

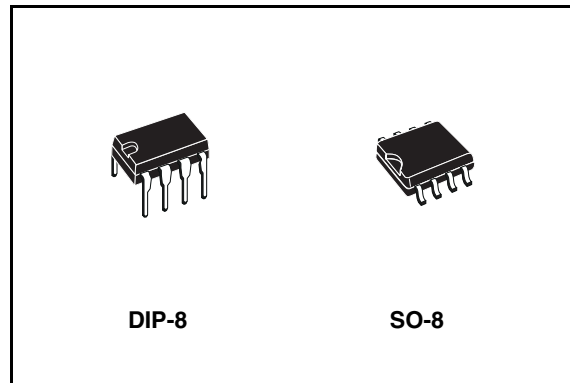


ST485AB

Very high speed low power RS-485/RS-422 transceiver

Features

- Low supply current: 5 mA max
- High data rate > 30 Mbps
- Designed for RS 485 interface applications
- -7 to 12 common mode input voltage range
- Driver maintains high impedance in 3-state or with the power off
- 70mV typical input hysteresis
- Operate from single 5 supply
- ± 4 kV ESD protection
- Current limiting and thermal shutdown for driver overload protection
- Latch-up free up to 500 mA



The ST485A is designed for bi-directional data communications or multipoint bus transmission lines.

Description

The ST485A is a low power, high speed transceiver for RS-485 and RS-422 communications. The device contains one driver and one receiver in half duplex configuration. The ST485A draws 3 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 |
|------------|-------------------|--------------------|-----------------------------------|
| ST485ABN | -40 to 85 °C | DIP-8 | 50parts per tube / 40tube per box |
| ST485ABDR | -40 to 85 °C | SO-8 (Tape & reel) | 2500 parts per reel |

Contents

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1 Pin configuration

Figure 1. Pin configuration

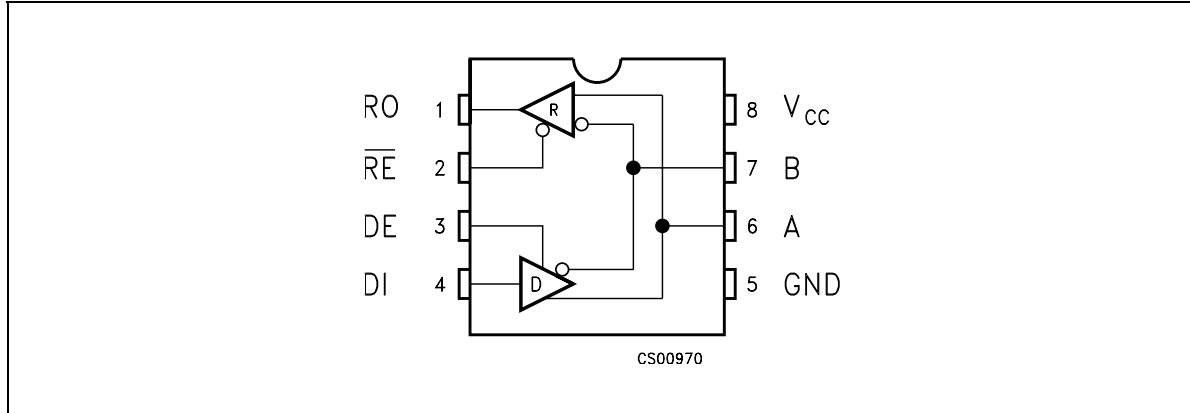


Table 2. Pin description

| Pin n° | Symbol | Name and function |
|--------|-----------------|---|
| 1 | RO | Receiver output. If A>B by 200 mV, RO will be high; if A<B by 200 mV, RO will be low |
| 2 | \overline{RE} | Receiver output enable. RO is enabled when RE is low; RO is high impedance when RE is high. If RE is high and DE is low, the device will enter a low power shutdown mode. |
| 3 | DE | Driver output enable. The driver outputs are enabled by bringing DE high. They are high impedance when DE is low. If RE is high DE is low, the device will enter a low-power shutdown mode. If the driver outputs are enabled, the part functions as line driver, while they are high impedance, it functions as line receivers if RE is low. |
| 4 | DI | Driver input. A low on DI forces output A low and output B high. Similarly, a high on DI forces output A high and output B low |
| 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 _{CC} | Supply voltage: V _{CC} = 4.75 V to 5.25 V |

2 Truth tables

Table 3. Truth table (driver)

| Inputs | | | Outputs | | Mode |
|-----------------|----|----|---------|---|--------|
| \overline{RE} | DE | DI | B | A | A |
| X | H | H | L | H | Normal |
| X | H | L | H | L | Normal |
| L | L | X | Z | Z | Normal |

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

Table 4. Truth table (receiver)

| Inputs | | | Outputs | Mode |
|-----------------|----|----------------------|---------|--------|
| \overline{RE} | DE | A-B | RO | |
| L | L | $\geq -0.2\text{ V}$ | H | Normal |
| L | L | $\leq -0.2\text{ V}$ | L | Normal |
| L | L | Inputs open | H | Normal |

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) | -0.3 to 7 | V |
| V_{DI} | Driver input voltage (DI) | -0.3 to 7 | V |
| V_{DO} | Driver output voltage (A, B) | -7.5 to 12.5 | V |
| V_{RI} | Receiver input voltage (A, B) | -7.5 to 12.5 | V |
| V_{RO} | Receiver output voltage (RO) | -0.3 to ($V_{CC} + 0.3$) | 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 ($V_{CC} = 4.5\text{ V to }5.5\text{ V}$, $T_A = -40\text{ to }85^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{ V}$) (*Note: 1*)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit | |
|--------------|-------------------------------|--|-----------------------|------|------|------|----|
| I_{SUPPLY} | V_{CC} Power supply current | No load, $V_{RE}=0\text{ V}$ or V_{CC} | $V_{DE} = V_{CC}$ | | 2.3 | 5 | mA |
| | | | $V_{DE} = 0\text{ V}$ | | 2.6 | 5 | mA |
| $C_{I/O}$ | Input/output capacitance | | | 10 | | pF | |
| C_{AB} | Driver output capacity | | | 10 | | pF | |

Table 7. Logic input electrical characteristics ($V_{CC} = 4.5\text{ V to }5.5\text{ V}$, $T_A = -40\text{ to }85^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{ V}$) (*Note: 1*)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------|----------------------------|--|----------------------|------|-----------|---------------|
| V_{IL} | Input logic threshold low | DE, DI, RE | | | 0.8 | V |
| V_{IH} | Input logic threshold high | DE, DI, RE | 2 | | | V |
| I_{IN1} | Logic input current | DE, DI, RE | | | ± 2.0 | μA |
| I_{IN2} | Input current (A, B) | $V_{DE}=0\text{ V}$, $V_{CC}= 0\text{ or }5.25\text{ V}$ | $V_{IN}=12\text{ V}$ | | 1 | mA |
| | | | $V_{IN}=-7\text{ V}$ | | -0.8 | mA |

Table 8. Transmitter electrical characteristics ($V_{CC} = 4.5\text{ V to }5.5\text{ V}$, $T_A = -40\text{ to }85^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{ V}$) (*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) | $R_L = 54\ \Omega$ (RS-422) $V_{CM} = -7\text{ V to }12\text{ V}$ | 1.5 | 2.7 | 5 | V |
| ΔV_{OD} | Change in magnitude of driver differential output voltage for complementary output states (<i>Note: 1</i>) | $R_L = 27\ \Omega$ or $50\ \Omega$ | | 0 | 0.2 | V |
| V_{OC} | Driver common mode output voltage | $R_L = 27\ \Omega$ or $50\ \Omega$ | 1 | | 3 | V |
| ΔV_{OC} | Change in magnitude of driver common mode output voltage (<i>Note: 1</i>) | $R_L = 54\ \Omega$ or $100\ \Omega$ | | 0 | 0.2 | V |
| I_{OSD} | Driver short circuit output current | $V_O = -7\text{ V to }12\text{ V}$ | | | ± 250 | mA |

Table 9. Receiver electrical characteristics ($V_{CC} = 4.5\text{ V to }5.5\text{ V}$, $T_A = -40\text{ to }85^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{ V}$) (*Note: 1*)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-----------------|---|---|------|------|---------|------------------|
| 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 | $I_{OUT} = -4\text{ mA}$, $V_{ID} = 200\text{ mV}$ | 3.5 | 4.7 | | V |
| V_{OL} | Receiver Output Low Voltage | $I_{OUT} = 4\text{ mA}$, $V_{ID} = -200\text{ mV}$ | | 0.2 | 0.4 | V |
| I_{OZR} | 3-State (High Impedance) Output Current at Receiver | $V_O = 0.4\text{ V to }2.4\text{ V}$ | | | ± 1 | μA |
| R_{RIN} | Receiver Input Resistance | $V_{CM} = -7\text{ V to }12\text{ V}$ | 12 | 24 | | $\text{K}\Omega$ |
| I_{OSR} | Receiver Short-Circuit Current | $V_O = 0\text{ V to }V_{CC}$ | 7 | | 95 | mA |

Table 10. Driver switching characteristics ($V_{CC} = 4.5\text{ V to }5.5\text{ V}$, $T_A = -40\text{ to }85^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{ V}$) (See *Note: 1*, *Note 3*)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|------------------------|---|---|------|------|------|------|
| D_R | Maximum data rate | Jitter < 5% | 30 | 50 | | Mbps |
| t_{PLH} t_{PHL} | Propagation delay input to output | $R_L = 54\ \Omega$, $C_{L1} = C_{L2} = 50\text{ pF}$, (<i>Figure 8.</i>) | | 18 | 30 | ns |
| t_{SKEW} | Differential output delay skew | $R_L = 54\ \Omega$, $C_{L1} = C_{L2} = 50\text{ pF}$, (<i>Figure 6.</i>) | | 0.5 | 2 | ns |
| t_{TLH} t_{THL} | Rise or fall differential time | $R_L = 54\ \Omega$, $C_{L1} = C_{L2} = 50\text{ pF}$, (<i>Figure 6.</i>) | | 8 | 12 | ns |
| t_{PZL} | Output enable time | $C_L = 50\text{ pF}$, S1 Closed | | | 30 | ns |
| t_{PZH} | Output enable time | $C_L = 50\text{ pF}$, S2 Closed | | | 30 | ns |
| t_{PHZ} | Output disable time | $C_L = 15\text{ pF}$, S2 Closed | | | 30 | ns |
| t_{PLZ} | Output disable time | $C_L = 15\text{ pF}$, S1 Closed | | | 30 | ns |
| $t_{SK(EN)}$ | Synchronous driver operation a-b at enable | | | | 2 | ns |
| $t_{SK(DS)}$ | Synchronous driver operation A-B at disable | | | 4 | 6 | ns |

Table 11. 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 $T_A = 25^\circ C$, $V_{CC} = 5V$) (See [Note: 1](#), [Note 3](#))

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|------------------------|--|-----------------------------|------|------|------|------|
| t_{PLH} t_{PHL} | Propagation Delay | $C_L = 15$ pF | | 18 | 30 | ns |
| t_{RPDS} | $ t_{PLH} - t_{PHL} $ Propagation delay skew | $C_L = 15$ pF | | 0.5 | 2 | ns |
| t_{PZL} | Output enable time | $C_{RL} = 15$ pF, S1 Closed | | 7 | 12 | ns |
| t_{PZH} | Output enable time | $C_{RL} = 15$ pF, S2 Closed | | 7 | 12 | ns |
| t_{PHZ} | Output disable time | $C_{RL} = 15$ pF, S2 Closed | | 7 | 12 | ns |
| t_{PLZ} | Output disable time | $C_{RL} = 15$ pF, S1 Closed | | 7 | 12 | ns |

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

2 Applies to peak current. See typical Operating Characteristics.

3 $t_r = t_f \leq 6$ ms.

5 Test circuit and typical characteristics

Figure 2. Driver DC test load

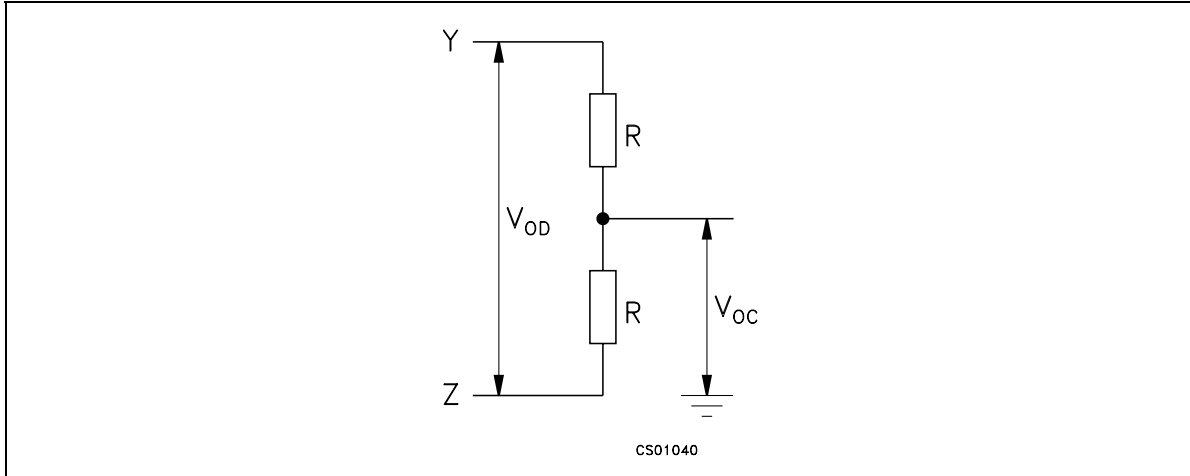


Figure 3. Receiver timing test load

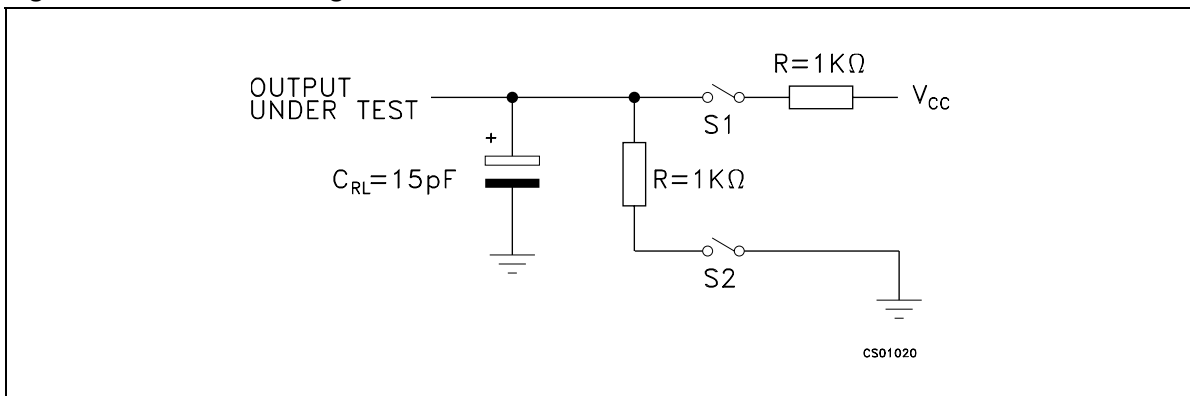


Figure 4. Driver/receiver timing test circuit

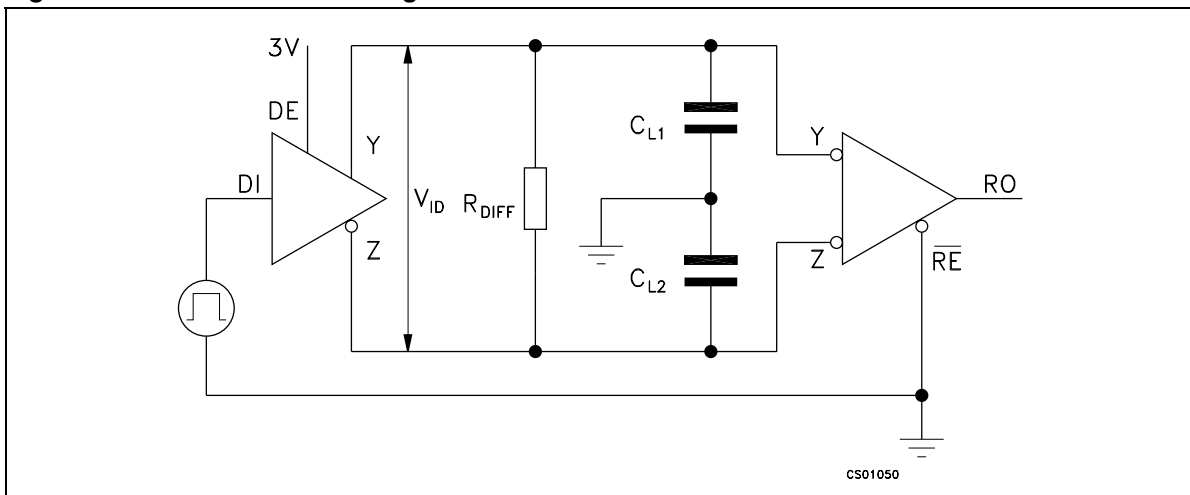


Figure 5. Driver timing test load

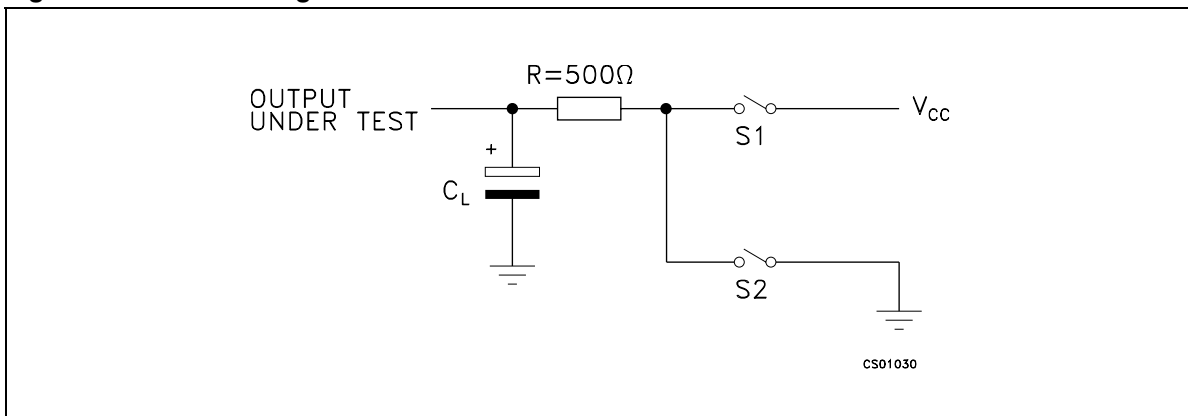


Figure 6. Driver timing test load

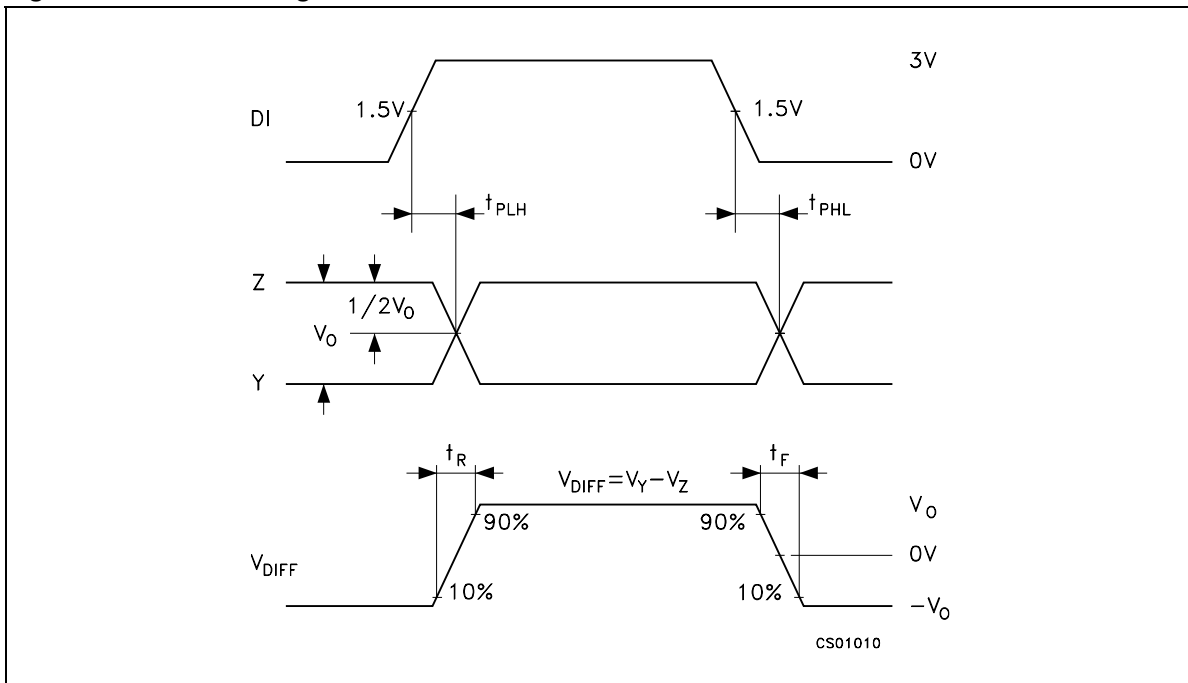


Figure 7. Driver enable and disable time

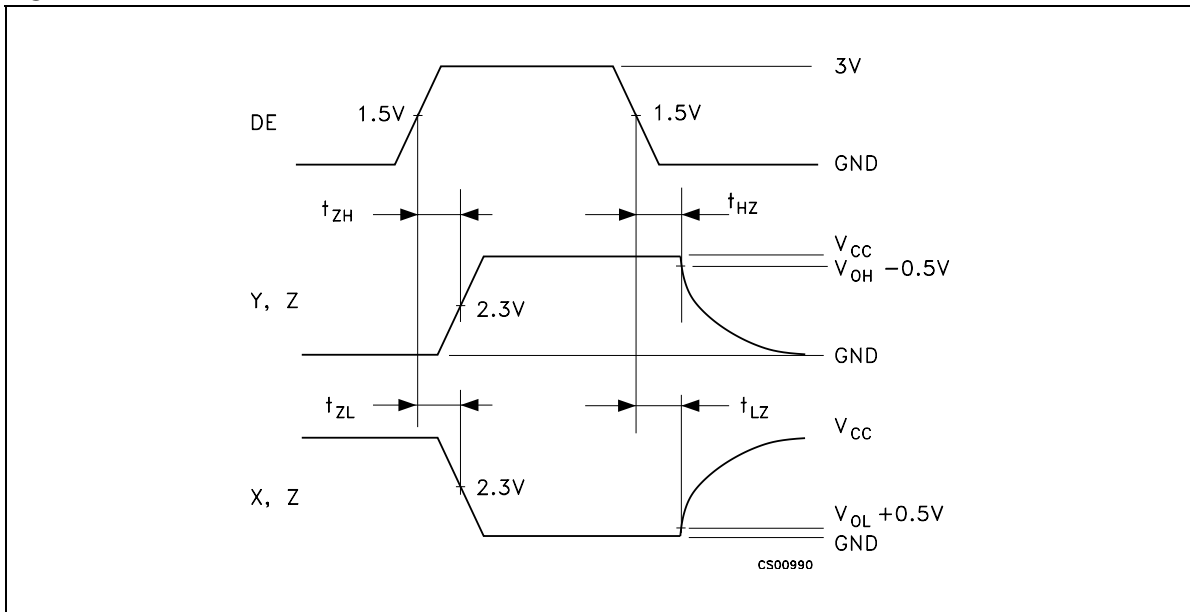


Figure 8. Receiver propagation delay

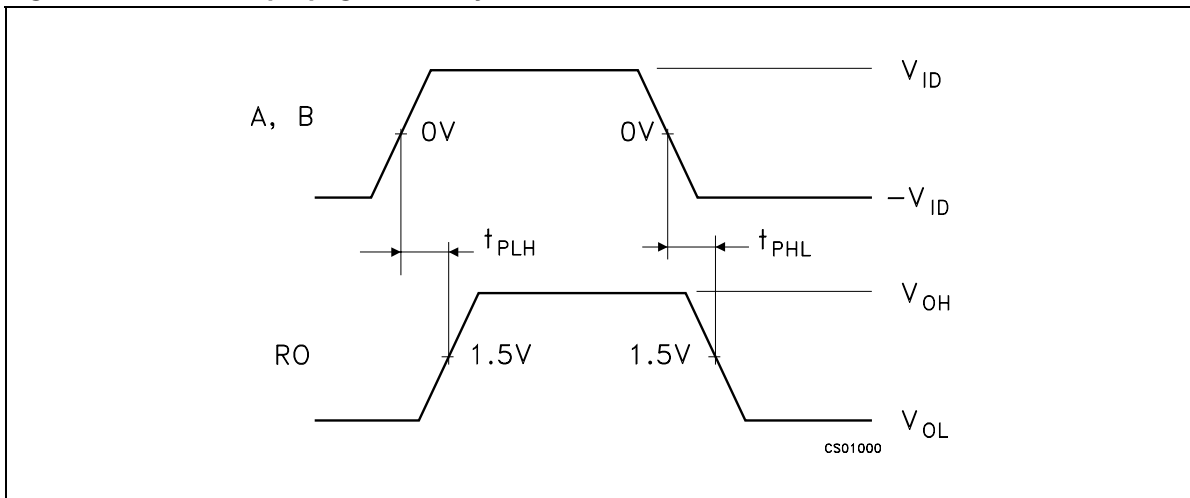


Figure 9. Receiver enable and disable time

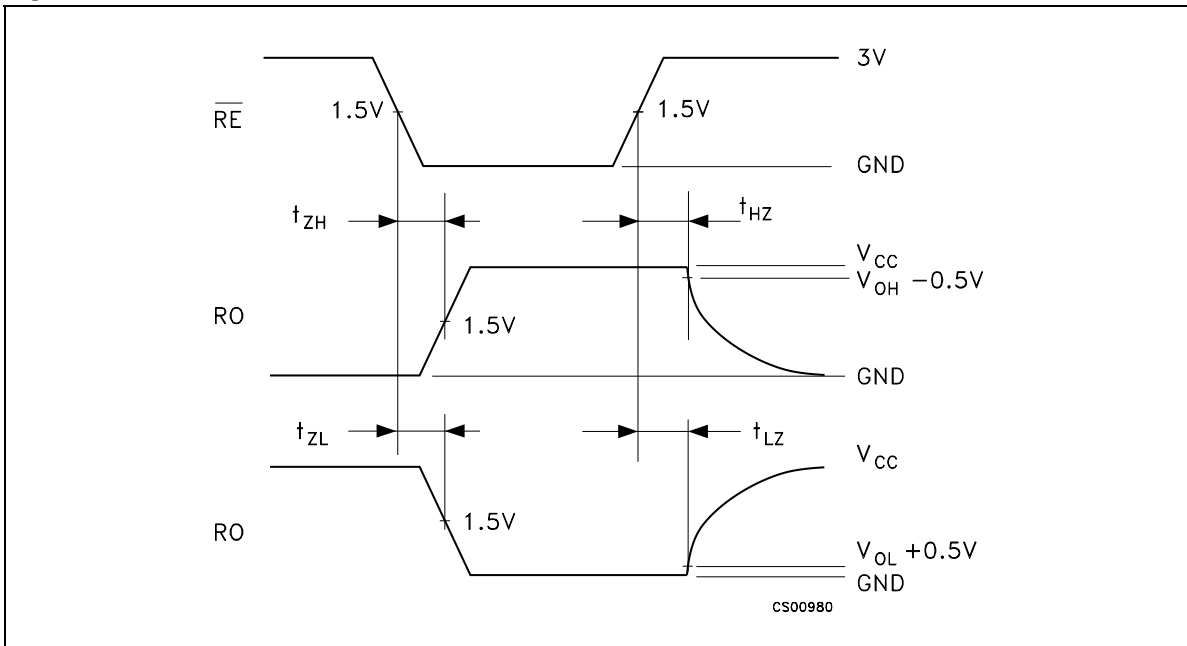


Figure 10. Receiver output current vs. output voltage (output low)

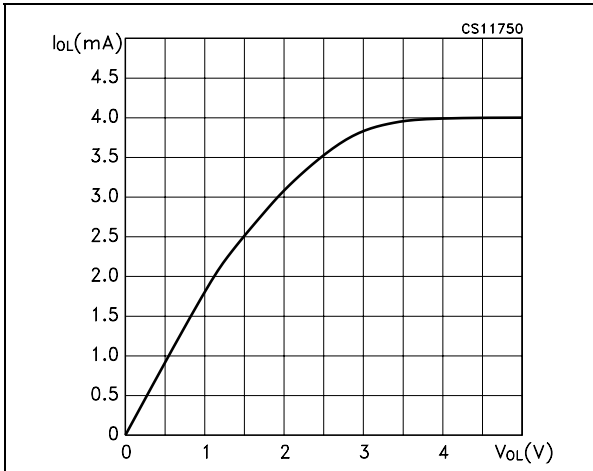


Figure 11. Receiver output current vs. output voltage (output high)

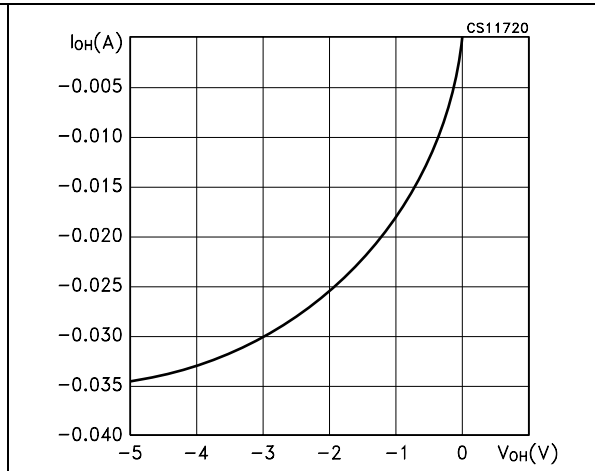


Figure 12. Driver diff. output voltage vs common mode voltage (diff. output low)

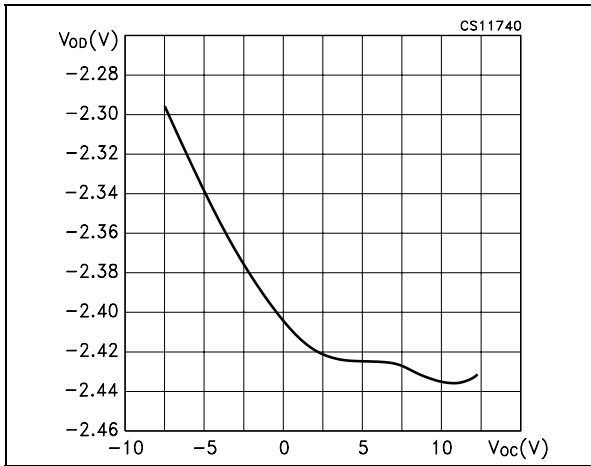


Figure 13. Driver diff. output voltage vs common mode voltage (diff. output low)

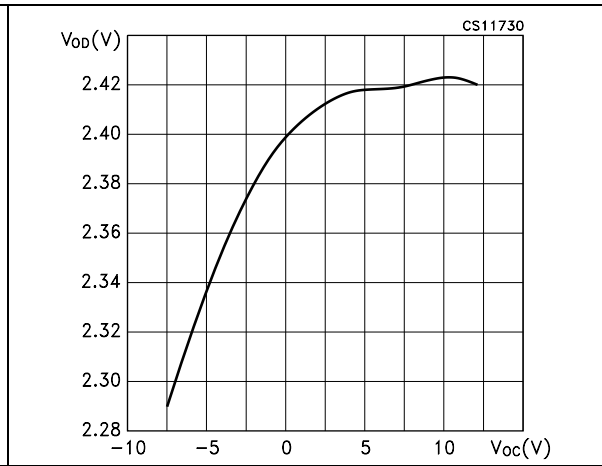


Figure 14. Driver short circuit current vs line voltage (output high)

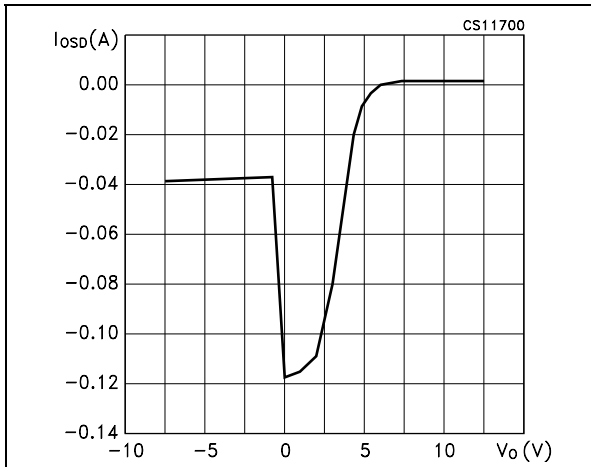


Figure 15. Driver short circuit current vs. line voltage (output low)

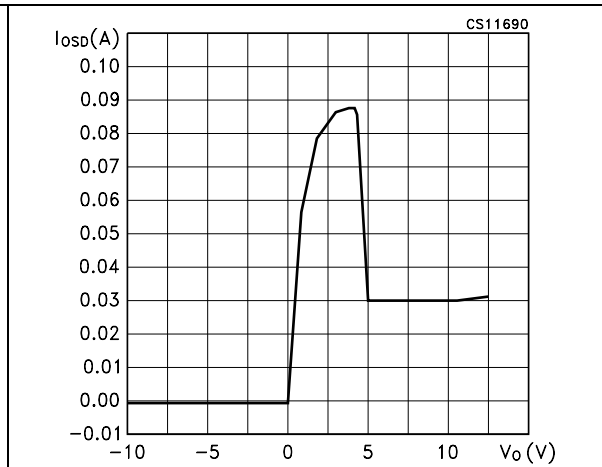
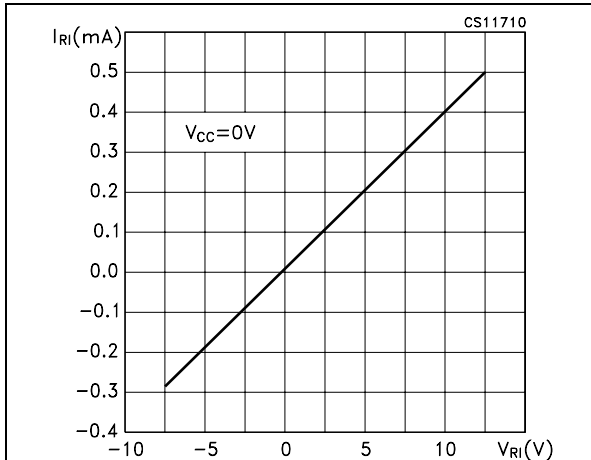


Figure 16. Receiver input current vs input voltage

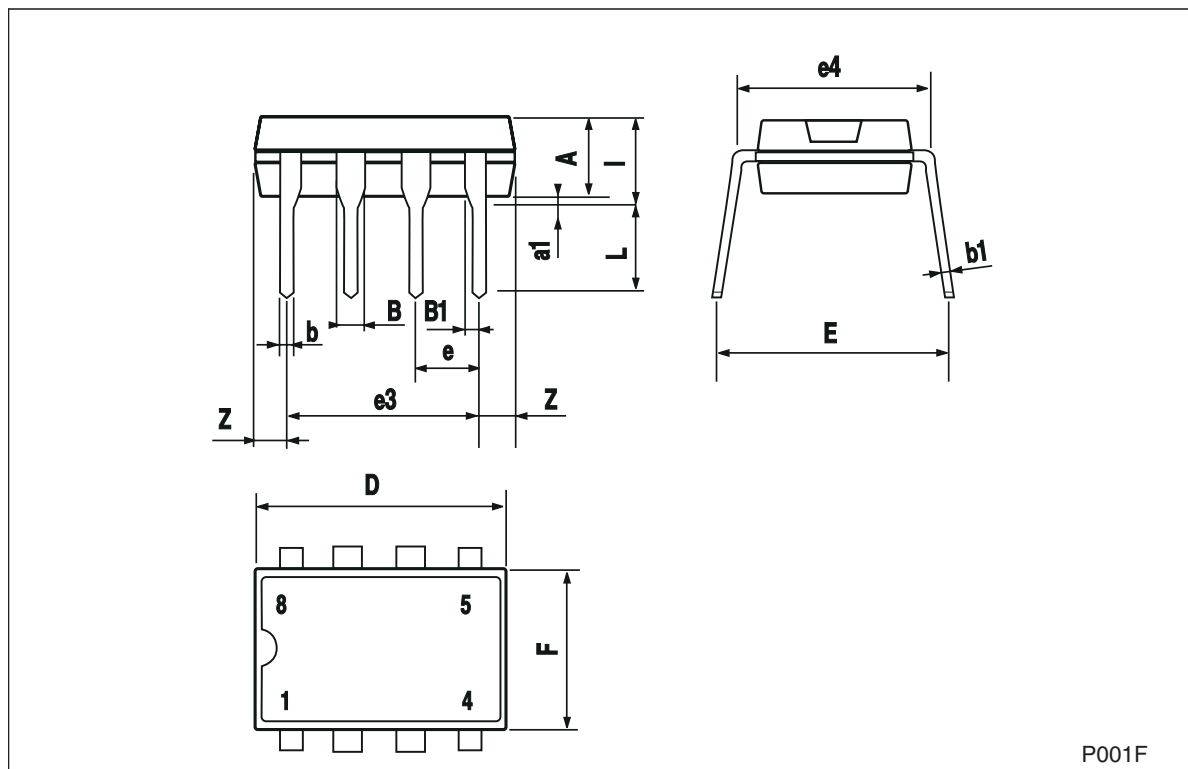


6 Package mechanical data

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

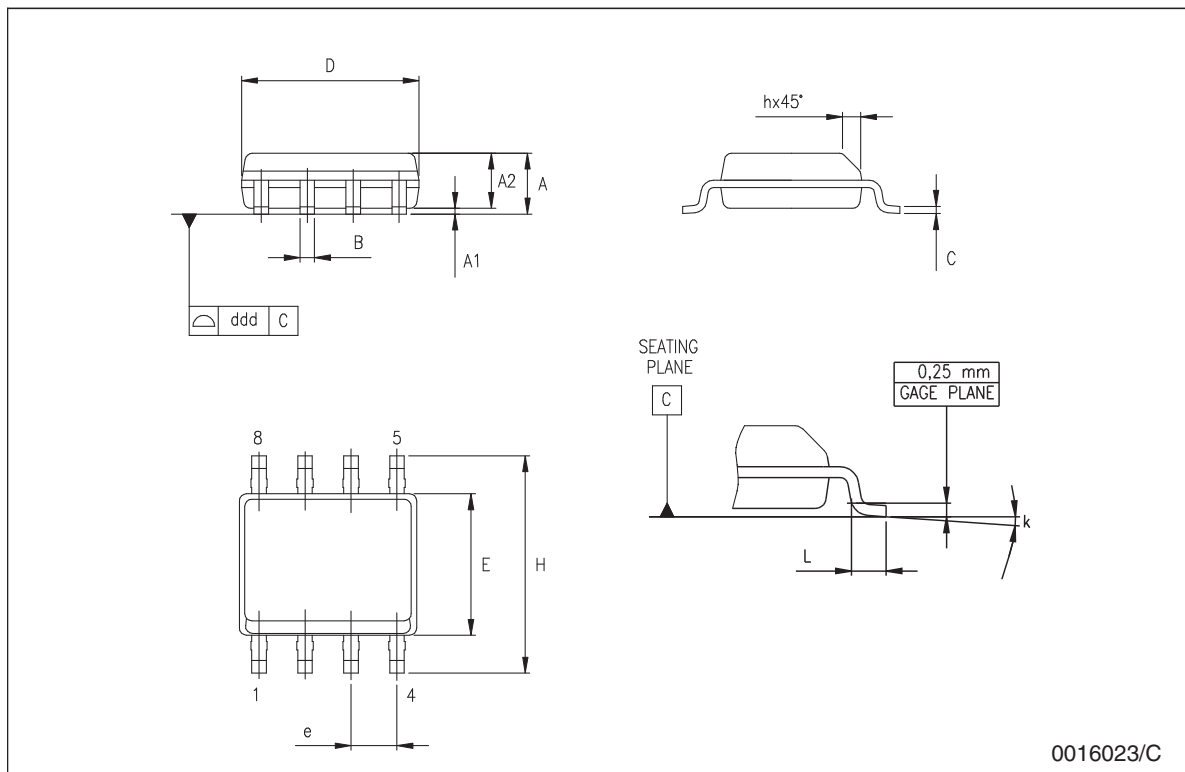
| Dim. | mm. | | | inch. | | |
|------|------|------|------|-------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | 3.3 | | | 0.130 | |
| a1 | 0.7 | | | 0.028 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| B1 | 0.91 | | 1.04 | 0.036 | | 0.041 |
| b | | 0.5 | | | 0.020 | |
| b1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



P001F

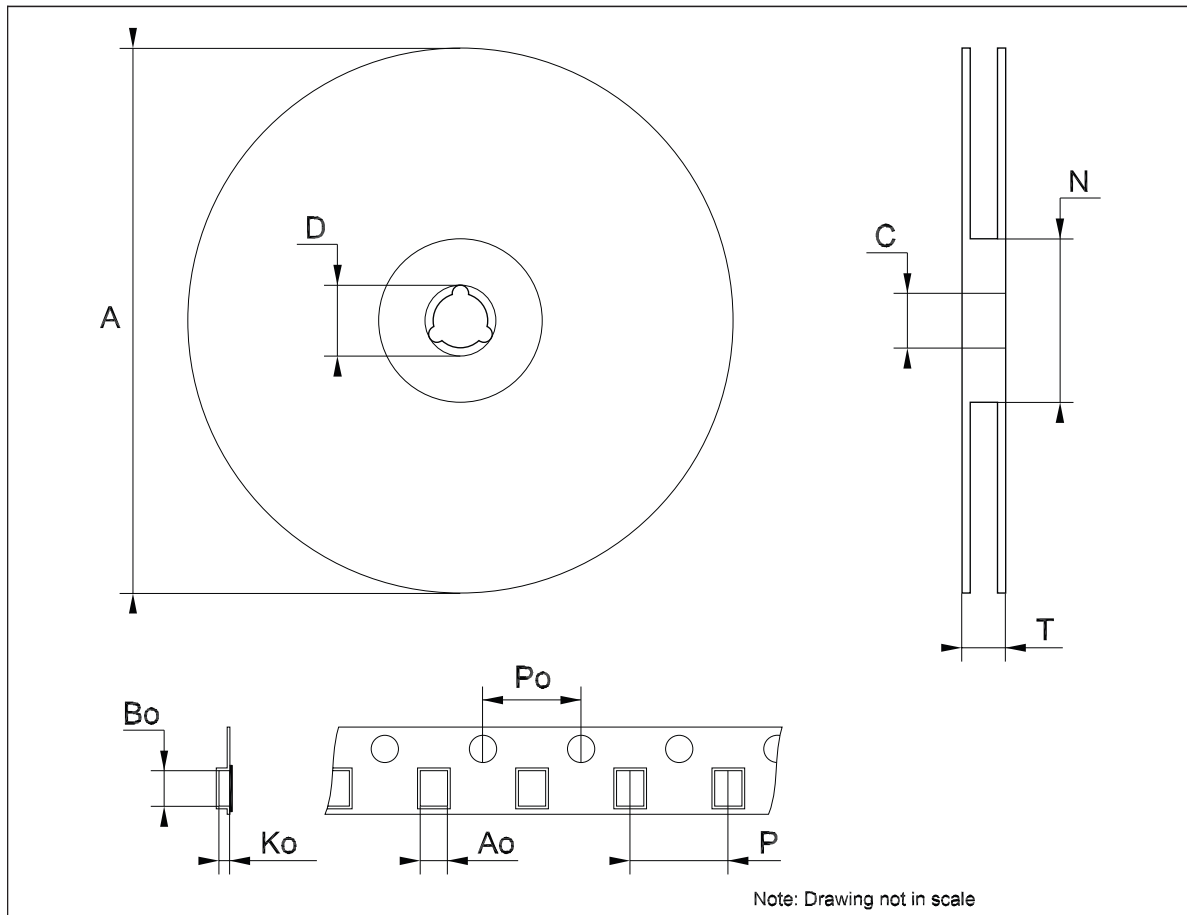
SO-8 mechanical data

| 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 |



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 12. Revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 28-Mar-2006 | 2 | Order codes updated and new template. |
| 24-Aug-2007 | 3 | Added Table 1 in cover page. |

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