



ST485

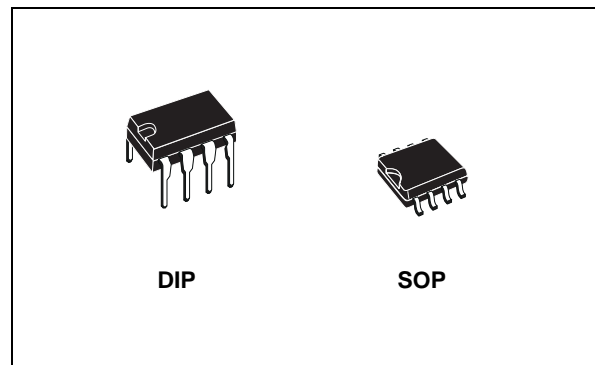
LOW POWER RS-485/RS-422 TRANSCEIVER

- LOW QUIESCENT CURRENT: 300 μ A
- DESIGNED FOR RS-485 INTERFACE APPLICATIONS
- -7V TO 12V COMMON MODE INPUT VOLTAGE RANGE
- DRIVER MAINTAINS HIGH IMPEDANCE IN 3-STATE OR WITH THE POWER OFF
- 70mV TYPICAL INPUT HYSTERESIS
- 30ns PROPAGATION DELAYS, 5ns SKEW
- OPERATE FROM A SINGLE 5V SUPPLY
- CURRENT LIMITING AND THERMAL SHUTDOWN FOR DRIVER OVERLOAD PROTECTION
- ALLOWS UP TO 64 TRANSCEIVERS ON THE BUS

DESCRIPTION

The ST485 is a low power transceiver for RS-485 and RS-422 communication. Each part contains one driver and one receiver.

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



It operates from a single 5V 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.

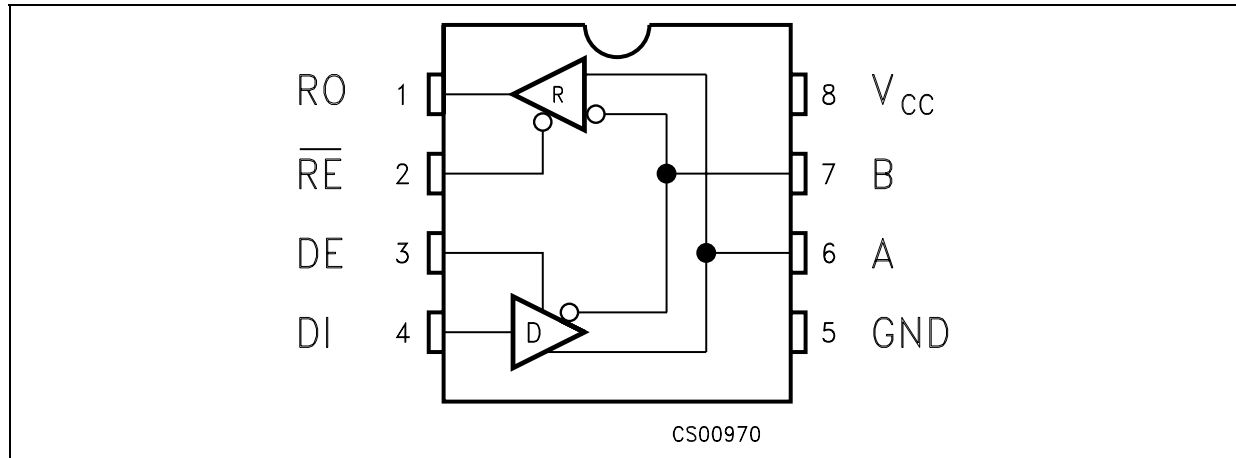
The ST485 is designed for bi-directional data communications on multipoint bus transmission line (half-duplex applications).

The ST485 is available in three temperature ranges: commercial (0 $^{\circ}$ C to 70 $^{\circ}$ C), industrial (-40 $^{\circ}$ C to 85 $^{\circ}$ C) and automotive (-55 $^{\circ}$ C to 125 $^{\circ}$ C)

ORDERING CODES

| Type | Temperature Range | Package | Comments |
|----------|-------------------------|--------------------|------------------------------------|
| ST485CN | 0 to 70 $^{\circ}$ C | DIP-8 | 50parts per tube / 40tube per box |
| ST485BN | -40 to 85 $^{\circ}$ C | DIP-8 | 50parts per tube / 40tube per box |
| ST485XN | -55 to 125 $^{\circ}$ C | DIP-8 | 50parts per tube / 40tube per box |
| ST485CD | 0 to 70 $^{\circ}$ C | SO-8 (Tube) | 100parts per tube / 20tube per box |
| ST485BD | -40 to 85 $^{\circ}$ C | SO-8 (Tube) | 100parts per tube / 20tube per box |
| ST485XD | -55 to 125 $^{\circ}$ C | SO-8 (Tube) | 100parts per tube / 20tube per box |
| ST485CDR | 0 to 70 $^{\circ}$ C | SO-8 (Tape & Reel) | 2500 parts per reel |
| ST485BDR | -40 to 85 $^{\circ}$ C | SO-8 (Tape & Reel) | 2500 parts per reel |
| ST485XDR | -55 to 125 $^{\circ}$ C | SO-8 (Tape & Reel) | 2500 parts per reel |

PIN CONFIGURATION



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 _{CC} | Supply Voltage |

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 |

X= Don't Care; Z=High Impedance

TRUTH TABLE (RECEIVER)

| INPUTS | | | OUTPUT |
|--------|----|-------------|--------|
| RE | DE | A-B | RO |
| L | L | ≥ +0.2V | H |
| L | L | ≤ -0.2V | L |
| L | L | INPUTS OPEN | H |
| H | L | X | Z |

X= Don't Care; Z=High Impedance

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|-----------------|--------------------------------|---------------------------------|------|
| V _{CC} | Supply Voltage | 12 | V |
| V _I | Control Input Voltage (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) | ± 14 | V |
| V _{RI} | Receiver Input Voltage (A, B) | ± 14 | V |
| V _{RO} | Receiver Output Voltage (RO) | -0.5 to (V _{CC} + 0.5) | V |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

DC ELECTRICAL 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 | Value | | | | | Unit |
|-----------------|---|--|--------------|------------|------------|---------------|------------|--------------------|
| | | | -40 to 85 °C | | | -55 to 125 °C | | |
| | | | Min. | Typ. | Max. | Min. | Max. | |
| V_{OD1} | Differential Driver Output (No Load) | | | | 5 | | 5 | V |
| V_{OD2} | Differential Driver Output (With Load) | $R_L = 27\Omega$ (RS-485) (See Fig.1) $R_L = 50\Omega$ (RS-422) (See Fig.1) | 1.5 | | 5 5 | 1.4 | 5 5 | V V |
| ΔV_{OD} | Change in Magnitude of Driver Differential Output Voltage for Complementary Output States | $R_L = 27\Omega$ or 50Ω (See Fig. 1) | | | 0.2 | | 0.2 | V |
| V_{OC} | Driver Common-Mode Output Voltage | $R_L = 27\Omega$ or 50Ω (See Fig. 1) | | | 3 | | 3 | V |
| ΔV_{OC} | Change in Magnitude of Driver Common-Mode Output Voltage for Complementary Output States | $R_L = 27\Omega$ or 50Ω (See Fig. 1) | | | 0.2 | | 0.2 | V |
| V_{IH} | Input High Voltage | \overline{RE} , DE, DI | 2.0 | | | 2.0 | | V |
| V_{IL} | Input Low Voltage | \overline{RE} , DE, DI | | | 0.8 | | 0.8 | V |
| I_{IN1} | Input Current | \overline{RE} , DE, DI | | | ± 2 | | ± 2 | μA |
| I_{IN2} | Input Current (A, B) | $V_{CM} = 0V$ or $5.25V$ $V_{DE} = 0V$ $V_{IN} = 12V$ $V_{IN} = -7V$ | | | 1 -0.8 | | 1 -0.8 | mA mA |
| V_{TH} | Receiver Differential Threshold Voltage | $V_{CM} = -7$ to $12V$ | -0.2 | | 0.2 | -0.2 | 0.2 | V |
| ΔV_{TH} | Receiver Input Hysteresis | $V_{CM} = 0V$ | | 70 | | | | mV |
| V_{OH} | Receiver Output High Voltage | $I_O = -4mA$ $V_{ID} = 200mV$ | 3.5 | | | 3.4 | | V |
| V_{OL} | Receiver Output Low Voltage | $I_O = 4mA$ $V_{ID} = -200mV$ | | | 0.4 | | 0.55 | V |
| I_{OZR} | 3-State (High Impedance) Output Current at Receiver | $V_O = 0.4$ to $2.4V$ | | | ± 1 | | ± 1 | μA |
| R_{IN} | Receiver Input Resistance | $V_{CM} = -7$ to $12V$ | 24 | | | 24 | | K Ω |
| I_{CC} | No Load Supply Current (Note 2) | $V_{RE} = 0V$ or V_{CC} $V_{DE} = V_{CC}$ $V_{DE} = 0V$ | | 400 300 | 900 500 | | 900 500 | μA μA |
| I_{OSD1} | Driver Short-Circuit Current, $V_O=High$ | $V_O = -7$ to $12V$ (Note 3) | 35 | | 250 | 35 | 250 | mA |
| I_{OSD2} | Driver Short-Circuit Current, $V_O=Low$ | $V_O = -7$ to $12V$ (Note 3) | 35 | | 250 | 35 | 250 | mA |
| I_{OSR} | Receiver Short-Circuit Current | $V_O = 0V$ to V_{CC} | 7 | | 95 | 7 | 95 | mA |

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.

Note 2: Supply current specification is valid for loaded transmitters when $V_{DE} = 0V$

Note 3: Applies to peak current. See typical Operating Characteristics.

DRIVER 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 | Value | | | | | Unit |
|------------------------|-----------------------------------|---|--------------|------|------|---------------|------|------|
| | | | -40 to 85 °C | | | -55 to 125 °C | | |
| | | | Min. | Typ. | Max. | Min. | Max. | |
| t_{PLH} t_{PHL} | Propagation Delay Input to Output | $R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 5) | 10 | 30 | 60 | | 70 | ns |
| t_{SK} | Output Skew to Output | $R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 5) | | 5 | 10 | | 10 | ns |
| t_{TLH} t_{THL} | Rise or Fall Time | $R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 5) | 3 | 15 | 40 | 3 | 45 | ns |
| t_{PZH} | Output Enable Time | $C_L = 100pF$ $S2 = Closed$ (See Fig. 4 and 6) | | 70 | 90 | | 90 | ns |
| t_{PZL} | Output Enable Time | $C_L = 100pF$ $S1 = Closed$ (See Fig. 4 and 6) | | 70 | 90 | | 90 | ns |
| t_{PLZ} | Output Disable Time | $C_L = 15pF$ $S1 = Closed$ (See Fig. 4 and 6) | | 70 | 90 | | 90 | ns |
| t_{PHZ} | Output Disable Time | $C_L = 15pF$ $S2 = Closed$ (See Fig. 4 and 6) | | 70 | 90 | | 90 | 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.

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 | Value | | | | | Unit |
|------------------------|-----------------------------------|---|--------------|------|------|---------------|------|------|
| | | | -40 to 85 °C | | | -55 to 125 °C | | |
| | | | Min. | Typ. | Max. | Min. | Max. | |
| t_{PLH} t_{PHL} | Propagation Delay Input to Output | $R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 7) | 20 | 130 | 210 | | 230 | ns |
| t_{SKD} | Differential Receiver Skew | $R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$ (See Fig. 3 and 7) | | 13 | | | | ns |
| t_{PZH} | Output Enable Time | $C_{RL} = 15pF$ $S1 = Closed$ (See Fig. 2 and 8) | | 20 | 50 | | 56 | ns |
| t_{PZL} | Output Enable Time | $C_{RL} = 15pF$ $S2 = Closed$ (See Fig. 2 and 8) | | 20 | 50 | | 56 | ns |
| t_{PLZ} | Output Disable Time | $C_{RL} = 15pF$ $S1 = Closed$ (See Fig. 2 and 8) | | 20 | 50 | | 56 | ns |
| t_{PHZ} | Output Disable Time | $C_{RL} = 15pF$ $S2 = Closed$ (See Fig. 2 and 8) | | 20 | 50 | | 56 | ns |
| f_{MAX} | Maximum Data Rate | | 2.5 | | | 2.5 | | Mbps |

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.

TEST CIRCUITS AND TYPICAL CHARACTERISTICS

Figure 1 : Driver DC Test Load

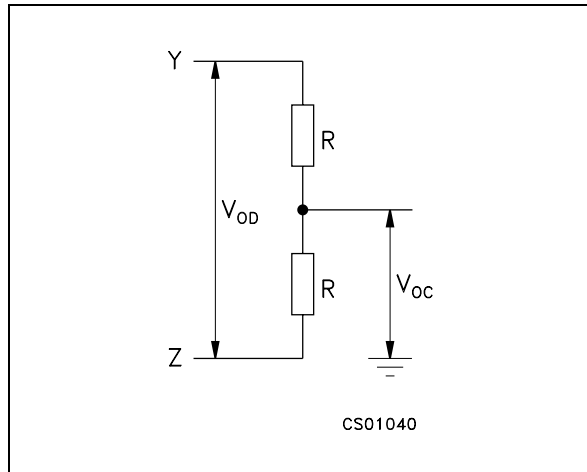


Figure 2 : Receiver Timing Test Load

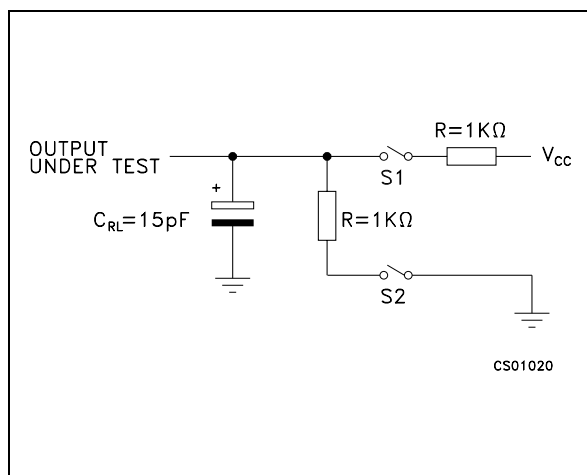


Figure 3 : Drive/Receiver Timing Test Circuit

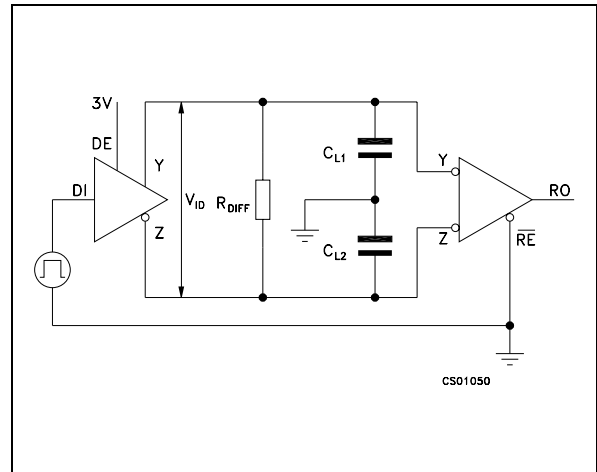


Figure 4 : Driver Timing Test Load

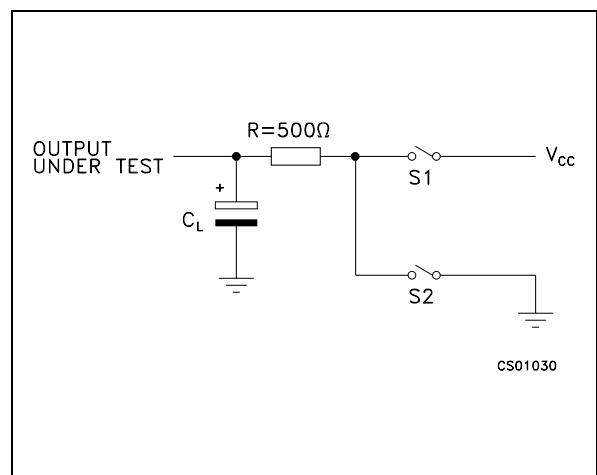


Figure 5 : Driver Propagation Delay

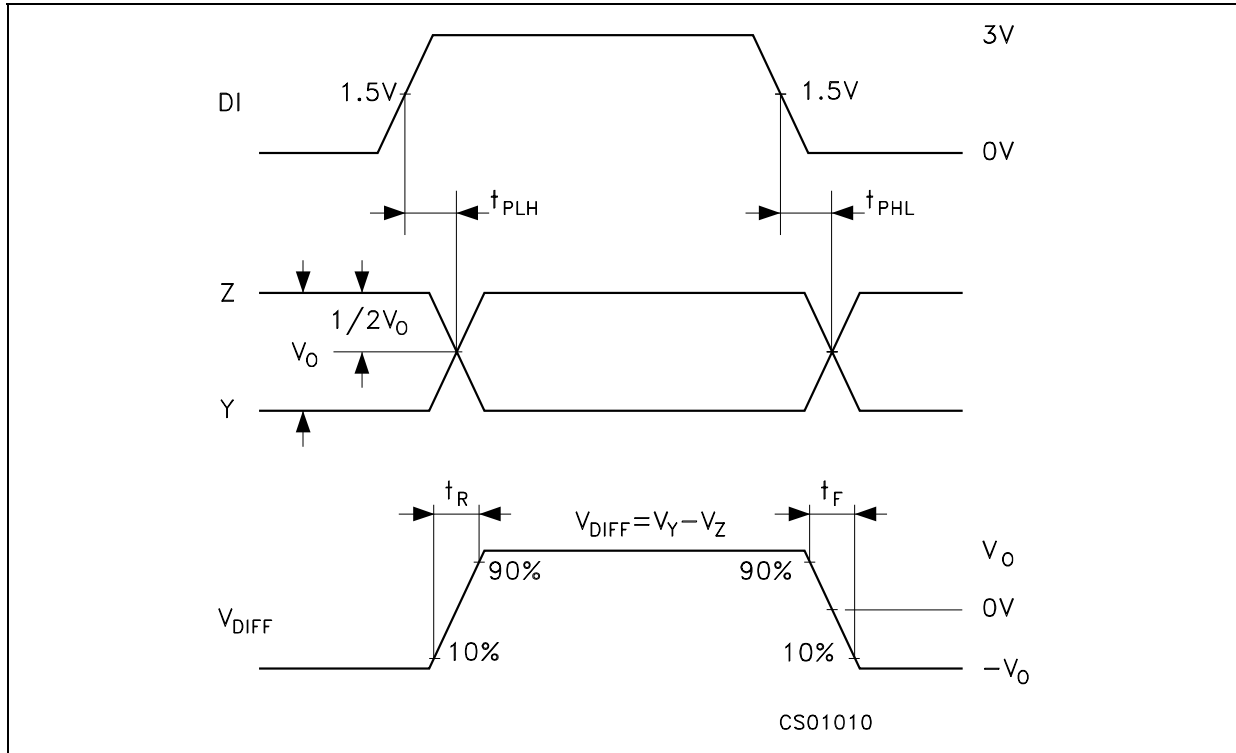


Figure 6 : Driver Enable and Disable Time

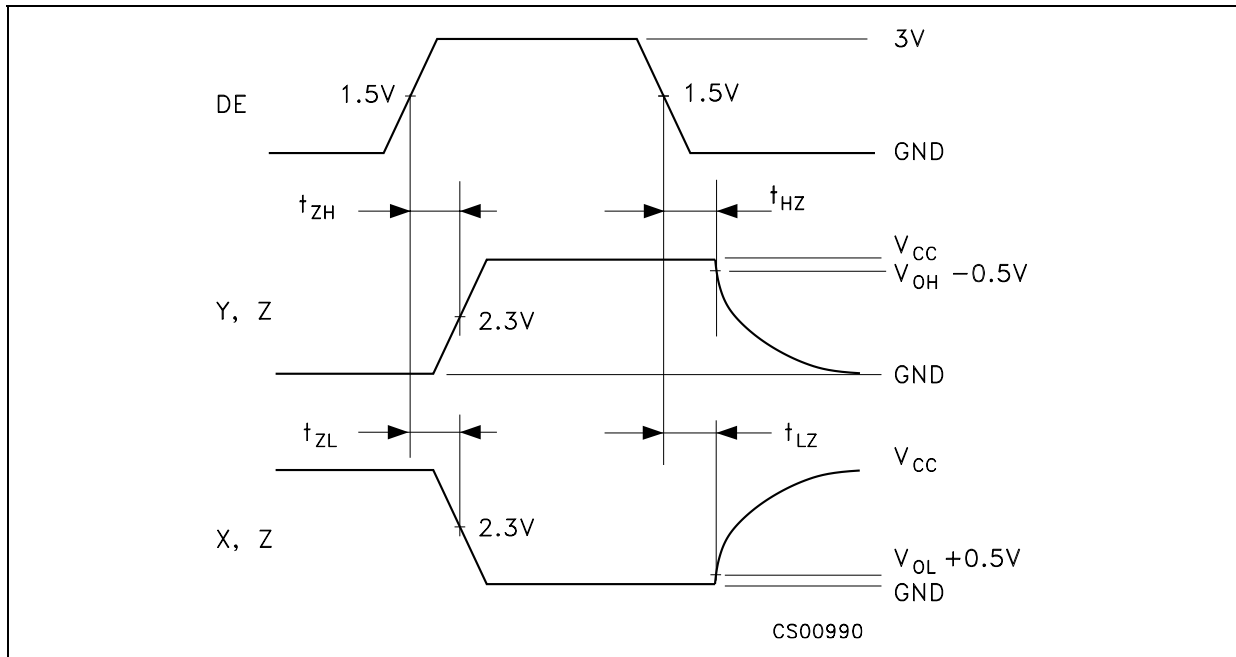


Figure 7 : Receiver Propagation Delay

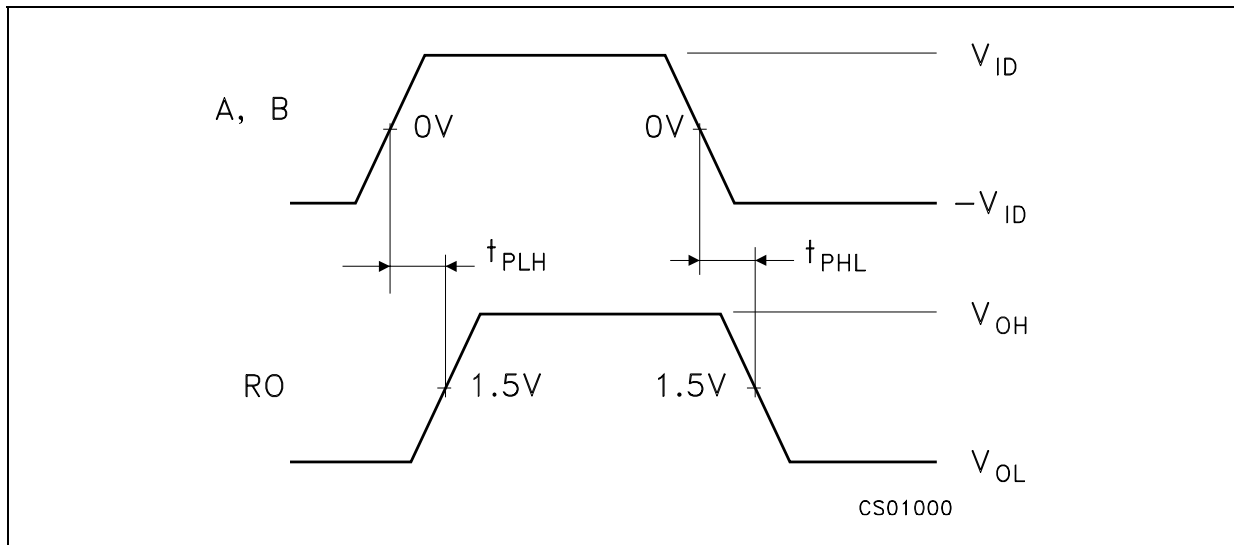


Figure 8 : Receiver Enable and Disable Time

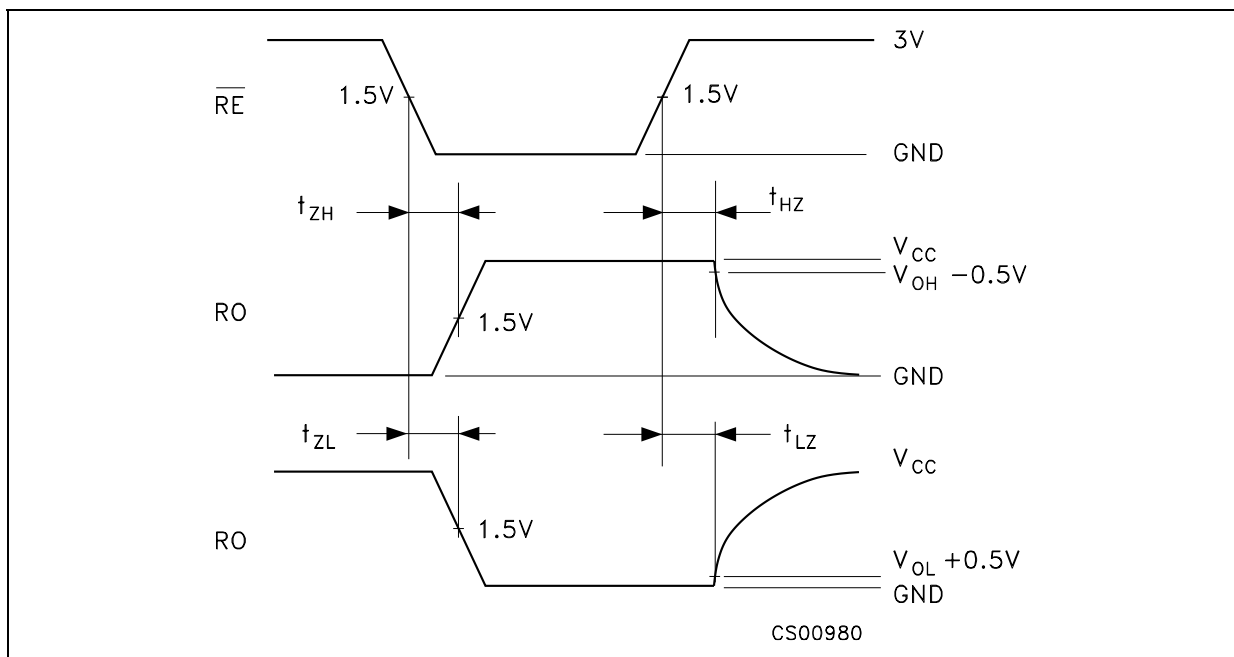


Figure 9 : Receiver Output Current vs Output Low Voltage

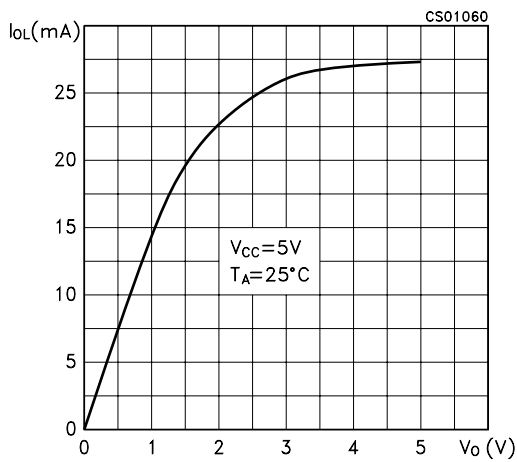


Figure 12 : Driver Output Current vs Output High Voltage

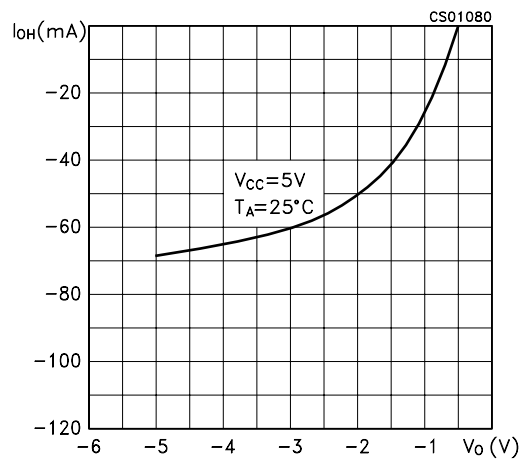


Figure 10 : Receiver Output Current vs Output High Voltage

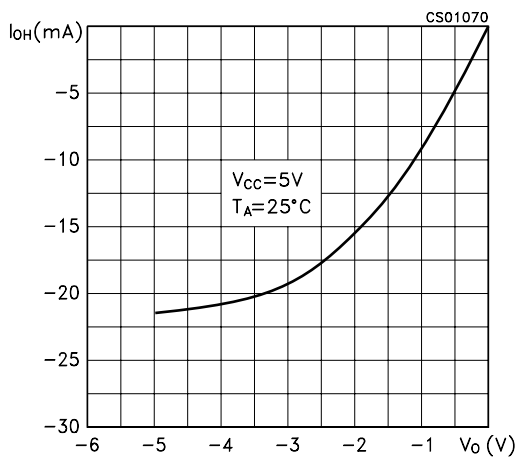


Figure 13 : Supply Current vs Temperature

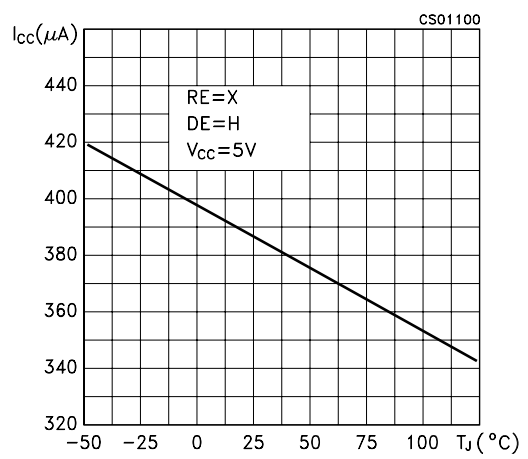


Figure 11 : Driver Output Current vs Output Low Voltage

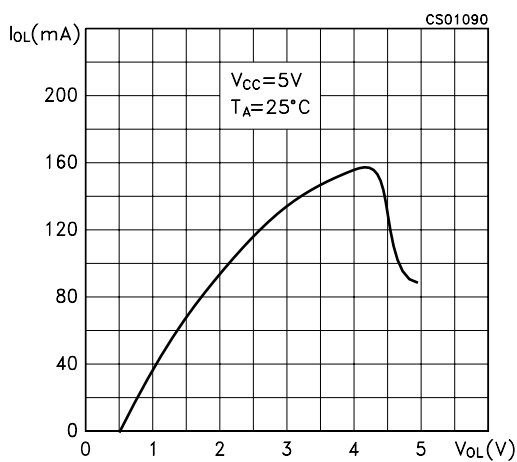


Figure 14 : Receiver High Level Output Voltage vs Temperature

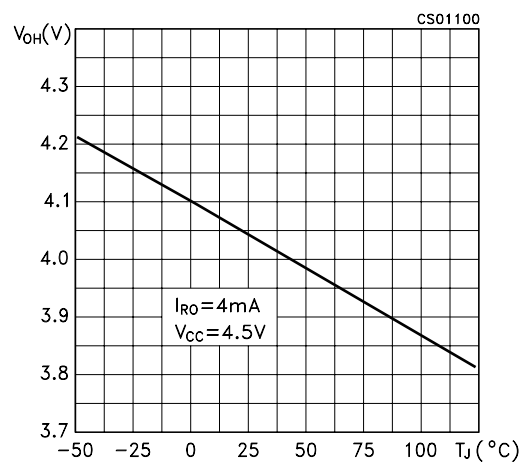
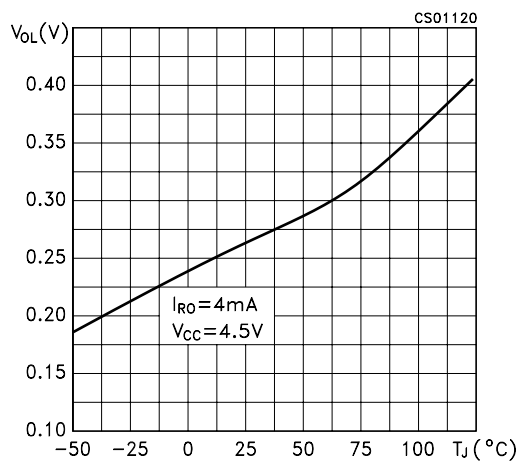
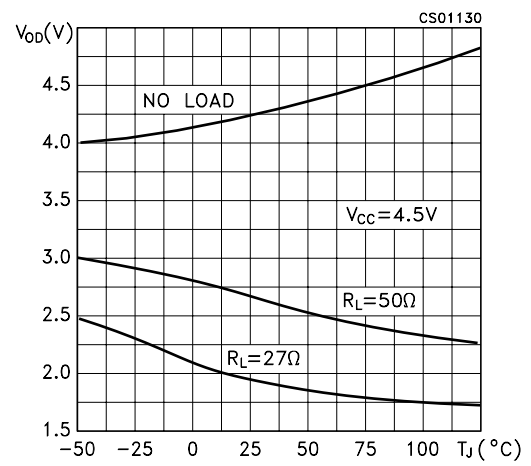
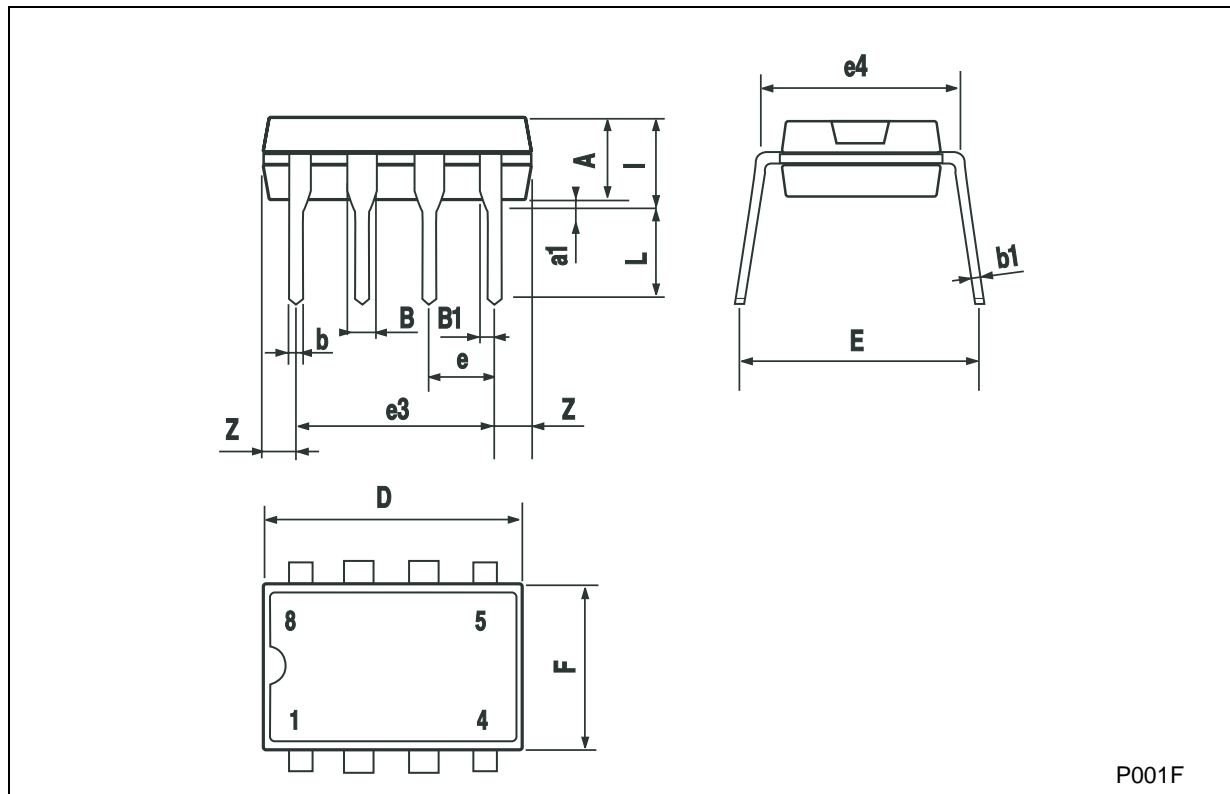


Figure 15 : Receiver Low Level Output Voltage vs Temperature**Figure 16** : Differential Driver Output Voltage vs Temperature

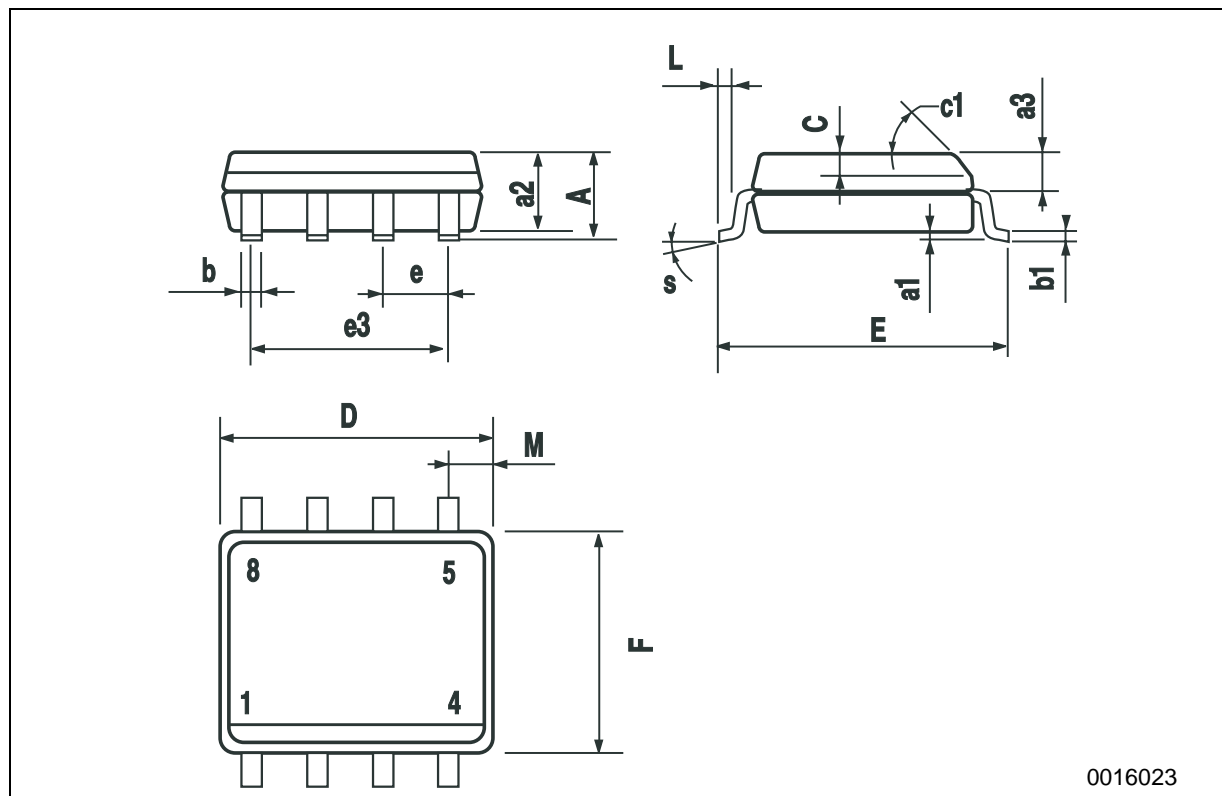
Plastic DIP-8 MECHANICAL DATA

| 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 |



SO-8 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|------------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.25 | 0.003 | | 0.009 |
| a2 | | | 1.65 | | | 0.064 |
| a3 | 0.65 | | 0.85 | 0.025 | | 0.033 |
| b | 0.35 | | 0.48 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | 0.25 | | 0.5 | 0.010 | | 0.019 |
| c1 | 45° (typ.) | | | | | |
| D | 4.8 | | 5.0 | 0.189 | | 0.196 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 3.81 | | | 0.150 | |
| F | 3.8 | | 4.0 | 0.149 | | 0.157 |
| L | 0.4 | | 1.27 | 0.015 | | 0.050 |
| M | | | 0.6 | | | 0.023 |
| S | 8° (max.) | | | | | |



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