



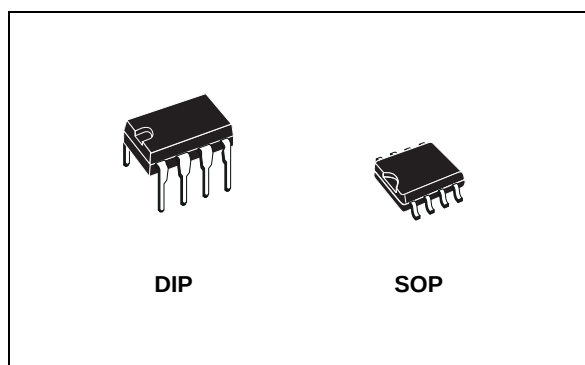
## ST485E

### ±15KV ESD PROTECTED, LOW POWER RS-485/RS-422 TRANSCEIVER

- LOW QUIESCENT CURRENT: 300µA
- 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
- ESD PROTECTION:  
±15KV (H.B.M.)  
±8KV (IEC-1000-4-2 CONTACT DISCHARGE)
- ALLOWS UP TO 64 TRANSCEIVERS ON THE BUS

#### DESCRIPTION

The ST485E is a low power transceiver for RS-485 and RS-422 communication. Each driver output and receiver input is protected against ±15KV electrostatic discharge (H.B.M.) (ESD) shocks, without latchup. These parts contain one



driver and one receiver in half duplex configuration.

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

It operates from a single 5V supply.

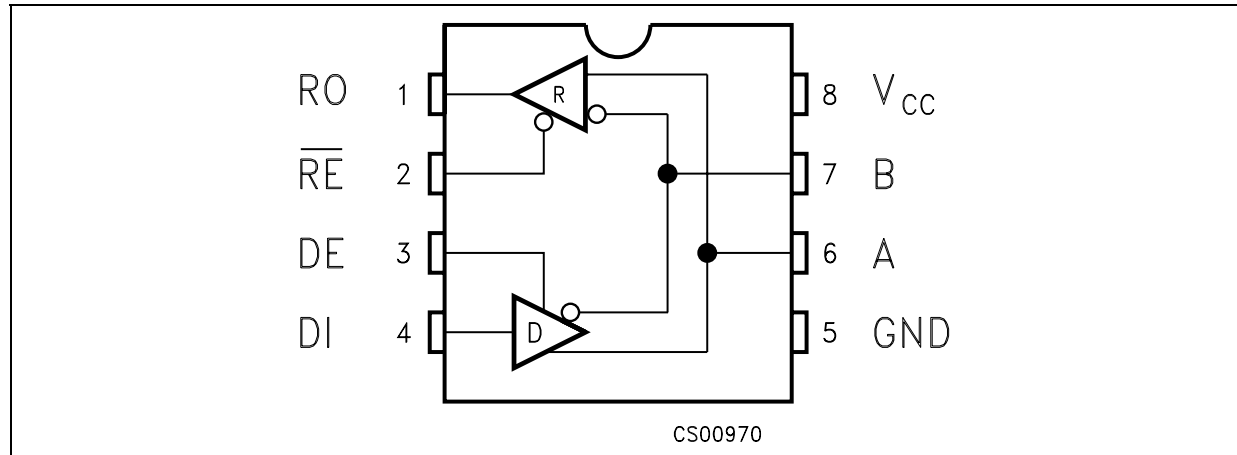
Driver is short-circuit current limited and is protected against excessive power dissipation by thermal shutdown circuitry that places the driver outputs into a high-impedance state.

The ST485E is designed for bi-directional data communications on multipoint bus transmission line (half-duplex applications).

#### ORDERING CODES

| Type      | Temperature Range | Package            | Comments                           |
|-----------|-------------------|--------------------|------------------------------------|
| ST485ECN  | 0 to 70 °C        | DIP-8              | 50parts per tube / 40tube per box  |
| ST485EBN  | -40 to 85 °C      | DIP-8              | 50parts per tube / 40tube per box  |
| ST485EXN  | -55 to 125 °C     | DIP-8              | 50parts per tube / 40tube per box  |
| ST485ECD  | 0 to 70 °C        | SO-8 (Tube)        | 100parts per tube / 20tube per box |
| ST485EBD  | -40 to 85 °C      | SO-8 (Tube)        | 100parts per tube / 20tube per box |
| ST485EXD  | -55 to 125 °C     | SO-8 (Tube)        | 100parts per tube / 20tube per box |
| ST485ECDR | 0 to 70 °C        | SO-8 (Tape & Reel) | 2500 parts per reel                |
| ST485EBDR | -40 to 85 °C      | SO-8 (Tape & Reel) | 2500 parts per reel                |
| ST485EXDR | -55 to 125 °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 <sub>CC</sub> | 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  | $\geq +0.2V$ | H      |
| L      | L  | $\leq -0.2V$ | 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 <sub>CC</sub> | Supply Voltage                 | 7                               | V    |
| V <sub>I</sub>  | Control Input Voltage (RE, DE) | -0.5 to (V <sub>CC</sub> + 0.5) | V    |
| V <sub>DI</sub> | Driver Input Voltage (DI)      | -0.5 to (V <sub>CC</sub> + 0.5) | V    |
| V <sub>DO</sub> | Driver Output Voltage (A, B)   | ± 14                            | V    |
| V <sub>RI</sub> | Receiver Input Voltage (A, B)  | ± 14                            | V    |
| V <sub>RO</sub> | Receiver Output Voltage (RO)   | -0.5 to (V <sub>CC</sub> + 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.

**ESD PERFORMANCE: TRANSMITTER OUTPUTS, RECEIVER INPUTS**

| Symbol | Parameter              | Test Conditions  | Min. | Typ. | Max. | Unit |
|--------|------------------------|------------------|------|------|------|------|
| ESD    | ESD Protection Voltage | Human Body Model | ±15  |      |      | KV   |
| ESD    | ESD Protection Voltage | IEC-1000-4-2     | ±8   |      |      | KV   |

**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                                                                  | Min. | Typ.       | Max.       | Unit     |
|-----------------|-------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------|------------|------------|----------|
| $V_{OD1}$       | Differential Driver Output (No Load)                                                      |                                                                                  |      |            | 5          | V        |
| $V_{OD2}$       | Differential Driver Output (With Load)                                                    | $R_L = 27\Omega$ (RS-485) (See Fig. 1)<br>$R_L = 50\Omega$ (RS-422) (See Fig. 1) | 1.5  |            | 5<br>5     | V<br>V   |
| $\Delta V_{OD}$ | Change in Magnitude of Driver Differential Output Voltage for Complementary Output States | $R_L = 27\Omega$ or $50\Omega$ (See Fig. 1)                                      |      |            | 0.2        | V        |
| $V_{OC}$        | Driver Common-Mode Output Voltage                                                         | $R_L = 27\Omega$ or $50\Omega$ (See Fig. 1)                                      |      |            | 3          | V        |
| $\Delta V_{OC}$ | Change in Magnitude of Driver Common-Mode Output Voltage for Complementary Output States  | $R_L = 27\Omega$ or $50\Omega$ (See Fig. 1)                                      |      |            | 0.2        | V        |
| $V_{IH}$        | Input High Voltage                                                                        | RE, DE, DI                                                                       | 2.0  |            |            | V        |
| $V_{IL}$        | Input Low Voltage                                                                         | RE, DE, DI                                                                       |      |            | 0.8        | V        |
| $I_{IN1}$       | Input Current                                                                             | RE, DE, DI                                                                       |      |            | ± 2        | μA       |
| $I_{IN2}$       | Input Current (A, B)                                                                      | $V_{CM} = 0V$ or $5.25V$ $V_{DE} = 0V$<br>$V_{IN} = 12V$<br>$V_{IN} = -7V$       |      |            | 1<br>-0.8  | mA<br>mA |
| $V_{TH}$        | Receiver Differential Threshold Voltage                                                   | $V_{CM} = -7$ to $12V$                                                           | -0.2 |            | 0.2        | V        |
| $\Delta V_{TH}$ | Receiver Input Hysteresis                                                                 | $V_{CM} = 0V$                                                                    |      | 70         |            | mV       |
| $V_{OH}$        | Receiver Output High Voltage                                                              | $I_O = -4mA$ $V_{ID} = 200mV$                                                    | 3.5  |            |            | V        |
| $V_{OL}$        | Receiver Output Low Voltage                                                               | $I_O = 4mA$ $V_{ID} = -200mV$                                                    |      |            | 0.4        | V        |
| $I_{OZR}$       | 3-State (High Impedance) Output Current at Receiver                                       | $V_O = 0.4$ to $2.4V$                                                            |      |            | ± 1        | μA       |
| $R_{IN}$        | Receiver Input Resistance                                                                 | $V_{CM} = -7$ to $12V$                                                           | 24   |            |            | KΩ       |
| $I_{CC}$        | No Load Supply Current (Note 2)                                                           | $V_{RE} = 0V$ or $V_{CC}$<br>$V_{DE} = V_{CC}$<br>$V_{DE} = 0V$                  |      | 400<br>300 | 900<br>500 | μA<br>μA |
| $I_{OSD1}$      | Driver Short-Circuit Current, $V_O = High$                                                | $V_O = -7$ to $12V$ (Note 3)                                                     | 35   |            | 250        | mA       |
| $I_{OSD2}$      | Driver Short-Circuit Current, $V_O = Low$                                                 | $V_O = -7$ to $12V$ (Note 3)                                                     | 35   |            | 250        | mA       |
| $I_{OSR}$       | Receiver Short-Circuit Current                                                            | $V_O = 0V$ to $V_{CC}$                                                           | 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                                                       | Min. | Typ. | Max. | Unit |
|------------------------|-----------------------------------|-----------------------------------------------------------------------|------|------|------|------|
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay Input to Output | $R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$<br>(See Fig. 3 and 5) |      | 25   | 45   | ns   |
| $t_{SK}$               | Output Skew to Output             | $R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$<br>(See Fig. 3 and 5) |      | 2    | 5    | ns   |
| $t_{TLH}$<br>$t_{THL}$ | Rise or Fall Time                 | $R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$<br>(See Fig. 3 and 5) |      | 15   | 40   | ns   |
| $t_{PZH}$              | Output Enable Time                | $C_L = 100pF$ $S2 = \text{Closed}$<br>(See Fig. 4 and 6)              |      | 35   | 50   | ns   |
| $t_{PZL}$              | Output Enable Time                | $C_L = 100pF$ $S1 = \text{Closed}$<br>(See Fig. 4 and 6)              |      | 25   | 40   | ns   |
| $t_{PLZ}$              | Output Disable Time               | $C_L = 15pF$ $S1 = \text{Closed}$<br>(See Fig. 4 and 6)               |      | 25   | 40   | ns   |
| $t_{PHZ}$              | Output Disable Time               | $C_L = 15pF$ $S2 = \text{Closed}$<br>(See Fig. 4 and 6)               |      | 35   | 50   | 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                                                       | Min. | Typ. | Max. | Unit |
|------------------------|-----------------------------------|-----------------------------------------------------------------------|------|------|------|------|
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay Input to Output | $R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$<br>(See Fig. 3 and 7) |      | 110  | 130  | ns   |
| $t_{SKD}$              | Differential Receiver Skew        | $R_{DIFF} = 54\Omega$ $C_{L1} = C_{L2} = 100pF$<br>(See Fig. 3 and 7) |      | 5    | 10   | ns   |
| $t_{PZH}$              | Output Enable Time                | $C_{RL} = 15pF$ $S2 = \text{Closed}$<br>(See Fig. 2 and 8)            |      | 11   | 35   | ns   |
| $t_{PZL}$              | Output Enable Time                | $C_{RL} = 15pF$ $S1 = \text{Closed}$<br>(See Fig. 2 and 8)            |      | 13   | 35   | ns   |
| $t_{PLZ}$              | Output Disable Time               | $C_{RL} = 15pF$ $S1 = \text{Closed}$<br>(See Fig. 2 and 8)            |      | 13   | 35   | ns   |
| $t_{PHZ}$              | Output Disable Time               | $C_{RL} = 15pF$ $S2 = \text{Closed}$<br>(See Fig. 2 and 8)            |      | 11   | 35   | ns   |
| $f_{MAX}$              | Maximum Data Rate                 |                                                                       | 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

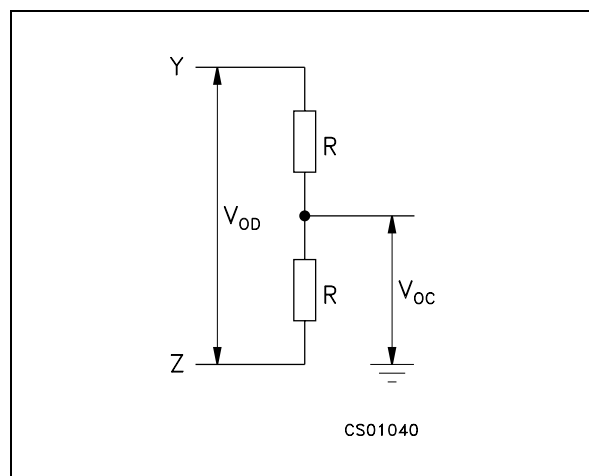


Figure 3 : Drive/Receiver Timing Test Circuit

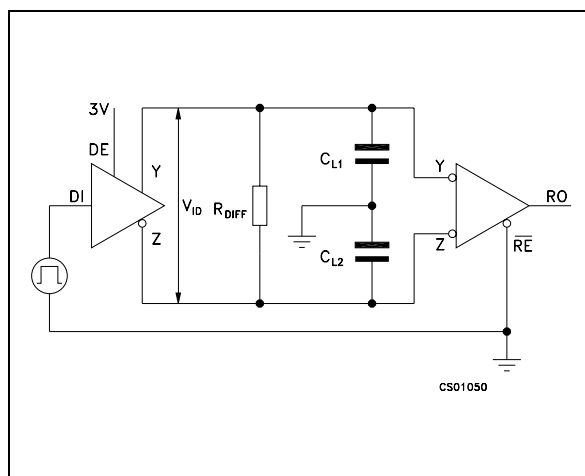


Figure 2 : Receiver Timing Test Load

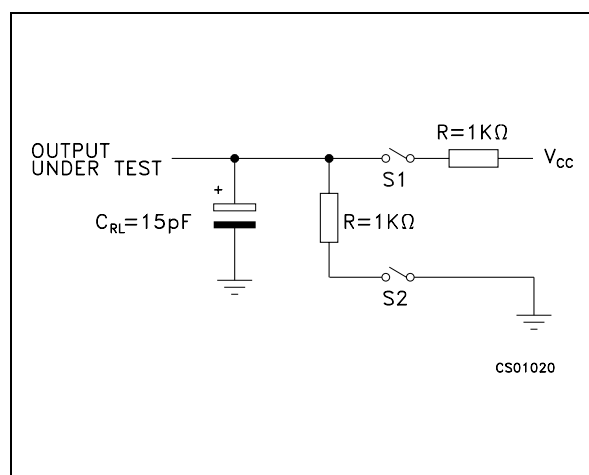
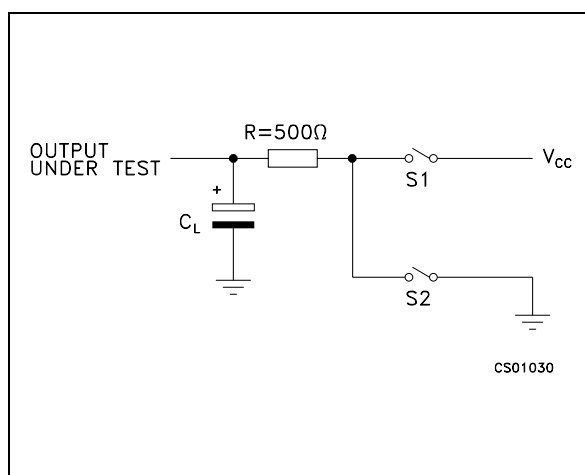
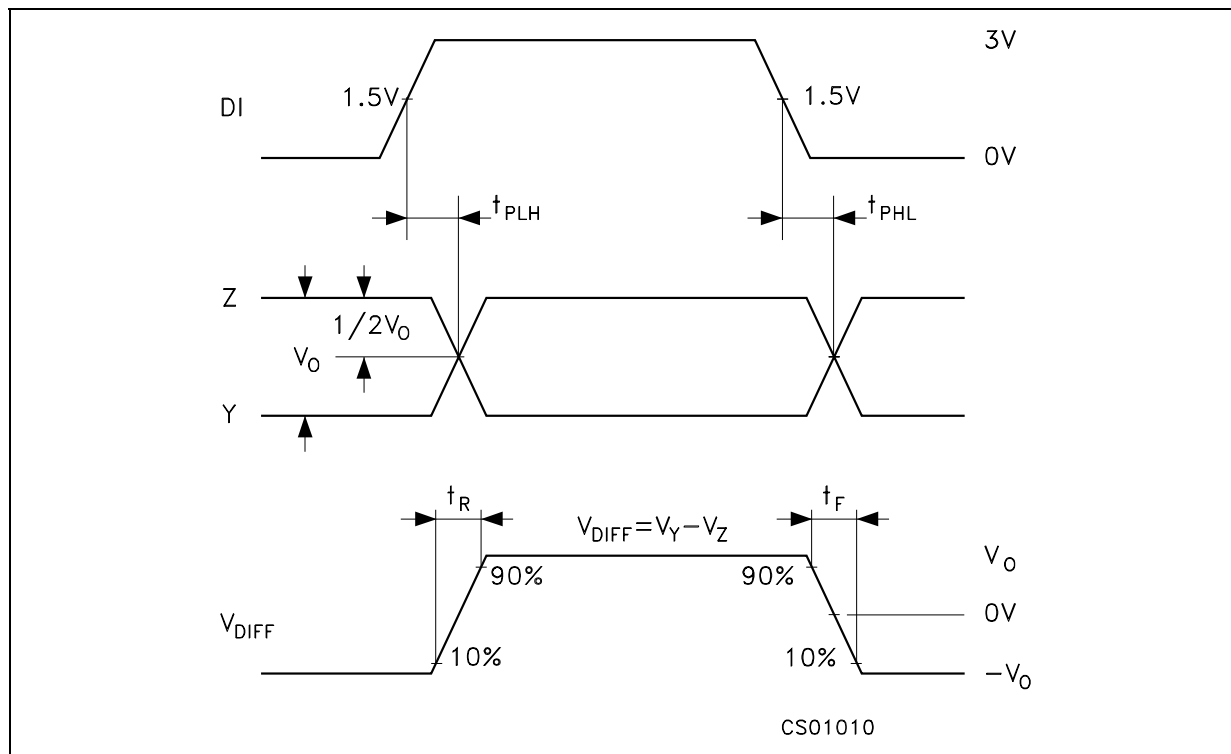
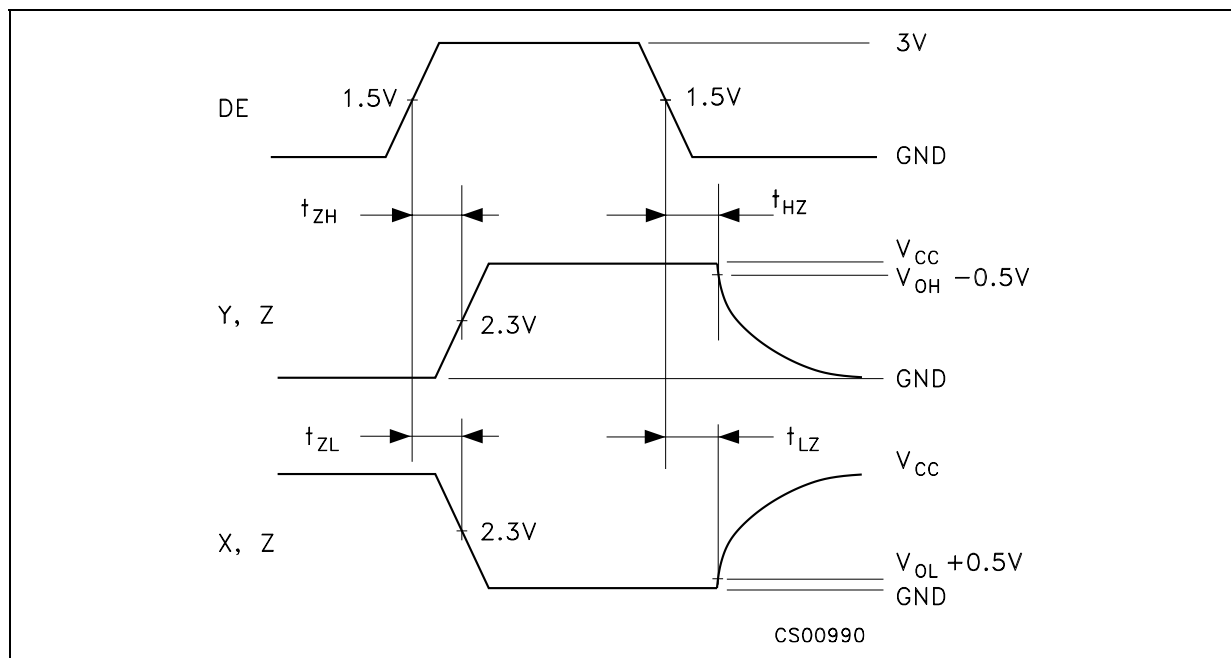
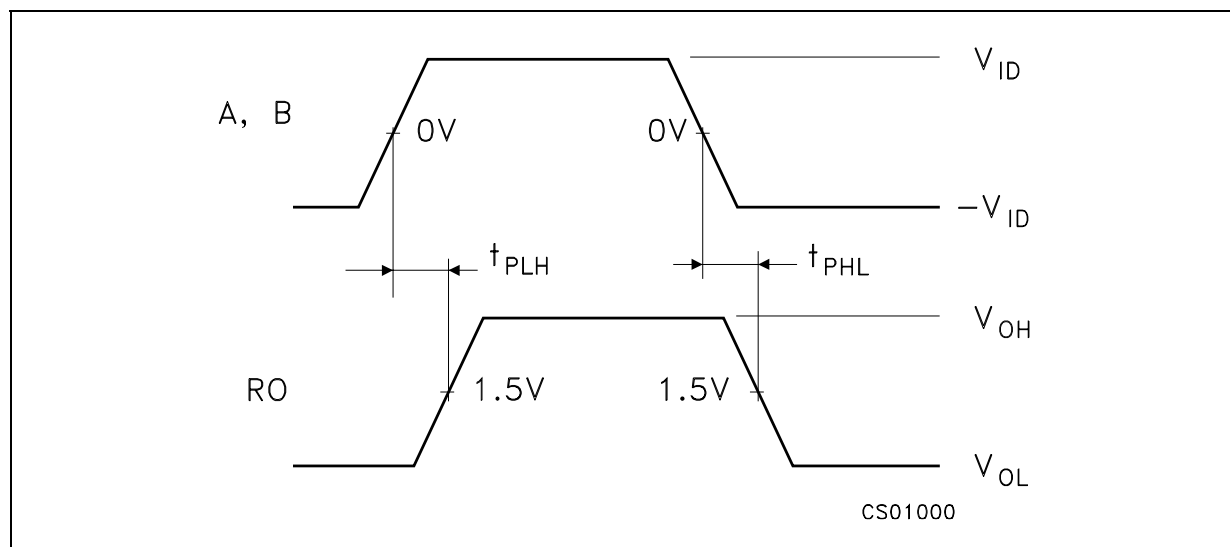
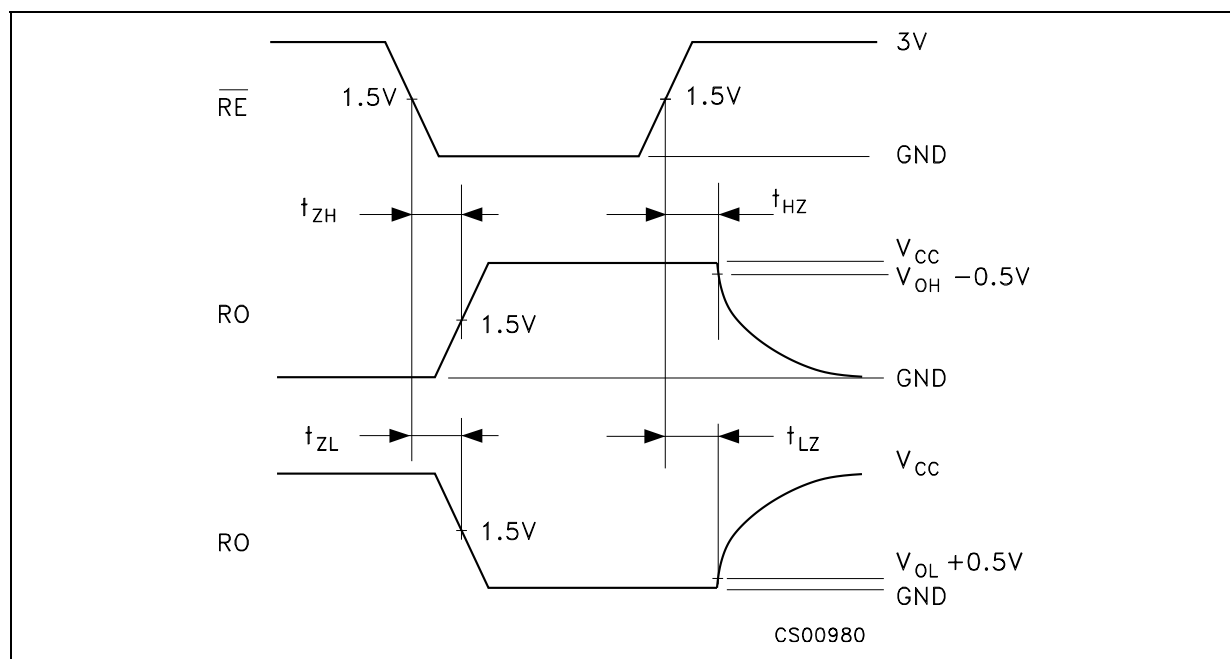


Figure 4 : Driver Timing Test Load



**Figure 5 : Driver Propagation Delay****Figure 6 : Driver Enable and Disable Time**

**Figure 7 : Receiver Propagation Delay****Figure 8 : Receiver Enable and Disable Time**

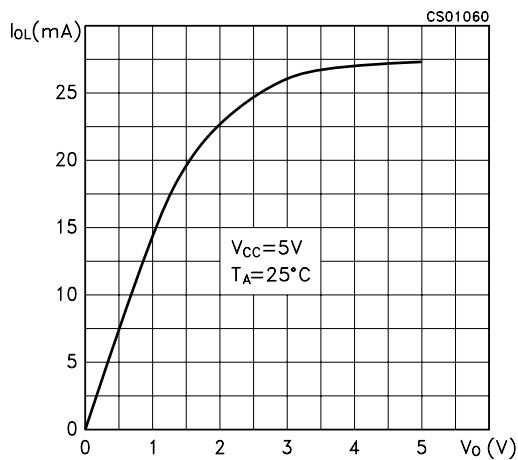
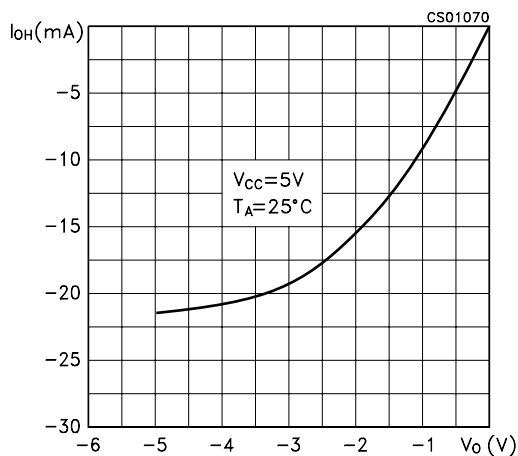
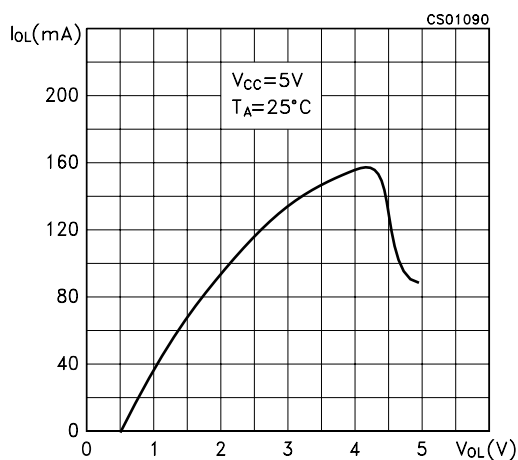
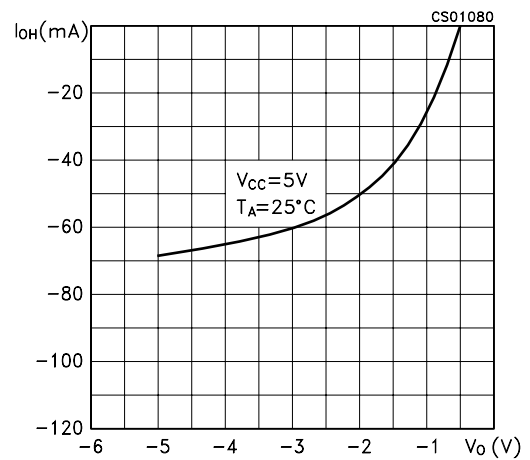
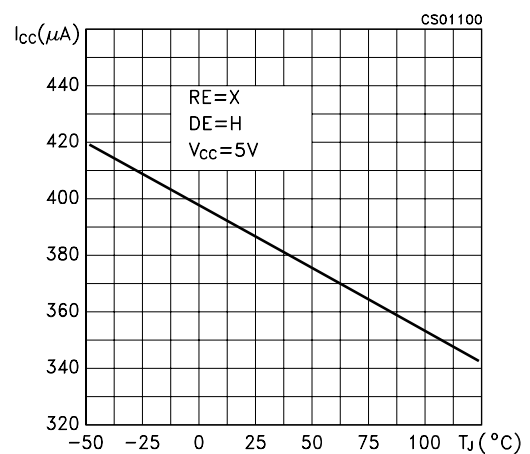
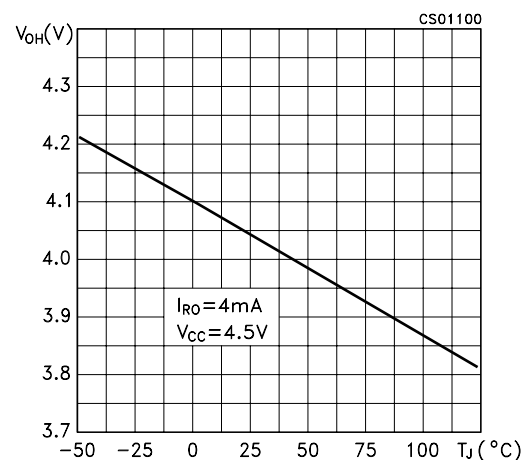
**Figure 9 : Receiver Output Current vs Output Low Voltage****Figure 10 : Receiver Output Current vs Output High Voltage****Figure 11 : Driver Output Current vs Output Low Voltage****Figure 12 : Driver Output Current vs Output High Voltage****Figure 13 : Supply Current vs Temperature****Figure 14 : Receiver High Level Output Voltage vs Temperature**



Figure 15 : Receiver Low Level Output Voltage vs Temperature

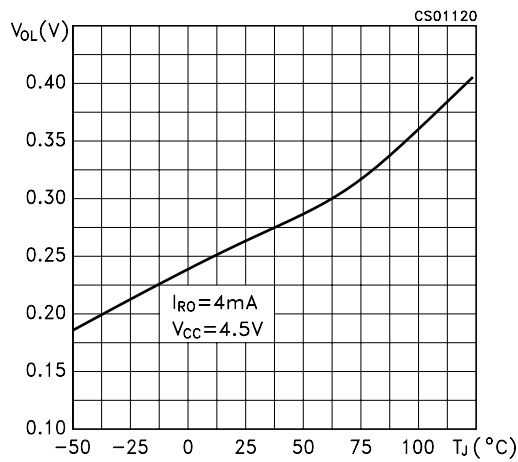
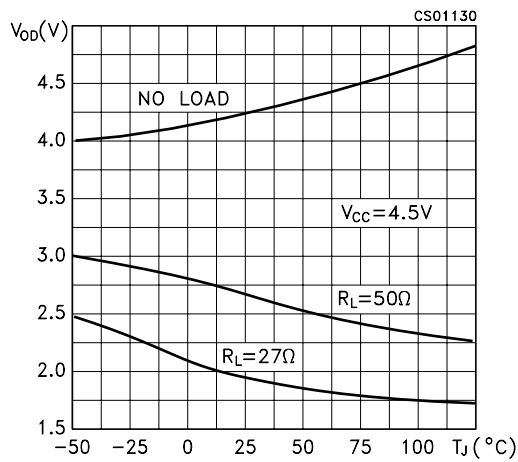
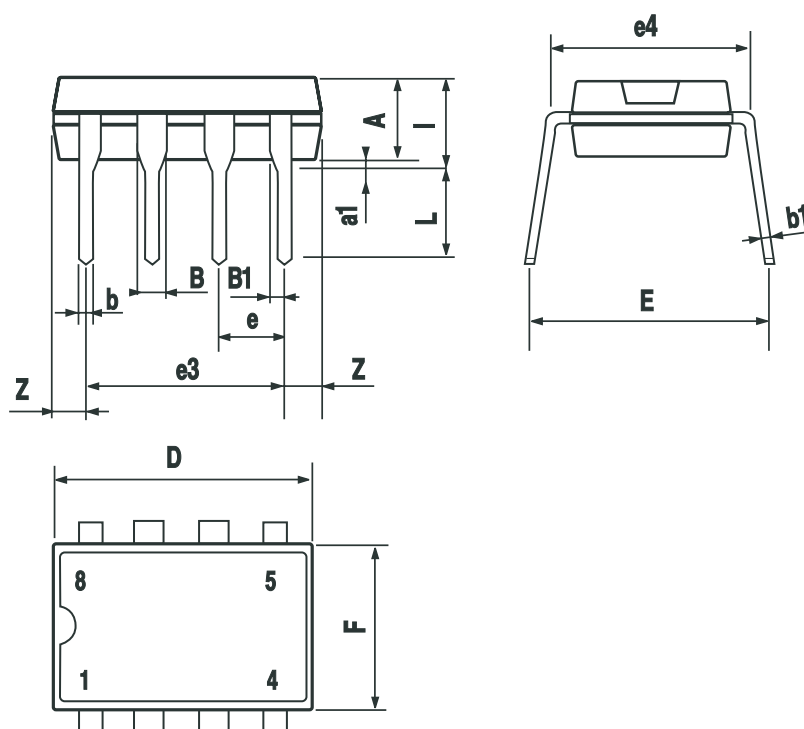


Figure 16 : Differential Driver Output Voltage vs Temperature



### Plastic DIP-8 MECHANICAL DATA

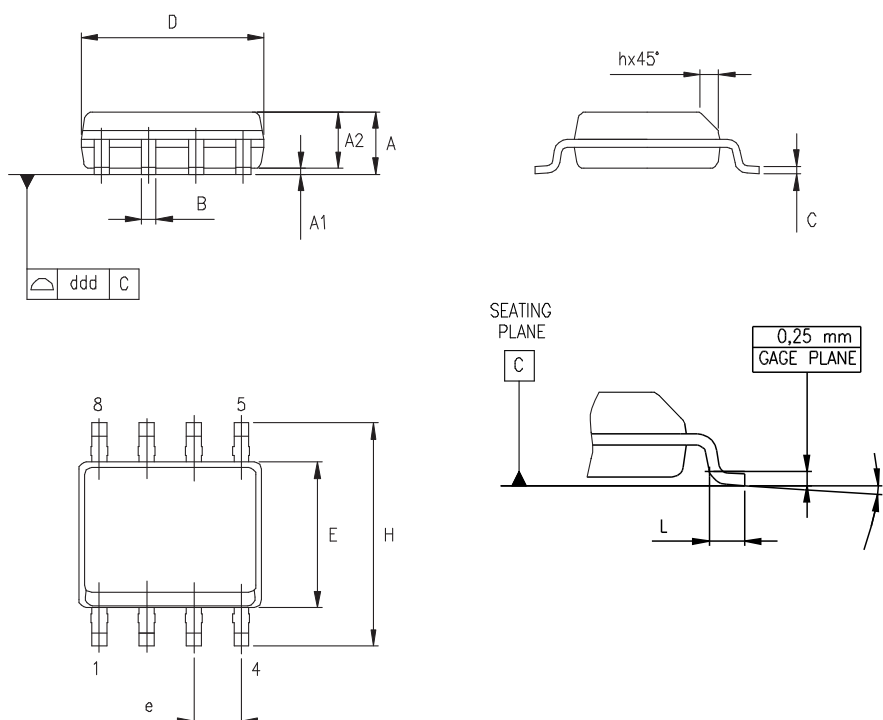
| DIM. | mm.  |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP  | MAX. | MIN.  | TYP.  | MAX.  |
| A    |      | 3.3  |      |       | 0.130 |       |
| a1   | 0.7  |      |      | 0.028 |       |       |
| B    | 1.39 |      | 1.65 | 0.055 |       | 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 |



P001F

## SO-8 MECHANICAL DATA

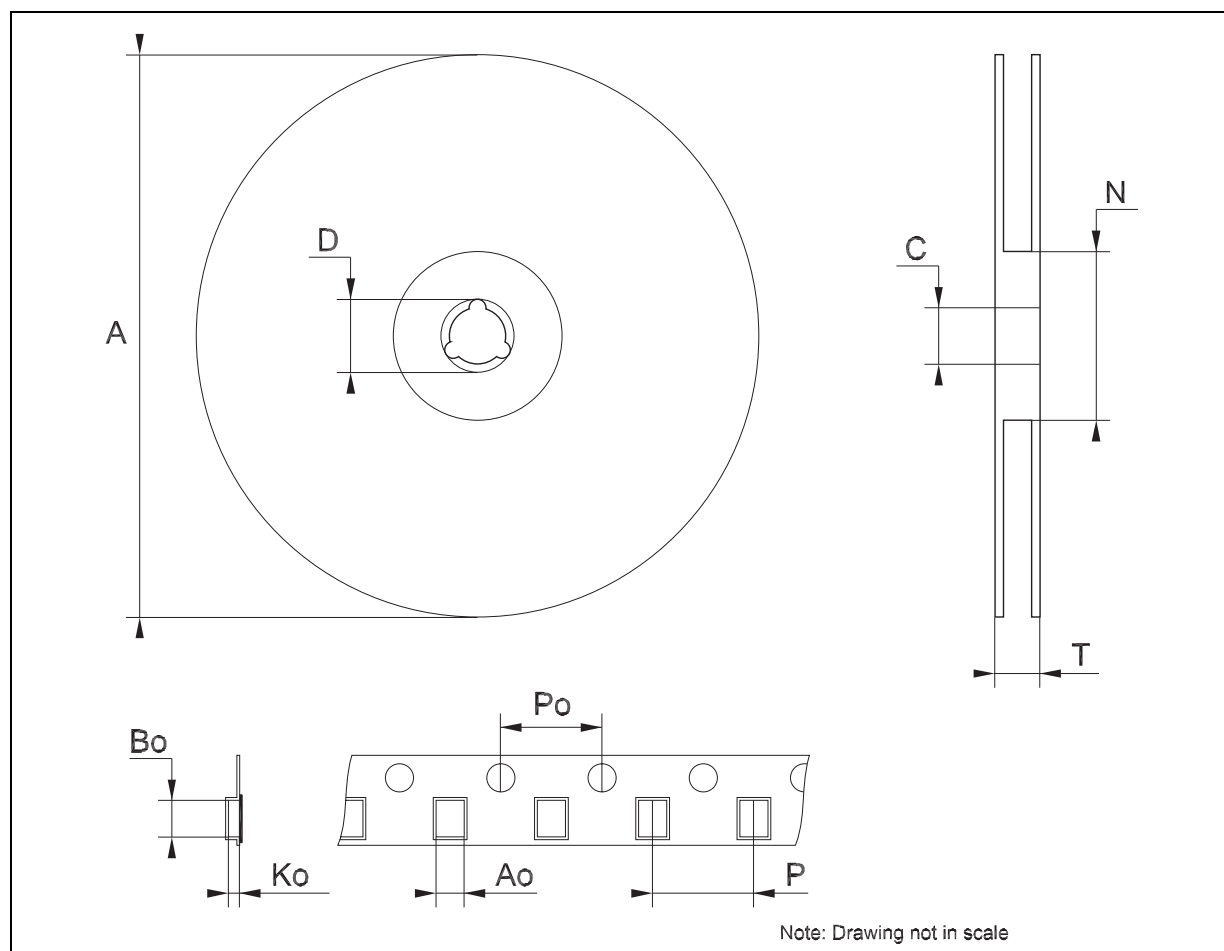
| DIM. | mm.       |      |      | inch  |       |       |
|------|-----------|------|------|-------|-------|-------|
|      | MIN.      | TYP  | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 1.35      |      | 1.75 | 0.053 |       | 0.069 |
| A1   | 0.10      |      | 0.25 | 0.04  |       | 0.010 |
| A2   | 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    | g° (max.) |      |      |       |       |       |
| ddd  |           |      | 0.1  |       |       | 0.04  |



0016023/C

## Tape &amp; 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  |



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