

## High speed differential line drivers

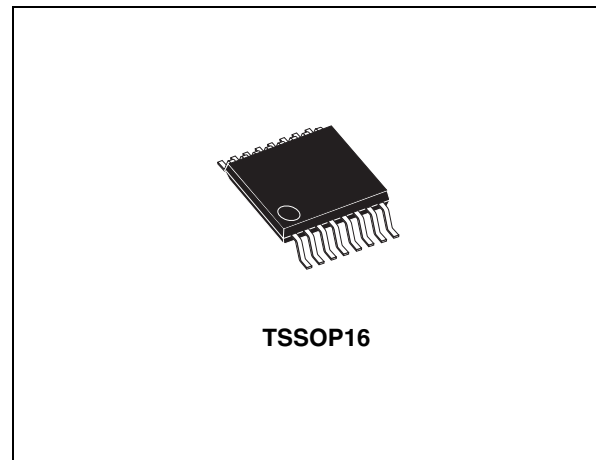
### Features

- Meets or exceeds the requirements of ANSI TIA/EIA-644 standard
- Low voltage differential signaling with typical output voltage of 350 mV and a 100  $\Omega$  load
- Typical output voltage rise and fall times of 750 ps (400 Mbps)
- Typical propagation delay times of 1.7 ns
- Operates from a single 3.3 V supply
- Power dissipation 25 mW typical per driver at 200 MHz
- Driver at high impedance when disabled or with  $V_{CC} = 0$  V
- Pin compatible with the AM26LS31, SN65LVDS31
- Low voltage TTL (LVTTTL) logic input levels

### Description

The STLVDS31B is a quad differential line drivers that implements the electrical characteristics of low voltage differential signaling (LVDS). This signaling technique lowers the output voltage levels of 5 V differential standard levels (such as TIA/EIA-422B) to reduce the power, increase the switching speeds and allows operations with a 3.3 V supply rail. Any of the four current mode drivers will deliver a minimum differential output voltage magnitude of 247 mV into a 100  $\Omega$  load when enabled.

The intended application of this device and signalling technique is for point-to-point baseband data transmission over controlled impedancemedia approximately 100  $\Omega$ . The



transmission media may be printed circuit board traces, backplanes or cables. The ultimate rate and distance of data transfer is dependent upon the attenuation characteristics of the media and noise coupling to the environment.

The STLVDS31B is characterized for operation from - 55  $^{\circ}$ C to 125  $^{\circ}$ C.

**Table 1. Device summary**

| Order code  | Temperature range       | Package                 | Packaging           |
|-------------|-------------------------|-------------------------|---------------------|
| STLVDS31BTR | - 40 to 85 $^{\circ}$ C | TSSOP16 (tape and reel) | 2500 parts per reel |

# Contents

|   |   |    |
|---|---|----|
| 1 | Pin configuration .....                   | 3  |
| 2 | Maximum ratings .....                     | 5  |
| 3 | Electrical characteristics .....          | 6  |
| 4 | Typical characteristics .....             | 8  |
| 5 | Typical performance characteristics ..... | 10 |
| 6 | Package mechanical data .....             | 11 |
| 7 | Revision history .....                    | 14 |

# 1 Pin configuration

Figure 1. Pin connections and functional diagram

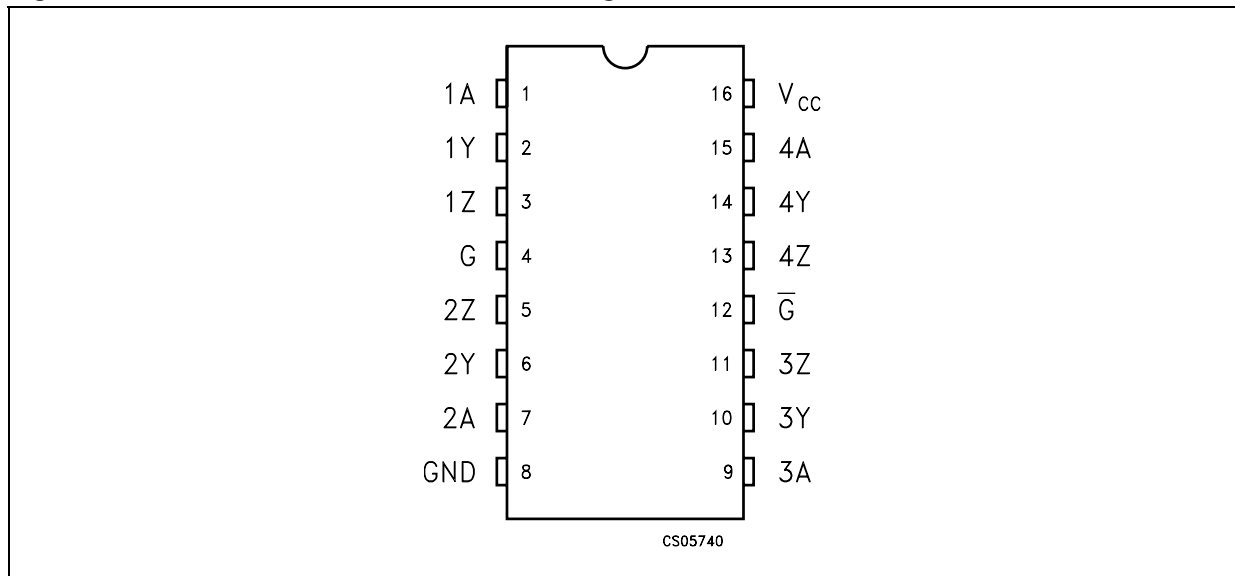


Table 2. Pin description

| Pin n°       | Symbol          | Name and function |
|--------------|-----------------|-------------------|
| 1, 7, 9, 15  | 1A to 4A        | Driver inputs     |
| 2, 6, 10, 14 | 1Y to 4Y        | Driver outputs    |
| 3, 5, 11, 13 | 1Z to 4Z        | Driver outputs    |
| 4            | G               | Enable            |
| 12           | G               | Enable            |
| 8            | GND             | Ground            |
| 16           | V <sub>CC</sub> | Supply voltage    |

Figure 2. Logic diagram and logic symbol

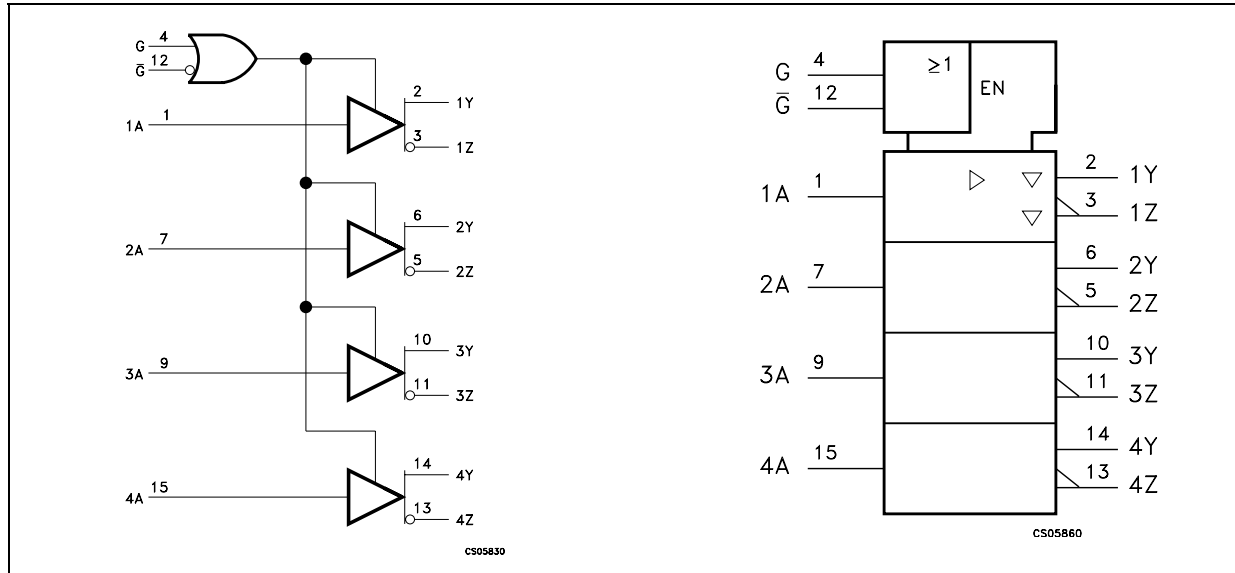


Table 3. Truth table for receiver

| $V_{ID} = V_A - V_B$                        | R |
|---|---|
| $V_{ID} \geq 100 \text{ mV}$                | H |
| $-100 \text{ mV} < V_{ID} < 100 \text{ mV}$ | ? |
| $V_{ID} \leq -100 \text{ mV}$               | L |
| OPEN  | H |

Table 4. Truth table

| Input | Enables |           | Outputs |   |
|-------|---------|-----------|---------|---|
|       | G       | $\bar{G}$ | Y       | Z |
| H     | H       | X         | H       | L |
| L     | H       | X         | L       | H |
| H     | X       | L         | H       | L |
| L     | X       | L         | L       | H |
| X     | L       | H         | Z       | Z |
| OPEN  | H       | X         | L       | H |
| OPEN  | X       | L         | L       | H |

L = Low level, H = High Level, X = Don't care, Z = High Impedance

## 2 Maximum ratings

**Table 5. Absolute maximum ratings**

| Symbol    | Parameter                     | Value                      | Unit |
|-----------|-------------------------------|----------------------------|------|
| $V_{CC}$  | Supply voltage <sup>(1)</sup> | -0.5 to 4.6                | V    |
| $V_I$     | DC input voltage              | -0.5 to ( $V_{CC} + 0.5$ ) | V    |
| $T_{STG}$ | Storage temperature range     | -65 to +150                | °C   |

1. All voltages except differential I/O bus voltage, are with respect to the network ground terminal.

*Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.*

**Table 6. Recommended operating conditions**

| Symbol    | Parameter                   | Min. | Typ. | Max. | Unit |
|-----------|-----------------------------|------|------|------|------|
| $V_{CC}$  | Supply voltage              | 3.0  | 3.3  | 3.6  | V    |
| $V_{IH}$  | HIGH level input voltage    | 2.0  |      |      | V    |
| $V_{ILI}$ | LOW level input voltage     |      |      | 0.8  | V    |
| $T_A$     | Operating temperature range | -40  |      | 85   | °C   |

### 3 Electrical characteristics

Over recommended operating conditions unless otherwise noted. All typical values are at  $T_A = 25\text{ }^\circ\text{C}$ , and  $V_{CC} = 3.3\text{ V}$ .

**Table 7. Electrical characteristics**

| Symbol              | Parameter   | Test condition   | Min.  | Typ. | Max.     | Unit          |
|---------------------|---|--|-------|------|----------|---------------|
| $V_{OD}$            | Differential output voltage   | $R_L = 100\Omega$ , <i>Figure 2</i>                                | 247   | 350  | 454      | mV            |
| $\Delta V_{OD}$     | Change in differential output voltage between logic state             |  | -50   |      | 50       | mV            |
| $\Delta V_{OC(SS)}$ | Change in steady-state common mode output voltage between logic state | <i>Figure 3</i>  | 1.125 | 1.2  | 1.375    | V             |
| $V_{OC(SS)}$        | Steady-state common mode output voltage                               | <i>Figure 3</i>  | -50   |      | 50       | mV            |
| $V_{OC(PP)}$        | Peak to peak common mode output voltage                               |  |       | 80   | 150      | mV            |
| $I_{CC}$            | Supply current  | $V_{IN} = 0.8\text{V}$ or $2\text{V}$ , Enabled, No Load           |       | 11.5 | 20       | mA            |
|                     |   | $V_{IN} = 0.8\text{V}$ or $2\text{V}$ , Enabled, $R_L = 100\Omega$ |       | 25   | 35       | mA            |
|                     |   | $V_{IN} = 0$ or $V_{CC}$ , Disabled                                |       | 0.3  | 1        | mA            |
| $I_{IH}$            | High level input current  | $V_{IH} = 2\text{V}$   |       | 4    | 20       | $\mu\text{A}$ |
| $I_{IL}$            | Low level input current   | $V_{IL} = 0.8\text{V}$   |       | 0.6  | 10       | $\mu\text{A}$ |
| $I_{SC}$            | Short circuit output current  | $V_{O(Y)}$ or $V_{O(Z)} = 0\text{V}$                               |       | 6.1  | - 24     | mA            |
|                     |   | $V_{OD} = 0$   |       |      | $\pm 12$ | mA            |
| $I_{OZ}$            | High impedance output current   | $V_O = 0$ or $2.4\text{V}$   |       |      | $\pm 1$  | $\mu\text{A}$ |
| $I_{CS}$            | Cold spare leakage current  | $V_I = 3.6\text{V}$ , $V_{DD} = 0\text{V}$                         |       |      | $\pm 20$ | $\mu\text{A}$ |
| $I_{OFF}$           | Power OFF output current  | $V_{CC} = 0$ , $V_O = 2.4\text{V}$                                 |       |      | $\pm 1$  | $\mu\text{A}$ |
| $C_{IN}$            | Input capacitance   |  |       | 3    |          | pF            |

Over recommended operating conditions unless otherwise noted. All typical values are at  $T_A = 25\text{ }^\circ\text{C}$ , and  $V_{CC} = 3.3\text{ V}$ .

**Table 8. Switching characteristics (1)**

| Symbol      | Parameter   | Test condition   | Min. | Typ. | Max. | Unit |
|-------------|---|--|------|------|------|------|
| $t_{PLH}$   | Propagation delay time, low to high output                  | $R_L = 100\Omega$ , $C_L = 10\text{pF}$<br><i>Figure 2</i> | 0.5  | 1.4  | 2    | ns   |
| $t_{PHL}$   | Propagation delay time, high to low output                  |  | 1    | 1.7  | 2.5  | ns   |
| $t_r$       | Differential output signal rise time                        |  | 0.4  | 0.5  | 0.6  | ns   |
| $t_f$       | Differential output signal fall time                        |  | 0.4  | 0.5  | 0.6  | ns   |
| $t_{sk(P)}$ | Pulse skew ( $ t_{THL} - t_{TLH} $ )                        |  |      | 0.3  | 0.6  | ns   |
| $t_{sk(O)}$ | Channel to channel output skew (2)                          |  |      | 0    | 0.3  | ns   |
| $t_{PZH}$   | Propagation delay time, high impedance to high level output | <i>Figure 4</i>  |      | 5.4  | 15   | ns   |
| $t_{PZL}$   | Propagation delay time, high impedance to low level output  |  |      | 2.5  | 15   | ns   |
| $t_{PHZ}$   | Propagation delay time, high level to high impedance output |  |      | 8.1  | 15   | ns   |
| $t_{PLZ}$   | Propagation delay time, low level to high impedance output  |  |      | 7.3  | 15   | ns   |

1. RS-232 IN to TTL-CMOS OUT (from 50 % to 50 %).
2.  $t_{sk(O)}$  is the maximum delay time difference between drivers on the same device.

# 4 Typical characteristics

Figure 3. Voltage and current definitions

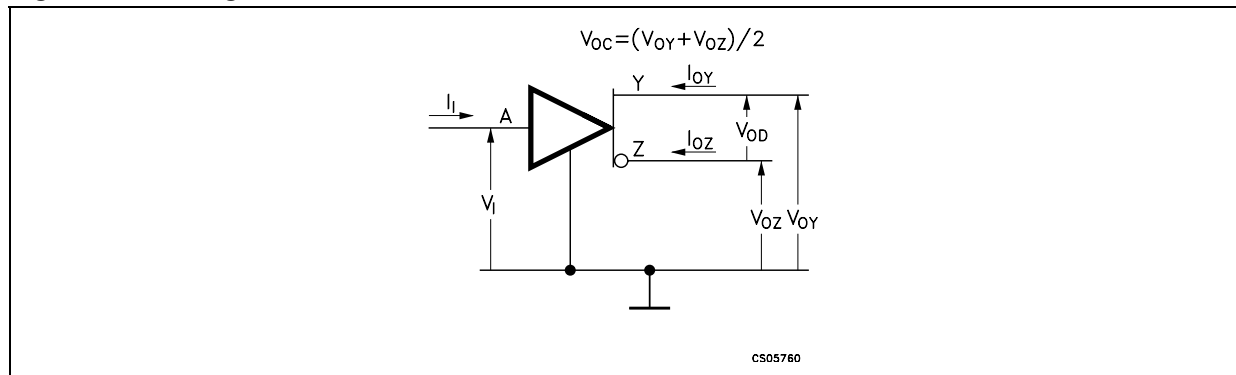
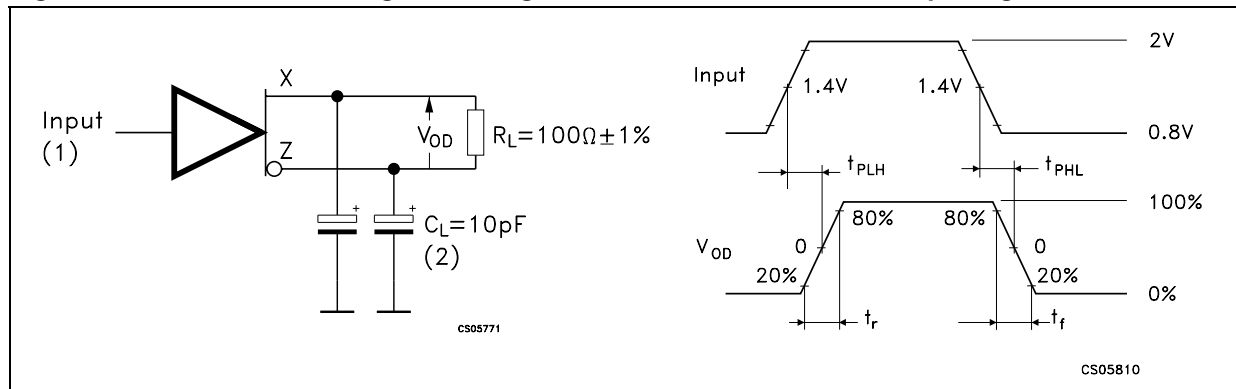
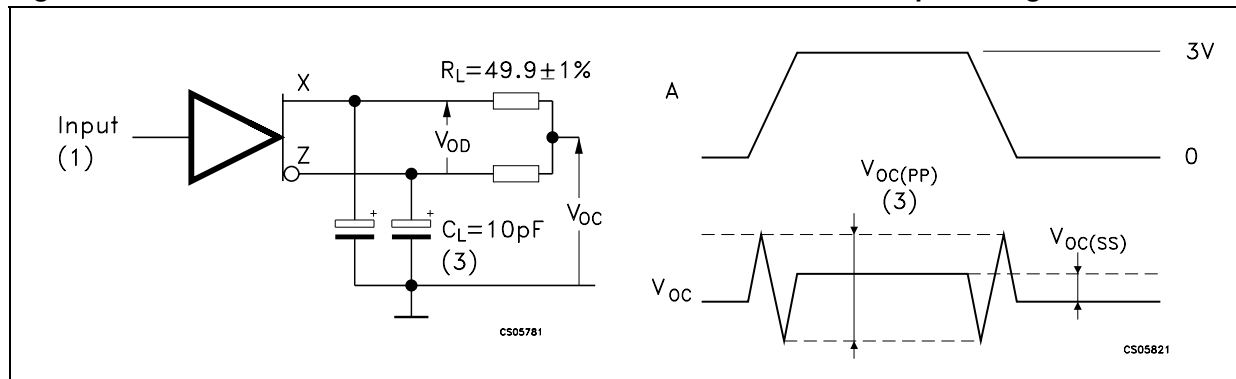


Figure 4. Test circuit, timing and voltage definitions for differential output signal



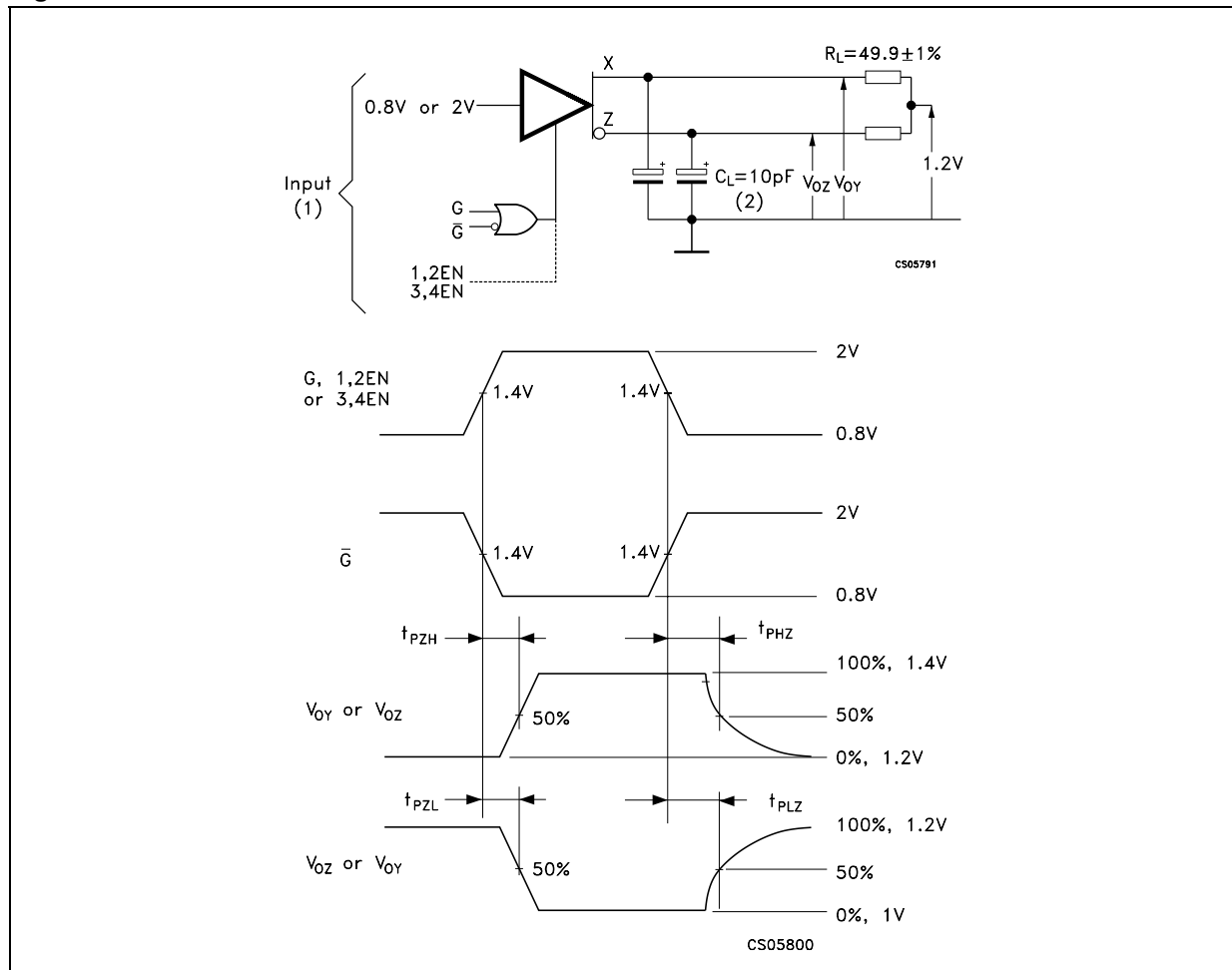
1. All input pulse are supplied by a generator having the following characteristics:  $t_r$  or  $t_f \leq 1$  ns, pulse repetition rate (PRR) = 50 Mpps, pulse width =  $10 \pm 0.2$  ns.
2.  $C_L$  includes instrumentation and fixture capacitance within 6 mm. of the D.U.T.

Figure 5. Test circuit and definitions for the driver common mode output voltage



1. All input pulse are supplied by a generator having the following characteristics:  $t_r$  or  $t_f \leq 1$  ns, pulse repetition rate (PRR) = 50 Mpps, pulse width =  $10 \pm 0.2$  ns.
2.  $C_L$  includes instrumentation and fixture capacitance within 6mm of the D.U.T
3. The measurement of  $V_{OC(PP)}$  is made on test equipment with a -3 dB bandwidth of at least 300 MHz.

Figure 6. Enable and disable time test circuit and waveform

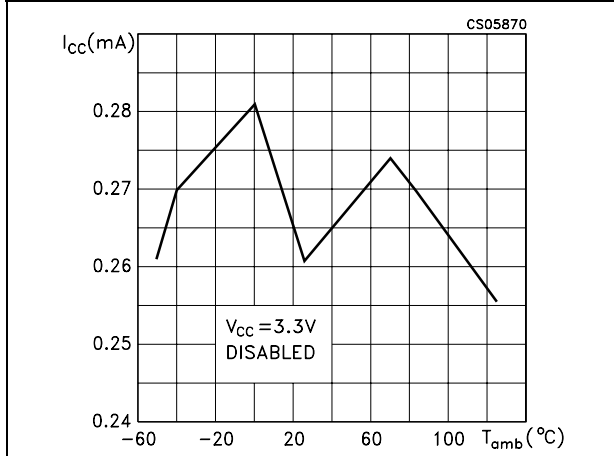


1. All input pulse are supplied by a generator having the following characteristics:  $t_r$  or  $t_f \leq 1$  ns, pulse repetition rate (PRR) = 0.5 Mpps, pulse width =  $500 \pm 10$  ns.
2.  $C_L$  includes instrumentation and fixture capacitance within 6 mm. of the D.U.T.

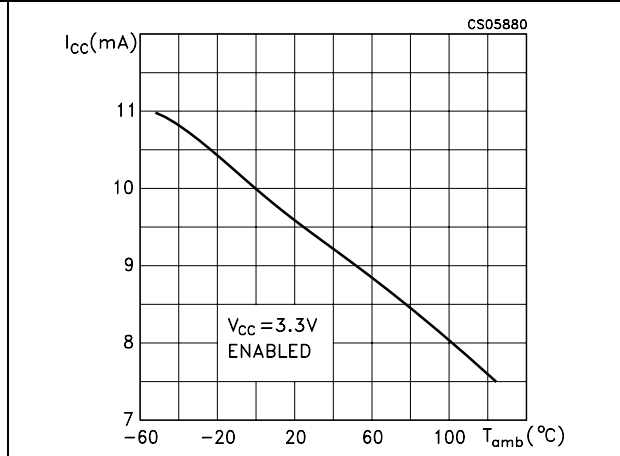
# 5 Typical performance characteristics

Unless otherwise specified  $T_J = 25\text{ }^\circ\text{C}$

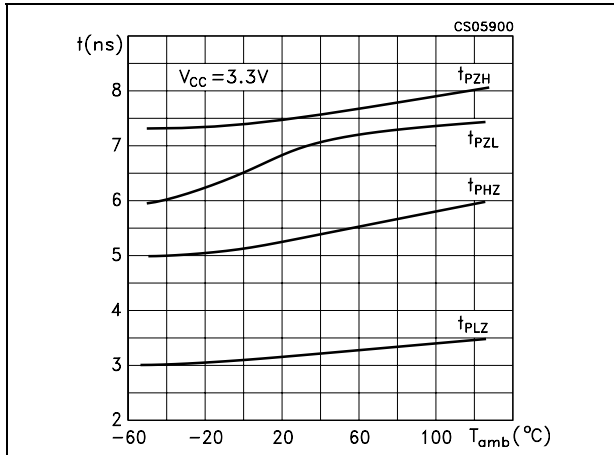
**Figure 7. Supply current vs. temperature**



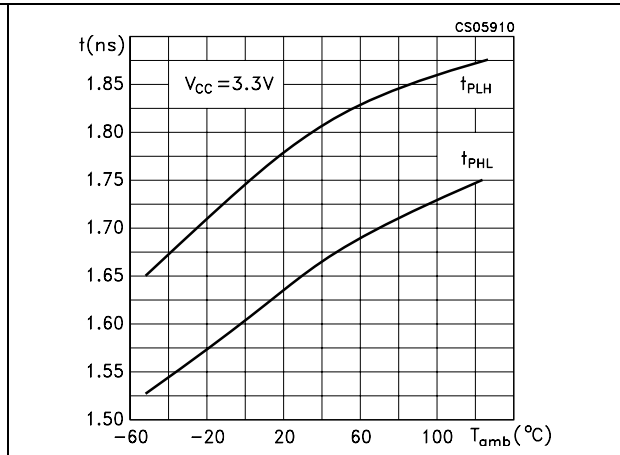
**Figure 8. Supply current vs. temperature**



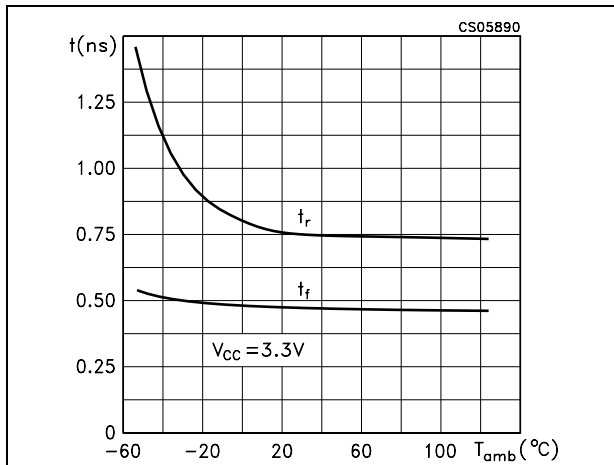
**Figure 9. Propagation delay enable to output**



**Figure 10. Propagation delay time**



**Figure 11. Differential output signal**

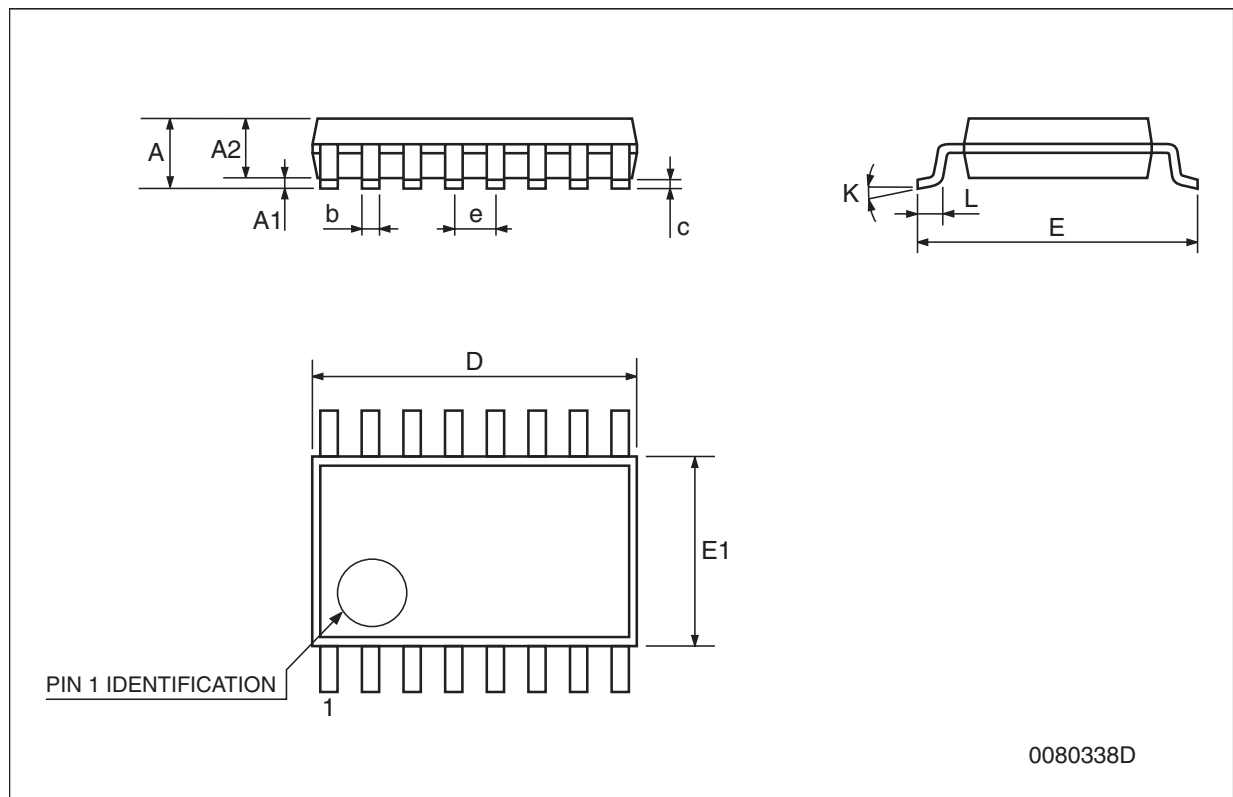


## 6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

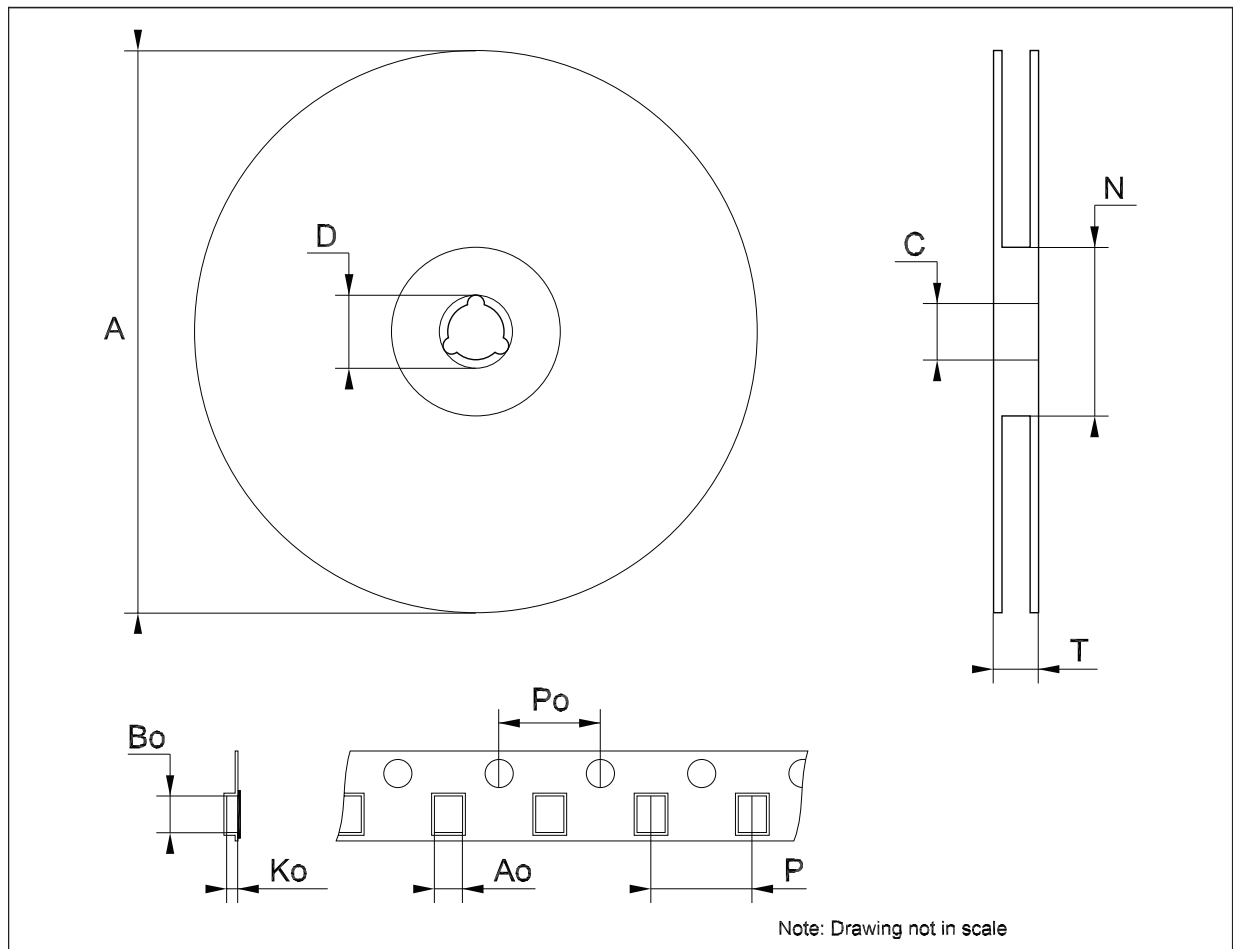
**TSSOP16 mechanical data**

| Dim. | mm.  |          |      | inch. |            |        |
|------|------|----------|------|-------|------------|--------|
|      | Min. | Typ.     | Max. | Min.  | Typ.       | Max.   |
| A    |      |          | 1.2  |       |            | 0.047  |
| A1   | 0.05 |          | 0.15 | 0.002 | 0.004      | 0.006  |
| A2   | 0.8  | 1        | 1.05 | 0.031 | 0.039      | 0.041  |
| b    | 0.19 |          | 0.30 | 0.007 |            | 0.012  |
| c    | 0.09 |          | 0.20 | 0.004 |            | 0.0079 |
| D    | 4.9  | 5        | 5.1  | 0.193 | 0.197      | 0.201  |
| E    | 6.2  | 6.4      | 6.6  | 0.244 | 0.252      | 0.260  |
| E1   | 4.3  | 4.4      | 4.48 | 0.169 | 0.173      | 0.176  |
| e    |      | 0.65 BSC |      |       | 0.0256 BSC |        |
| K    | 0°   |          | 8°   | 0°    |            | 8°     |
| L    | 0.45 | 0.60     | 0.75 | 0.018 | 0.024      | 0.030  |



**Tape & reel TSSOP16 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   | 6.7  |      | 6.9  | 0.264 |      | 0.272  |
| Bo   | 5.3  |      | 5.5  | 0.209 |      | 0.217  |
| Ko   | 1.6  |      | 1.8  | 0.063 |      | 0.071  |
| Po   | 3.9  |      | 4.1  | 0.153 |      | 0.161  |
| P    | 7.9  |      | 8.1  | 0.311 |      | 0.319  |



## 7 Revision history

**Table 9. Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 28-Mar-2006 | 5        | Order codes updated.                           |
| 15-Jul-2009 | 6        | Modified: <a href="#">Features on page 1</a> . |

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