

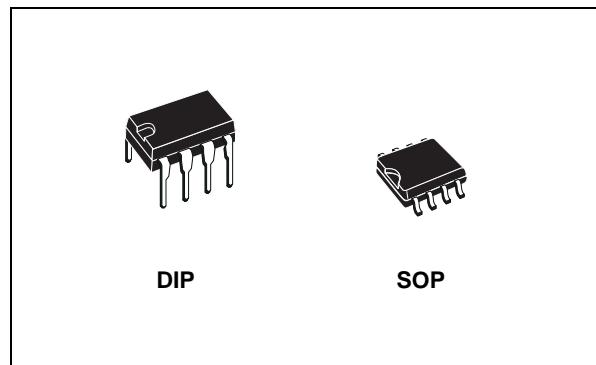


## LOW POWER HIGH SPEED RS-485/RS-422 TRANSCEIVER

- LOW SUPPLY CURRENT: 5mA MAX
- -7 TO 12 COMMON MODE INPUT VOLTAGE RANGE
- 70mV TYPICAL INPUT HYSTERESIS
- DESIGNED FOR 25Mbps OPERATION
- OPERATE FROM SINGLE 5V SUPPLY
- $\pm 4$ 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 5mA (typ.) of supply current when unloaded or fully loaded with disabled drivers. It operates from a single 5V supply.

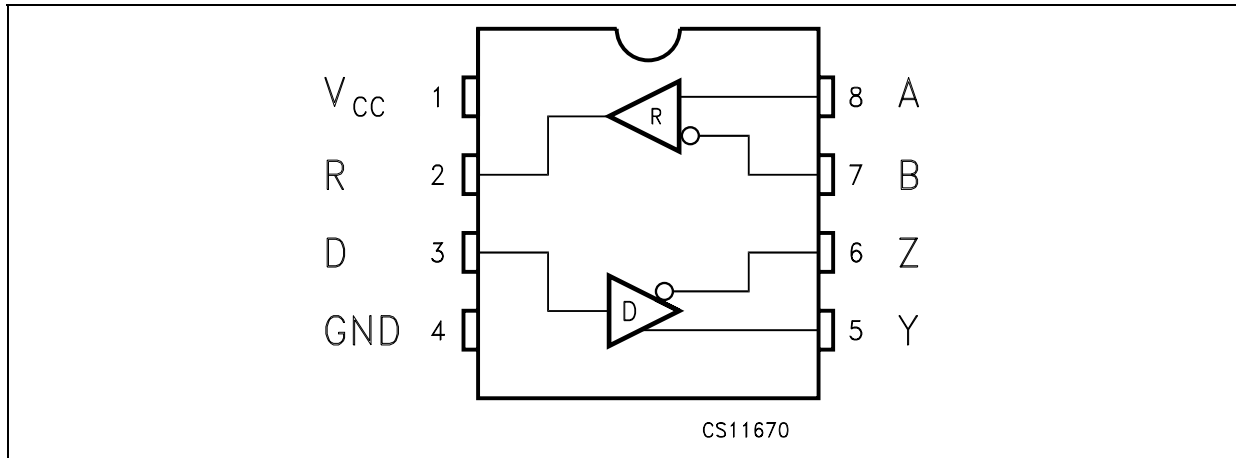


Driver is short-circuit current limited and is protected against excessive power dissipation by thermal shutdown circuitry that place the driver outputs into a high-impedance state. The receiver input has a fail-safe feature that guarantees a logic high output if both inputs are open circuit.

### ORDERING CODES

| Type      | Temperature Range | Package            | Comments                           |
|-----------|-------------------|--------------------|------------------------------------|
| ST490ACN  | 0 to 70 °C        | DIP-8              | 50parts per tube / 40tube per box  |
| ST490ABN  | -40 to 85 °C      | DIP-8              | 50parts per tube / 40tube per box  |
| ST490ACD  | 0 to 70 °C        | SO-8 (Tube)        | 100parts per tube / 20tube per box |
| ST490ABD  | -40 to 85 °C      | SO-8 (Tube)        | 100parts per tube / 20tube per box |
| ST490ACDR | 0 to 70 °C        | SO-8 (Tape & Reel) | 2500 parts per reel                |
| ST490ABDR | -40 to 85 °C      | SO-8 (Tape & Reel) | 2500 parts per reel                |

**PIN CONFIGURATION**



**PIN DESCRIPTION**

| PIN N° | SYMBOL          | NAME AND FUNCTION            |
|--------|-----------------|------------------------------|
| 1      | V <sub>CC</sub> | Supply Voltage               |
| 2      | RO              | Receiver Output.             |
| 3      | DI              | Driver Input.                |
| 4      | GND             | Ground                       |
| 5      | Z               | Inverting Driver Output      |
| 6      | Y               | Non-inverting Driver Output  |
| 7      | B               | Inverting Receiver Input     |
| 8      | A               | Non-inverting Receiver Input |

**TRUTH TABLE (DRIVER)**

| INPUT | OUTPUTS |   |
|-------|---------|---|
| DI    | Y       | Z |
| L     | L       | H |
| H     | H       | L |

X= Don't Care; Z=High Impedance

**TRUTH TABLE (RECEIVER)**

| DIFFERENTIAL INPUT    | OUTPUT |
|-----------------------|--------|
| A-B                   | RO     |
| ≥ -0.2V               | H      |
| between -0.2V to 0.2V | ?      |
| ≤ -0.2V               | L      |
| OPEN                  | H      |

?= Irrelevant; Z=High Impedance

**ABSOLUTE MAXIMUM RATINGS**

| Symbol                          | Parameter               | Value                           | Unit |
|---------------------------------|-------------------------|---------------------------------|------|
| V <sub>CC</sub>                 | Supply Voltage          | 7                               | V    |
| V <sub>DI</sub>                 | Driver Input Voltage    | -0.5 to 7                       | V    |
| V <sub>Y</sub> , V <sub>Z</sub> | Driver Output Voltage   | -7.5 to 12.5                    | V    |
| V <sub>A</sub> , V <sub>B</sub> | Receiver Input Voltage  | -7.5 to 12.5                    | V    |
| V <sub>RO</sub>                 | Receiver Output Voltage | -0.3 to (V <sub>CC</sub> + 0.3) | V    |
| ESD                             | Human Body Model        | 3.5                             | KV   |

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

**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 |
|--------------|---------------------------|-----------------|------|------|------|------|
| $I_{SUPPLY}$ | 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   |

**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) (Figure 1)       | 1.5      | 2.6  | 5         | V       |
| $V_{OD3}$       | Differential Drive Output (With Load)   | $R_L = 100\Omega$ (RS-422) (Figure 1)      | 2        | 3    |           | V       |
| $\Delta V_{OD}$ | Change in magnitude of Driver Differential Output Voltage for Complementary Output States (Note1) | $R_L = 54\Omega$ or $100\Omega$ (Figure 1) |          | 0    | 0.2       | V       |
| $V_{OC}$        | Driver Common Mode Output Voltage   | $R_L = 54\Omega$ (Figure 1)                | 1        |      | 3         | V       |
| $\Delta V_{OC}$ | Change in magnitude of Driver Common Mode Output Voltage (Note1)                                  | $R_L = 54\Omega$ (Figure 1)                |          | 0    | 0.2       | V       |
| $I_{OFF}$       | Power Off Output Current  | $V_{CC} = 0V$ $V_O = -7V$ to $12V$         |          |      | $\pm 100$ | $\mu A$ |
| $I_{OSD}$       | Driver Short Circuit Output Current   | $V_O = -7V$ to $12V$                       | $\pm 35$ |      | $\pm 250$ | mA      |
| $V_{IL}$        | Input Logic Threshold Low   |  |          |      | 0.8       | V       |
| $V_{IH}$        | Input Logic Threshold High  |  | 2        |      |           | V       |

**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       |
|-----------------|---|---|--------------|-------|-----------|------------|
| $I_{IN1}$       | Logic Input Current                     |   |              |       | $\pm 2.0$ | $\mu A$    |
| $I_{IN2}$       | Input Current (A, B)                    | other input=0V<br>$V_{CC} = 0$ or $5.25V$ | $V_{IN}=12V$ | 0.5   | 1         | mA         |
|                 |   |   | $V_{IN}=-7V$ | -0.35 | -0.8      | mA         |
| $V_{TH}$        | Receiver Differential Threshold Voltage | $V_{CM} = -7V$ to $12V$                   | -0.2         |       | 0.2       | V          |
| $\Delta V_{TH}$ | 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             | $I_{OUT} = 8mA$ , $V_{ID} = -200mV$       |              | 0.2   | 0.4       | V          |
| $R_{RIN}$       | Receiver Input Resistance               | $V_{CM} = -7V$ to $12V$                   | 12           | 24    |           | K $\Omega$ |
| $I_{OSR}$       | Receiver Short-Circuit Current          | $V_O = 0V$ to $V_{CC}$                    | 7            |       | 95        | mA         |

**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 |
| $t_{PLH}$<br>$t_{PHL}$ | 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   |
| $t_{TLH}$<br>$t_{THL}$ | Rise or Fall Differential Time    | $R_L = 54\Omega$ $C_{L1}=C_{L2}=50pF$ , (Figure 1) |      | 8    | 12   | ns   |
|                        |                                   |  |      |      |      |      |

**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 |
|------------------------|--|----------------------------|------|------|------|------|
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay Input to Output          | $C_L = 15pF$ (Figures 2,4) |      | 19   | 30   | ns   |
|                        |  |                            |      |      |      |      |
| $t_{SKD}$              | $ t_{PLH} - t_{PHL} $ Receiver Output Skew | $C_L = 15pF$ (Figures 2,4) |      | 1    | 3    | ns   |
| $t_{TLH}$<br>$t_{THL}$ | Rise or Fall Time                          | $C_L = 15pF$ (Figures 2,4) |      | 8    |      | ns   |
|                        |  |                            |      |      |      |      |

## TEST CIRCUITS AND TYPICAL CHARACTERISTICS

Figure 1 : Driver DC Test Load

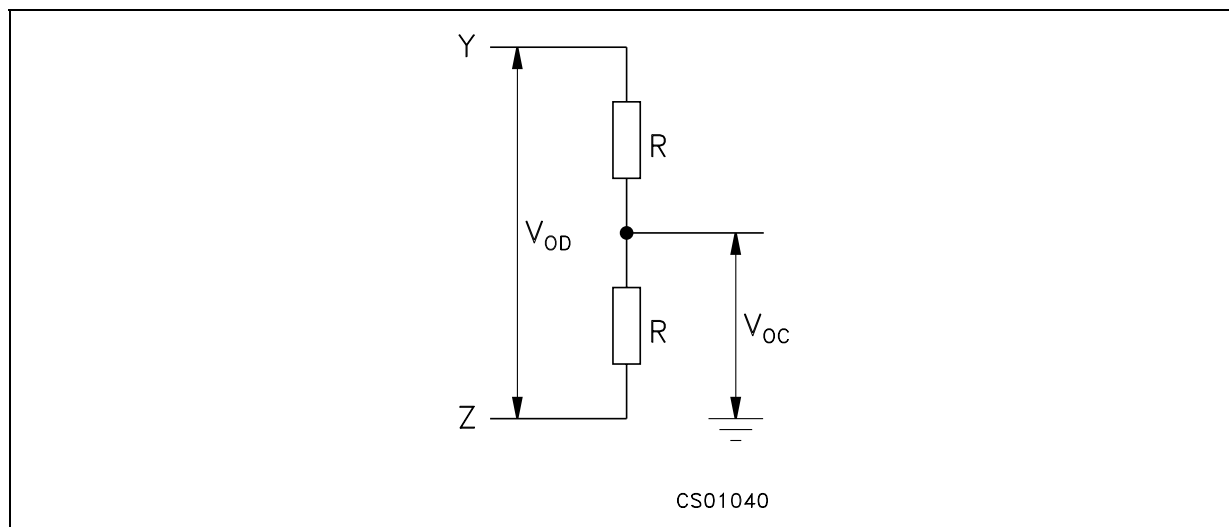


Figure 2 : Driver/Receiver Timing Test Circuit

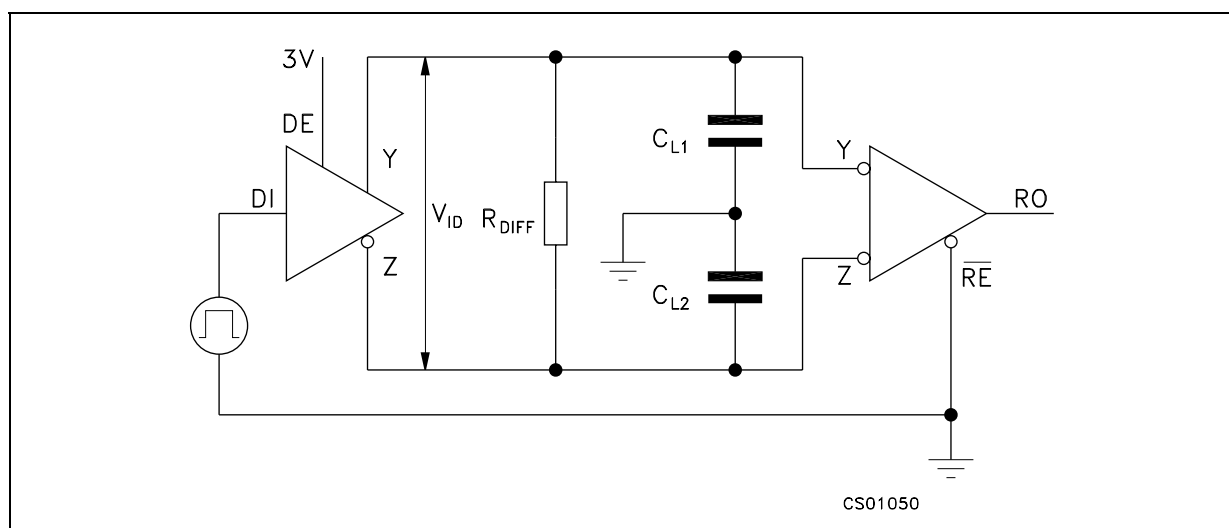


Figure 3 : Driver Propagation Delay

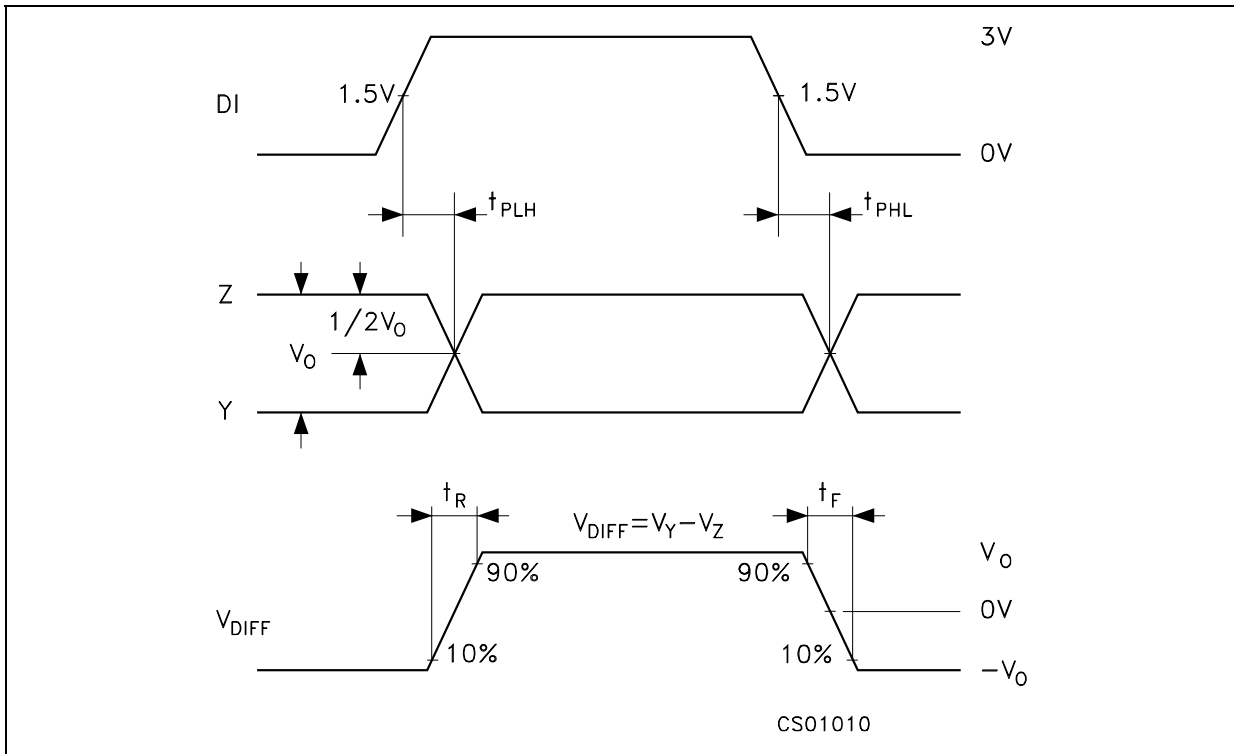
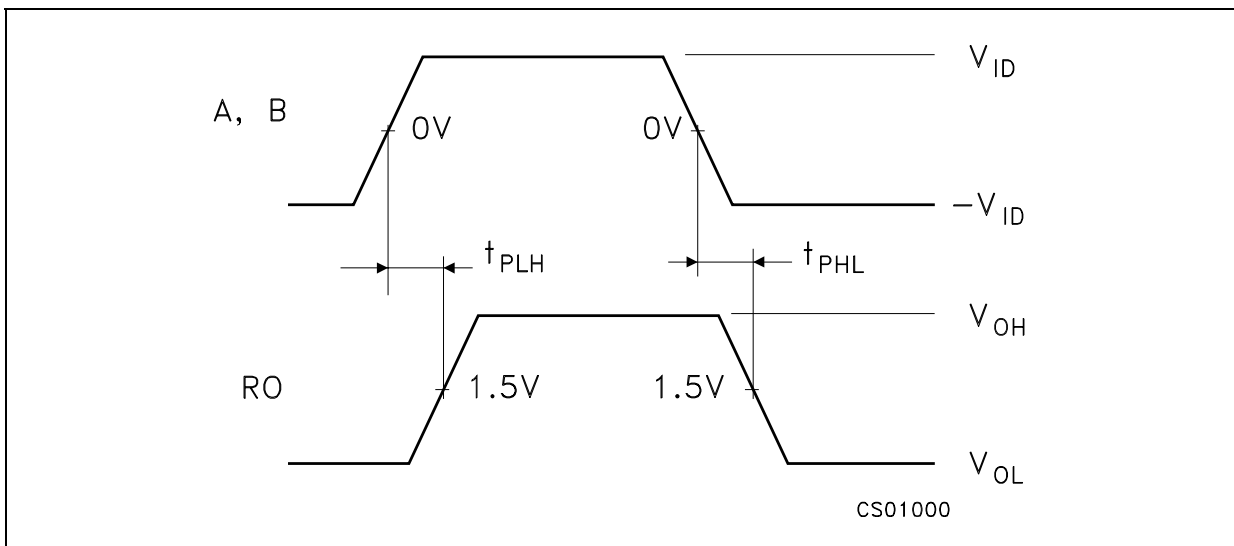
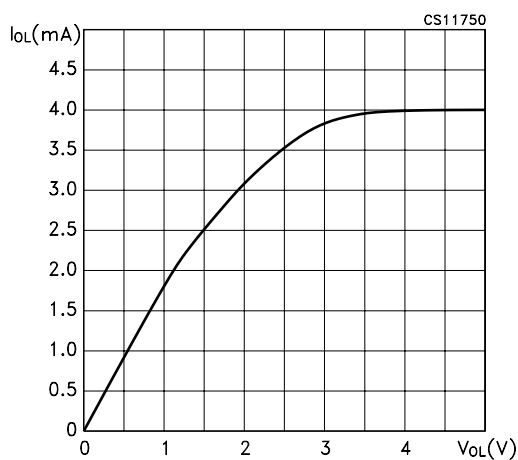


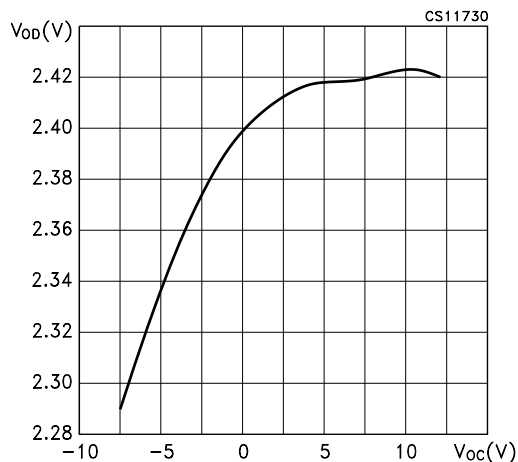
Figure 4 : Receiver Propagation Delay



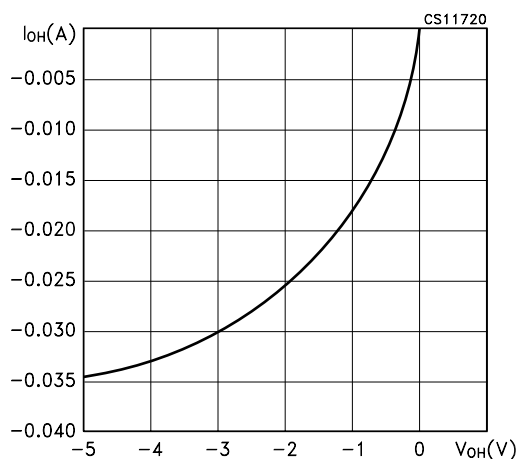
**Figure 5 :** Receiver Output Current vs Output Voltage (Output Low)



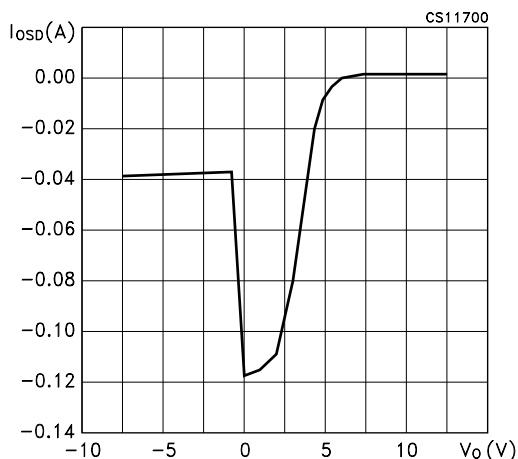
**Figure 8 :** Driver Diff. Output Voltage vs Common Mode Voltage (Diff. Output High)



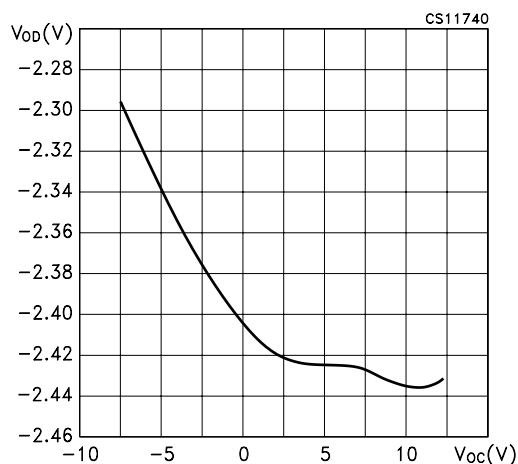
**Figure 6 :** Receiver Output Current vs Output Voltage (Output High)



**Figure 9 :** Driver Short Circuit Current vs Line Voltage (Output High)



**Figure 7 :** Driver Diff. Output Voltage vs Common Mode Voltage (Diff. Output Low)



**Figure 10 :** Driver Short Circuit Current vs. Line Voltage (Output Low)

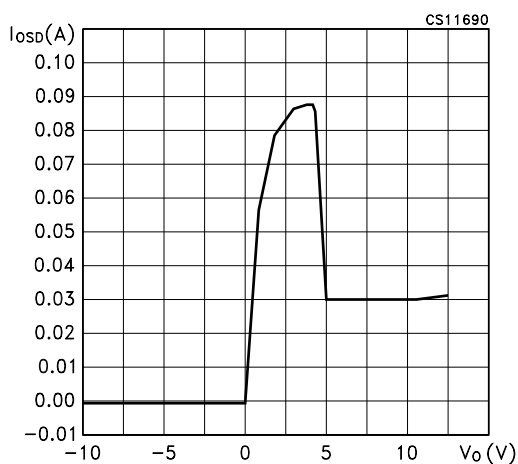
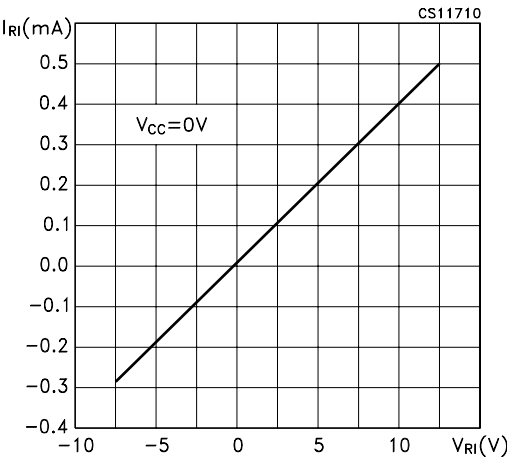


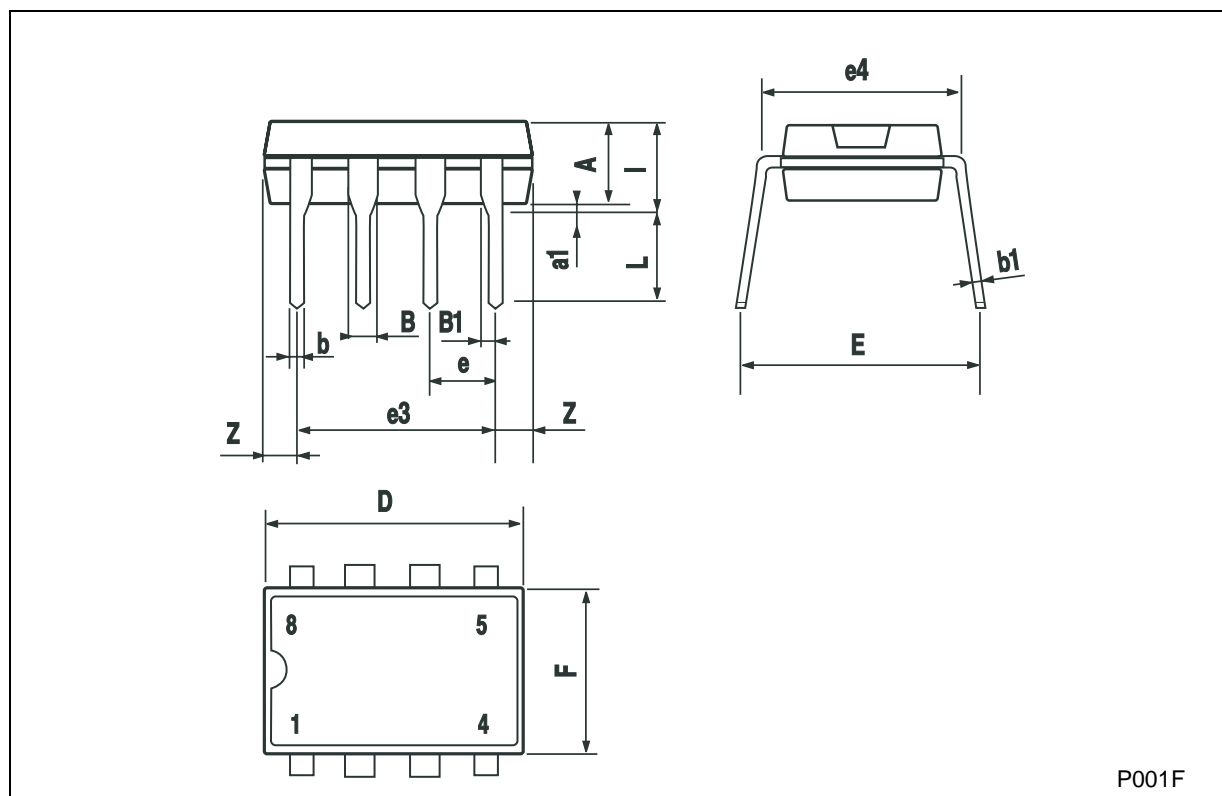
Figure 11 : Receiver Input Current vs Input Voltage





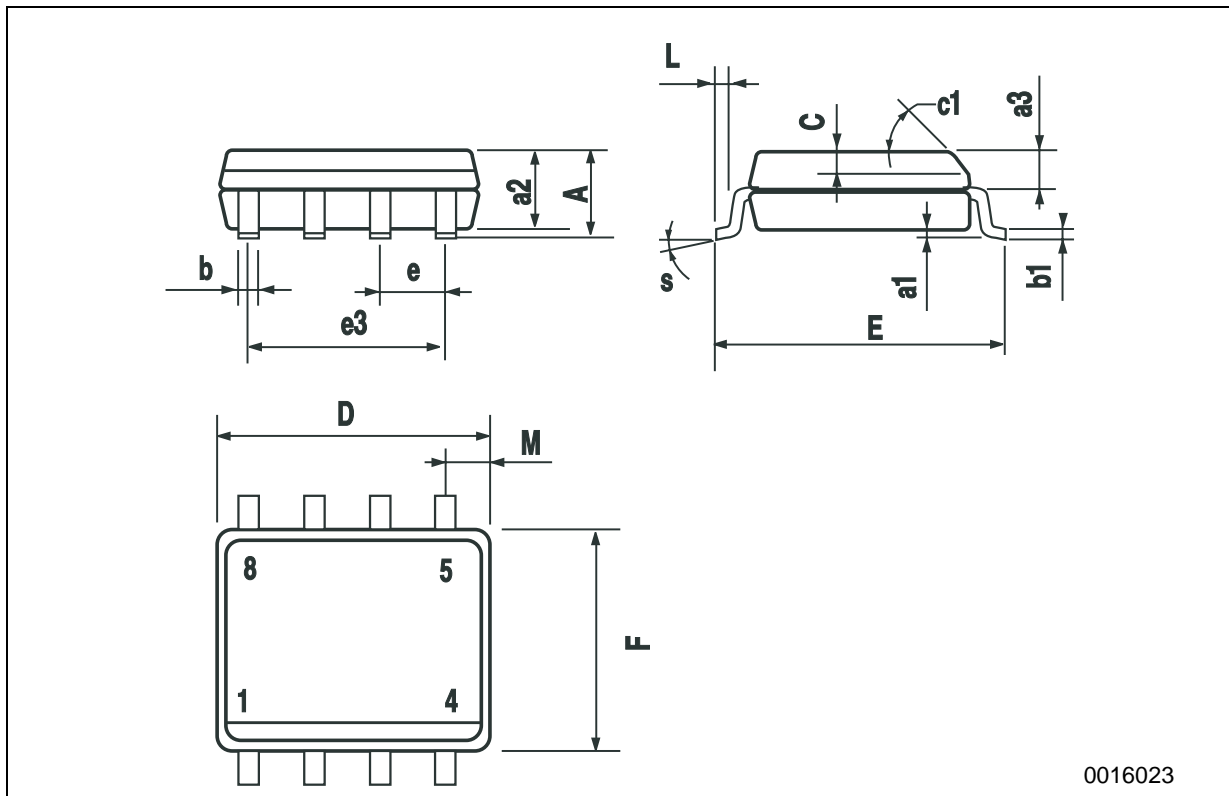
### Plastic DIP-8 MECHANICAL DATA

| 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 |



**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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