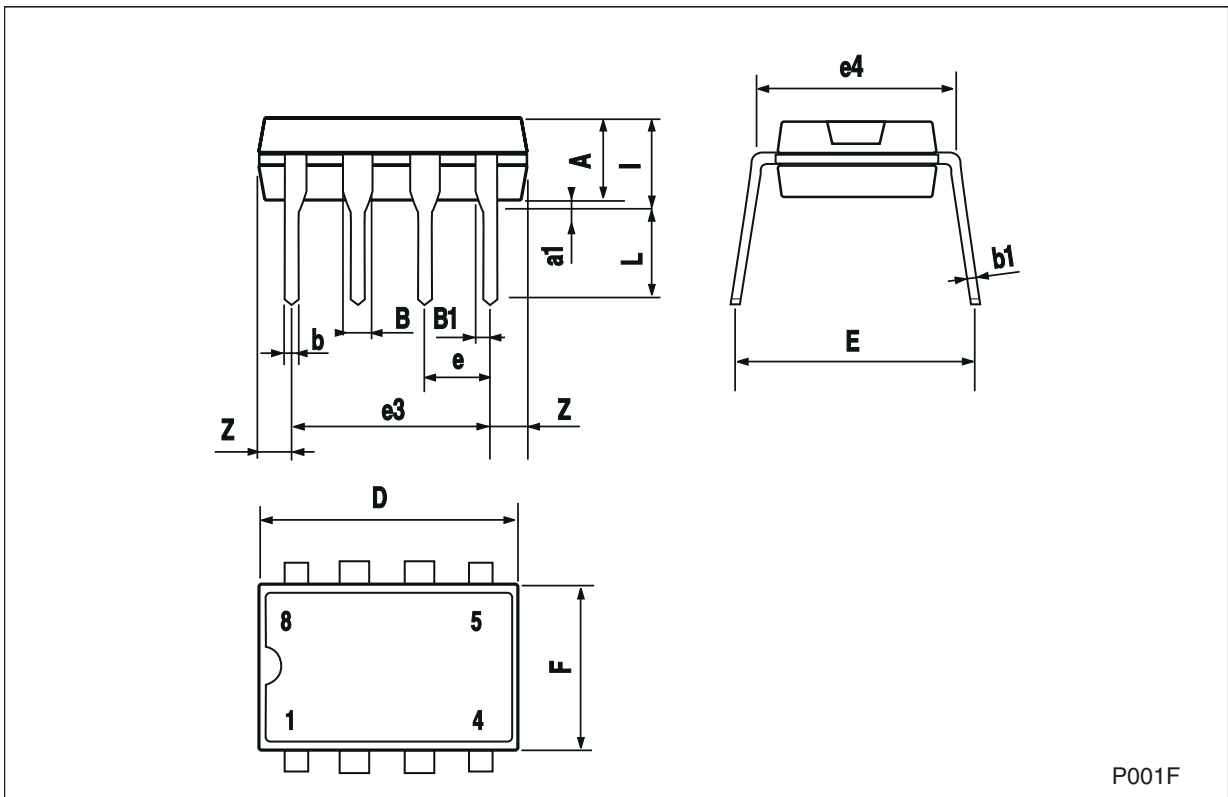
Figure 12. Receiver input current vs input voltage

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-8 mechanical data

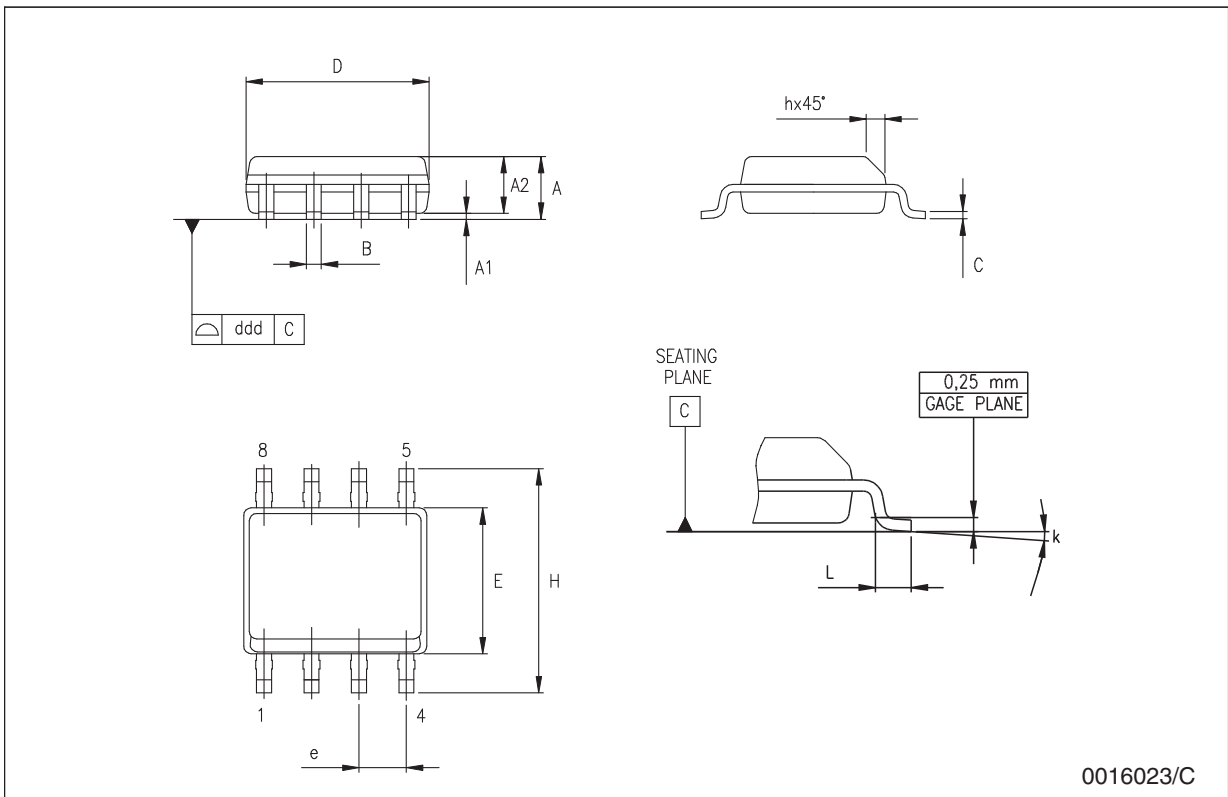
| Dim. | mm. | | | inch. | | |
|------|------|------|------|-------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | 3.3 | | | 0.130 | |
| a1 | 0.7 | | | 0.028 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| B1 | 0.91 | | 1.04 | 0.036 | | 0.041 |
| b | | 0.5 | | | 0.020 | |
| b1 | 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 |
| l | | | 4.8 | | | 0.189 |
| L | | 3.3 | | | 0.130 | |
| Z | 0.44 | | 1.6 | 0.017 | | 0.063 |



P001F

SO-8 mechanical data

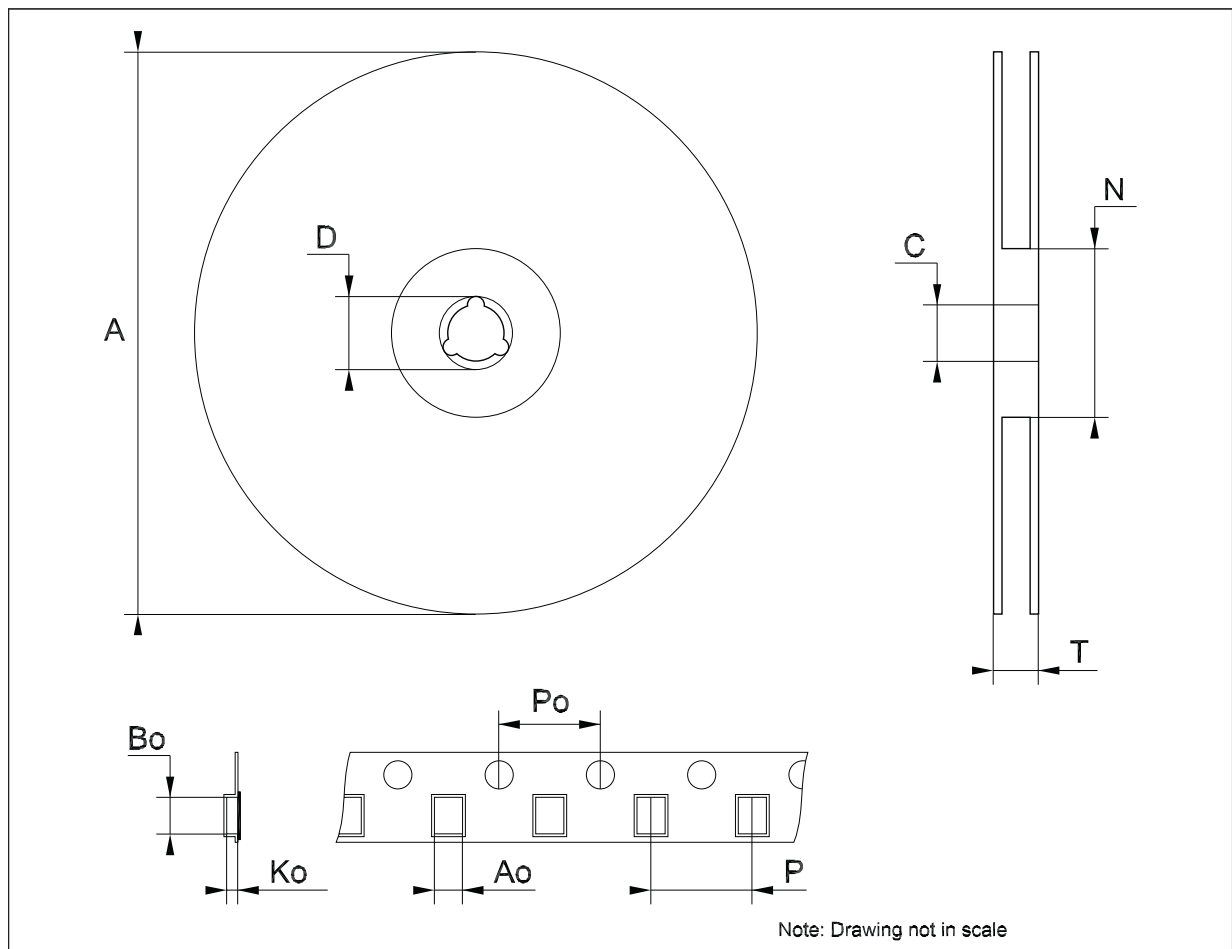
| Dim. | mm. | | | inch. | | |
|------|-----------|------|------|-------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 1.35 | | 1.75 | 0.053 | | 0.069 |
| A1 | 0.10 | | 0.25 | 0.04 | | 0.010 |
| A2 | 1.10 | | 1.65 | 0.043 | | 0.065 |
| B | 0.33 | | 0.51 | 0.013 | | 0.020 |
| C | 0.19 | | 0.25 | 0.007 | | 0.010 |
| D | 4.80 | | 5.00 | 0.189 | | 0.197 |
| E | 3.80 | | 4.00 | 0.150 | | 0.157 |
| e | | 1.27 | | | 0.050 | |
| H | 5.80 | | 6.20 | 0.228 | | 0.244 |
| h | 0.25 | | 0.50 | 0.010 | | 0.020 |
| L | 0.40 | | 1.27 | 0.016 | | 0.050 |
| k | 8° (max.) | | | | | |
| ddd | | | 0.1 | | | 0.04 |



0016023/C

Tape & reel SO-8 mechanical data

| Dim. | mm. | | | inch. | | |
|------|------|------|------|-------|------|--------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 330 | | | 12.992 |
| C | 12.8 | | 13.2 | 0.504 | | 0.519 |
| D | 20.2 | | | 0.795 | | |
| N | 60 | | | 2.362 | | |
| T | | | 22.4 | | | 0.882 |
| Ao | 8.1 | | 8.5 | 0.319 | | 0.335 |
| Bo | 5.5 | | 5.9 | 0.216 | | 0.232 |
| Ko | 2.1 | | 2.3 | 0.082 | | 0.090 |
| Po | 3.9 | | 4.1 | 0.153 | | 0.161 |
| P | 7.9 | | 8.1 | 0.311 | | 0.319 |



7 Revision history

Table 11. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 06-Jul-2005 | 2 | Typing error on table 2 - pin 5 non-inverting, pin 6 inverting. |
| 04-May-2006 | 3 | Order codes updated. |
| 08-Nov-2007 | 4 | Added: Table 1 . |
| 07-Feb-2008 | 5 | Modified: Table 1 on page 1 . |

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