

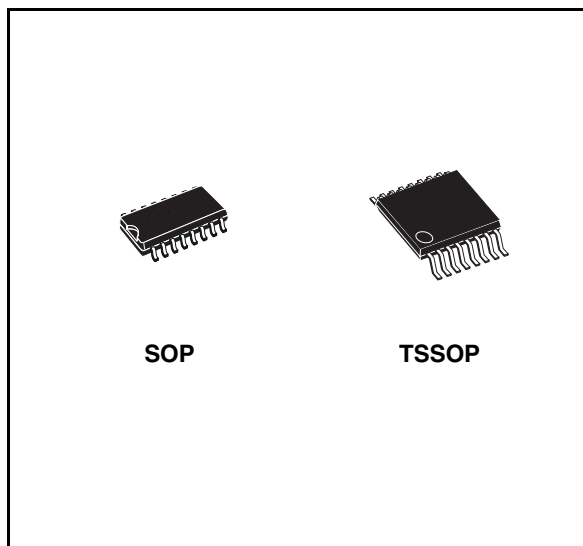
## High speed differential line receivers

### Features

- Meets or exceeds the requirements of ansi TIA/EIA-644 standard
- Operates with a single 3.3 V supply
- Designed for signaling rate up to 400 Mbps
- Differential input thresholds  $\pm 100$  mV max
- Typical propagation delay time of 2.5 ns
- Power dissipation 60 mW typical per receiver at 200 MHz
- Low voltage TTL (LVTTTL) logic output levels
- Pin compatible with the AM26LS32, SN65LVD32
- Open circuit fail safe
- ESD protection:
- 7 kV receiver pins
- 3 kV all pins vs gnd

### Description

The STLVDS32 is a differential line receiver 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 allow operations with a 3.3 V supply rail. This differential receiver provides a valid logical output state with a 3.3 V supply rail. It also provides a valid logical output state with a  $\pm 100$  mV differential input voltage within the input common mode voltage range. The



input common mode voltage allows 1 V of ground potential difference between two LVDS nodes.

The intended application of this device and signalling technique is both point-to-point and multidrop data transmission over controlled impedance media approximately 100  $\Omega$ . The transmission media may be printed circuit board traces, backplanes or cables. The ultimate rate and distance of data transfer depend upon the attenuation characteristics of the media and noise coupling to the environment.

The STLVDS32 version is characterized for operation from  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ .

**Table 1. Device summary**

| Order code  | Temperature range              | Package               | Packaging           |
|-------------|--------------------------------|-----------------------|---------------------|
| STLVDS32BDR | $-55$ to $125^{\circ}\text{C}$ | SO16 (Tape & reel)    | 2500 parts per reel |
| STLVDS32BTR | $-55$ to $125^{\circ}\text{C}$ | TSSOP16 (Tape & reel) | 2500 parts per reel |

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# 1 Pin configuration

Figure 1. Pin connections and functional diagram

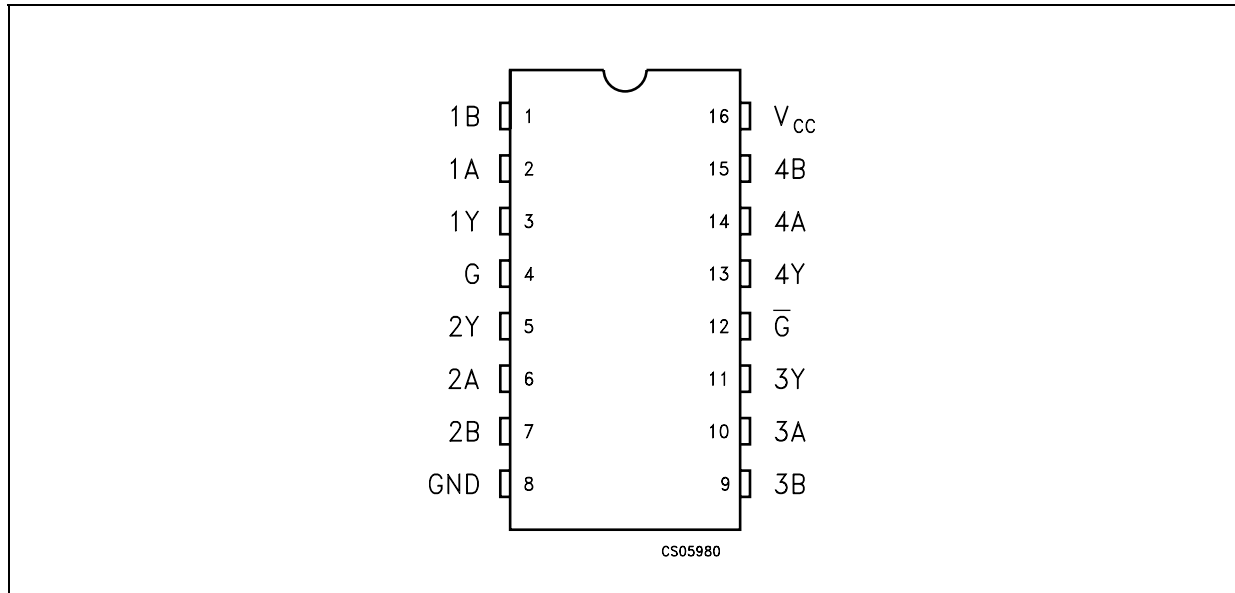


Table 2. Pin description

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

Figure 2. Logic diagram and logic symbol

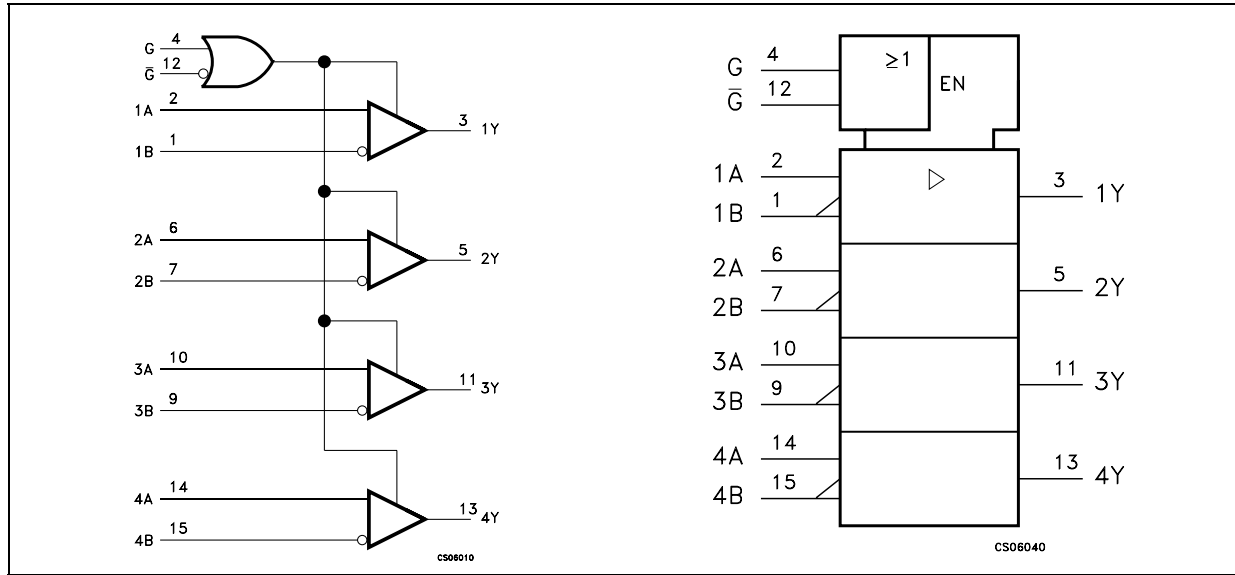


Table 3. Truth table

| Differential inputs<br><b>A, B</b>      | Enables  |           | Outputs<br><b>Y</b> |
|---|----------|-----------|---------------------|
|   | <b>G</b> | <b>Ḡ</b> |                     |
| $V_{ID} \geq 100\text{mV}$              | H        | X         | H                   |
|   | X        | L         | H                   |
| $-100\text{mV} < V_{ID} < 100\text{mV}$ | H        | X         | ?                   |
|   | X        | L         | ?                   |
| $V_{ID} \leq -100\text{mV}$             | H        | X         | L                   |
|   | X        | L         | L                   |
| X                                       | L        | H         | Z                   |
| OPEN                                    | H        | X         | H                   |
|   | X        | L         | H                   |

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

## 2 Maximum ratings

**Table 4. Absolute maximum ratings**

| Symbol    | Parameter                     |                 | Value                      | Unit |
|-----------|-------------------------------|-----------------|----------------------------|------|
| $V_{CC}$  | Supply voltage <sup>(1)</sup> |                 | -0.5 to 4.6                | V    |
| $V_I$     | Input voltage                 |                 | -0.5 to ( $V_{CC} + 0.5$ ) | V    |
| $V_I$     | Input voltage (A or B inputs) |                 | -0.5 to 4.6                | V    |
| ESD       | Human body model              | Pins receivers  | 7                          | kV   |
|           |                               | All pins vs gnd | 3                          |      |
| $T_{stg}$ | 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 5. 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 (ENABLE)       | 2.0            |      |                    | V    |
| $V_{IL}$   | LOW level input voltage (ENABLE)        |                |      | 0.8                | V    |
| $ V_{ID} $ | Magnitude of differential input voltage | 0.1            |      | 0.6                | V    |
| $V_{IC}$   | Common mode input voltage               | 0.5 $ V_{ID} $ |      | 2.4-0.5 $ V_{ID} $ | V    |
|            |   |                |      | $V_{CC} - 0.8$     |      |
| $T_A$      | Operating temperature range             | -40            |      | 85                 | °C   |

### 3 Electrical characteristics

**Table 6. Electrical characteristics**

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

| Symbol       | Parameter  | Test conditions                           | Min. | Typ. | Max.     | Unit          |
|--------------|--|---|------|------|----------|---------------|
| $V_{ITH+}$   | Positive going differential input voltage threshold        |   |      |      | 100      | mV            |
| $V_{ITH-}$   | Negative going differential input voltage threshold        |   | -100 |      |          | mV            |
| $V_{OH}$     | High level output voltage                                  | $I_{OH} = -8\text{ mA}$                   | 2.4  |      |          | V             |
|              |  | $I_{OH} = -4\text{ mA}$                   | 2.8  |      |          |               |
| $V_{OL}$     | Low level output voltage                                   | $I_{OH} = 8\text{ mA}$                    |      |      | 0.4      | V             |
| $I_{CC}$     | Supply current   | Enabled, No Load                          |      | 10   | 18       | mA            |
|              |  | Disabled                                  |      | 0.25 | 0.5      | mA            |
| $I_I$        | Input current (A or B inputs)                              | $V_I = 0\text{ V}$                        | -2   | -10  | -20      | $\mu\text{A}$ |
|              |  | $V_I = 2.4\text{ V}$                      | -1.2 | -3   |          |               |
| $I_{I(OFF)}$ | Power off input current (A or B inputs)                    | $V_{CC} = 0, V_I = 3.6\text{ V}$          |      | 10   | 20       | $\mu\text{A}$ |
| $I_{CS}$     | Cold spare leakage current                                 | $V_I = 3.6\text{ V}, V_{DD} = 0\text{ V}$ |      |      | $\pm 20$ | $\mu\text{A}$ |
| $I_{IH}$     | High level input current (EN, G, $\overline{G}$ or inputs) | $V_{IH} = 2\text{ V}$                     |      |      | 10       | $\mu\text{A}$ |
| $I_{IL}$     | Low level input current (EN, G, $\overline{G}$ or inputs)  | $V_{IL} = 0.8\text{ V}$                   |      |      | 10       | $\mu\text{A}$ |
| $I_{OZ}$     | High impedance output current                              | $V_O = 0\text{ or }V_{CC}$                |      |      | $\pm 10$ | $\mu\text{A}$ |

**Table 7. Switching characteristics**

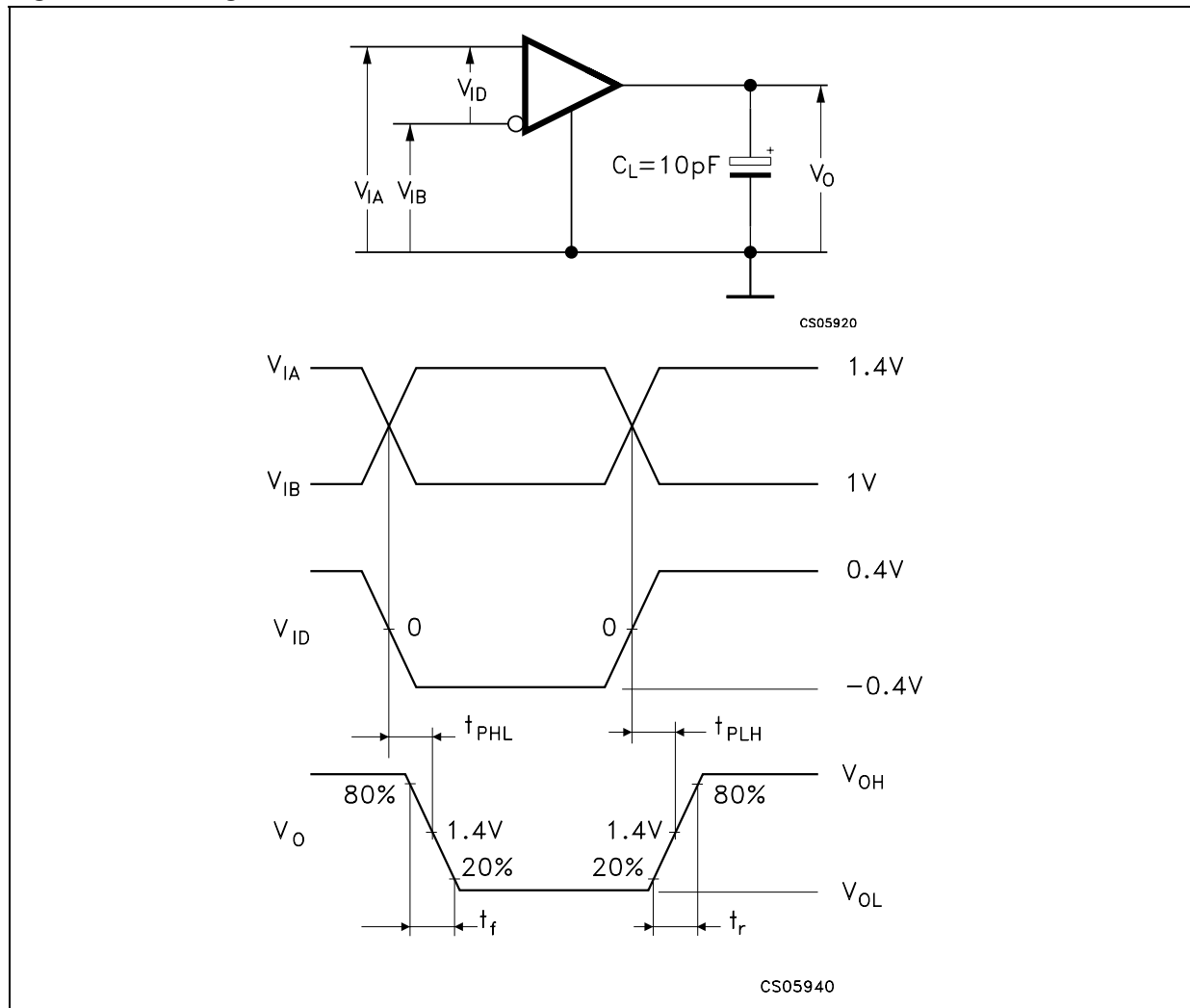
(Over recommended operating conditions unless otherwise noted. All typical values are at  $T_A = 25^\circ\text{C}$ , and  $V_{CC} = 3.3\text{ V}$ ).

| Symbol       | Parameter   | Test conditions                         | Min. | Typ. | Max. | Unit |
|--------------|---|---|------|------|------|------|
| $t_{PLH}$    | Propagation delay time, low to high output                  | $C_L = 10\text{ pF}$ , <i>Figure 3.</i> | 1.5  | 2.5  | 3.3  | ns   |
| $t_{PHL}$    | Propagation delay time, high to low output                  |   | 1.5  | 2.5  | 3.3  | ns   |
| $t_r$        | Output signal rise time                                     |   |      | 0.4  |      | ns   |
| $t_f$        | Output signal fall time                                     |   |      | 0.4  |      | ns   |
| $t_{sk(O)}$  | Channel to channel output skew ( <i>Note: 1</i> )           |   |      | 0.1  | 0.3  | ns   |
| $t_{sk(P)}$  | Pulse skew ( $ t_{PHL} - t_{PLH} $ ) ( <i>Note 2</i> )      |   |      | 0.2  | 0.4  | ns   |
| $t_{sk(PP)}$ | Part to part skew ( <i>Note 3</i> )                         |   |      |      | 1    | ns   |
| $t_{PZH}$    | Propagation delay time, high impedance to high level output | <i>Figure 4.</i>                        |      | 3    | 12   | ns   |
| $t_{PZL}$    | Propagation delay time, high impedance to low level output  |   |      | 5    | 12   | ns   |
| $t_{PHZ}$    | Propagation delay time, high level to high impedance output |   |      | 5    | 12   | ns   |
| $t_{PLZ}$    | Propagation delay time, low level to high impedance output  |   |      | 5    | 12   | ns   |

- Note:**
- $t_{sk(O)}$  is the maximum delay time difference between the propagation delay of one channel and that of the others on the same chip with any event on the inputs.
  - $t_{sk(P)}$  is the magnitude difference in differential propagation delay time between the positive going edge and the negative going edge of the same channel.
  - $t_{sk(PP)}$  is the differential channel-to-channel skew of any event between devices. This specification applies to devices at the same  $V_{CC}$ , and within  $5^\circ\text{C}$  of each other within the operating temperature range

# 4 Typical characteristics

Figure 3. Timing test and waveforms

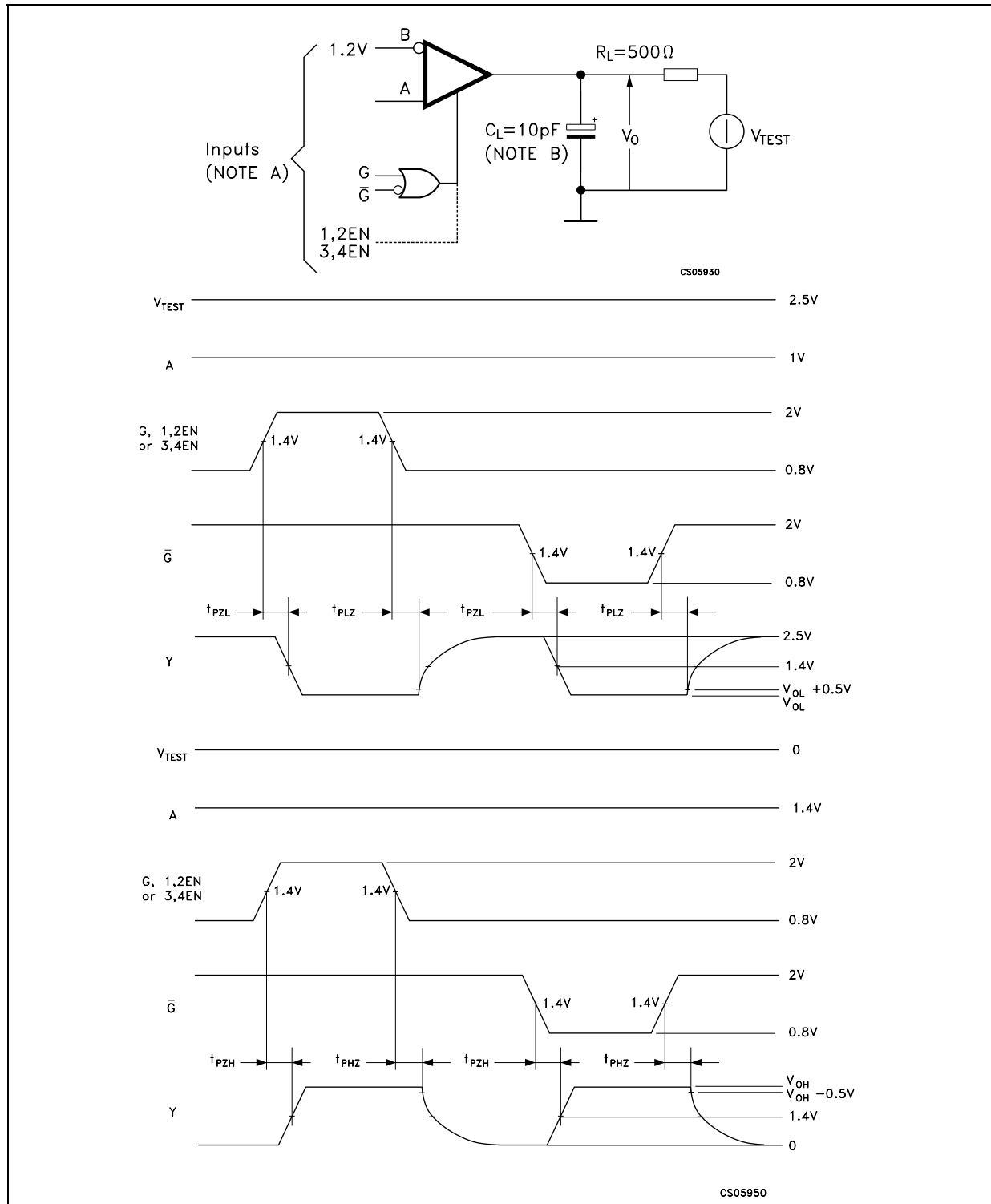


Note: A: All input pulse are supplied by a generator having the following characteristics:  $t_r$  or  $t_f \leq 1\text{ ns}$ , pulse repetition rate (PRR) = 50 Mpps, pulse width =  $10 \pm 0.2\text{ ns}$ .

Note: B:  $C_L$  includes instrumentation and fixture capacitance within 6 mm of the D.U.T.



Figure 4. Enable and disable time test circuit and waveform



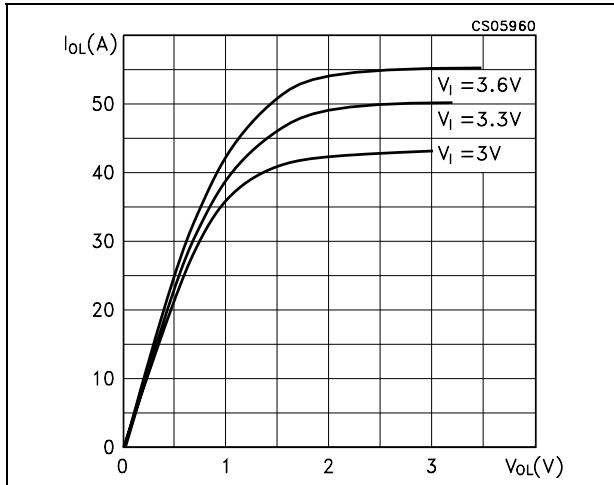
Note: A: All input pulse are supplied by a generator having the following characteristics:  $t_r$  or  $t_f \leq 1\ \text{ns}$ , pulse repetition rate (PRR) = 50 Mpps, pulse width =  $10 \pm 0.2\ \text{ns}$ .

Note: B:  $C_L$  includes instrumentation and fixture capacitance within 6 mm of the D.U.T.

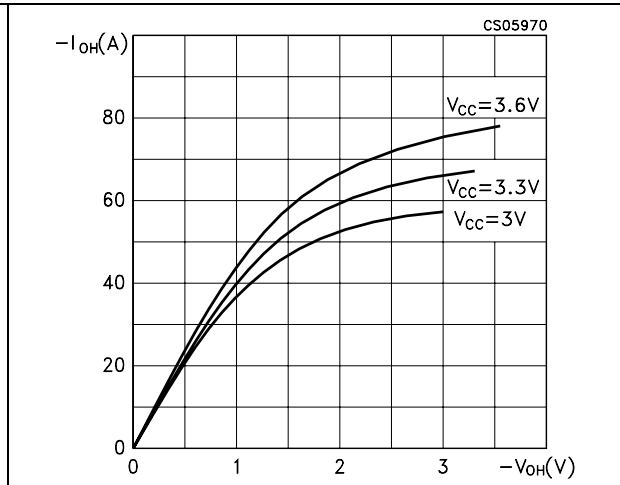
# 5 Typical performance characteristics

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

**Figure 5. Output current vs output voltage**



**Figure 6. Output current vs output voltage**

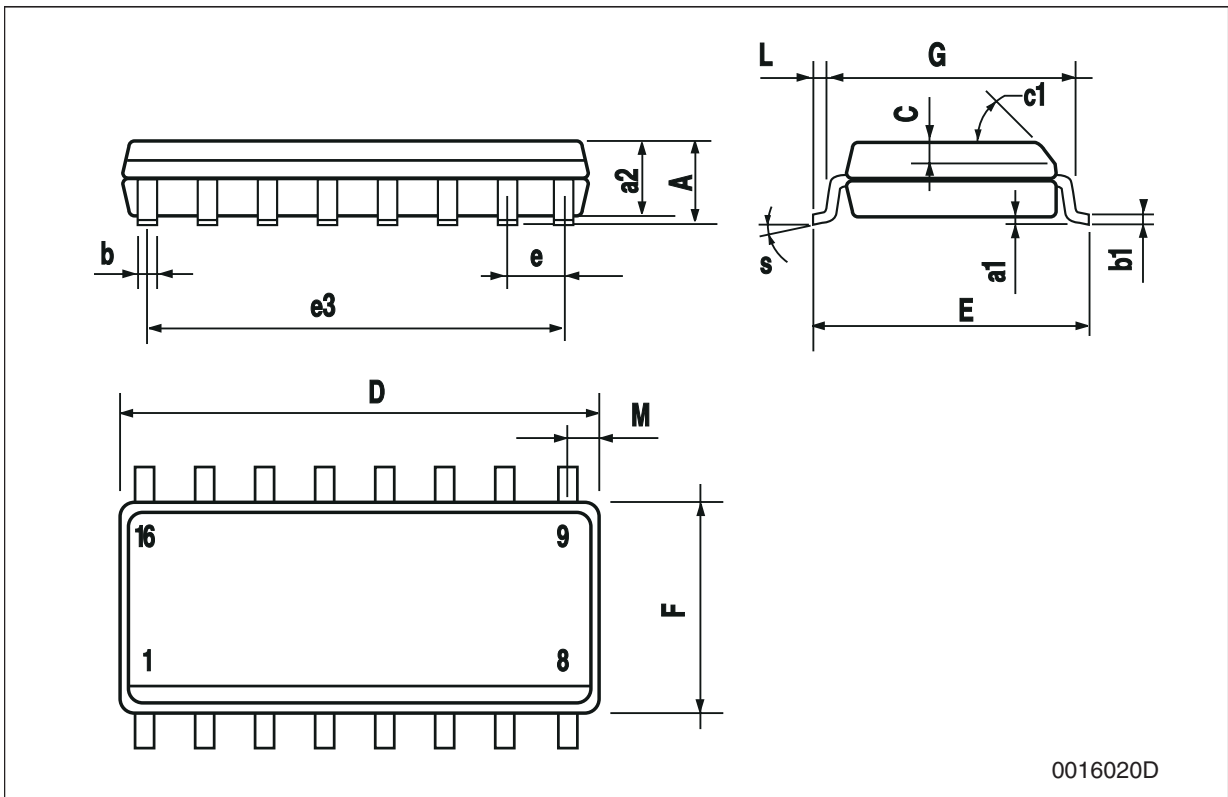


## 6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK<sup>®</sup> 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](http://www.st.com).

**SO-16 mechanical data**

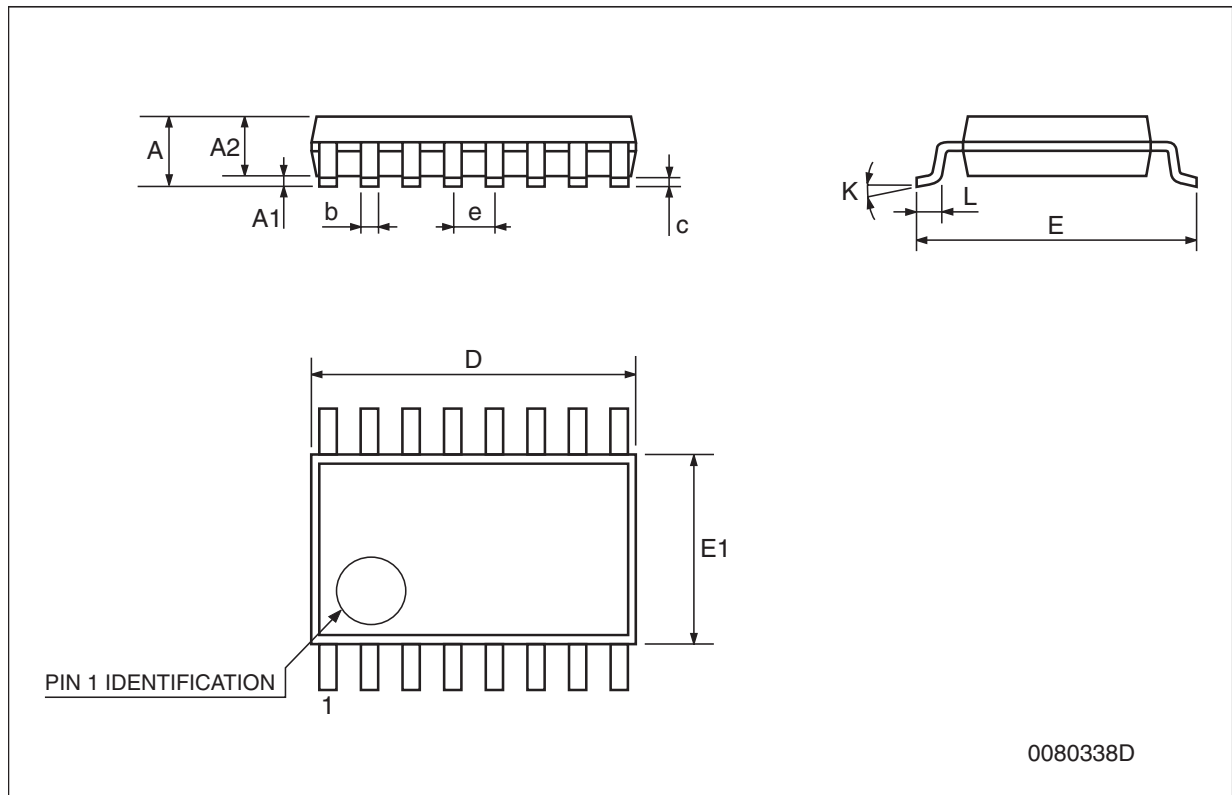
| Dim. | mm.        |      |      | inch. |       |       |
|------|------------|------|------|-------|-------|-------|
|      | Min.       | Typ. | Max. | Min.  | Typ.  | Max.  |
| A    |            |      | 1.75 |       |       | 0.068 |
| a1   | 0.1        |      | 0.25 | 0.004 |       | 0.010 |
| a2   |            |      | 1.64 |       |       | 0.063 |
| b    | 0.35       |      | 0.46 | 0.013 |       | 0.018 |
| b1   | 0.19       |      | 0.25 | 0.007 |       | 0.010 |
| C    |            | 0.5  |      |       | 0.019 |       |
| c1   | 45° (typ.) |      |      |       |       |       |
| D    | 9.8        |      | 10   | 0.385 |       | 0.393 |
| E    | 5.8        |      | 6.2  | 0.228 |       | 0.244 |
| e    |            | 1.27 |      |       | 0.050 |       |
| e3   |            | 8.89 |      |       | 0.350 |       |
| F    | 3.8        |      | 4.0  | 0.149 |       | 0.157 |
| G    | 4.6        |      | 5.3  | 0.181 |       | 0.208 |
| L    | 0.5        |      | 1.27 | 0.019 |       | 0.050 |
| M    |            |      | 0.62 |       |       | 0.024 |
| S    | 8° (max.)  |      |      |       |       |       |



0016020D

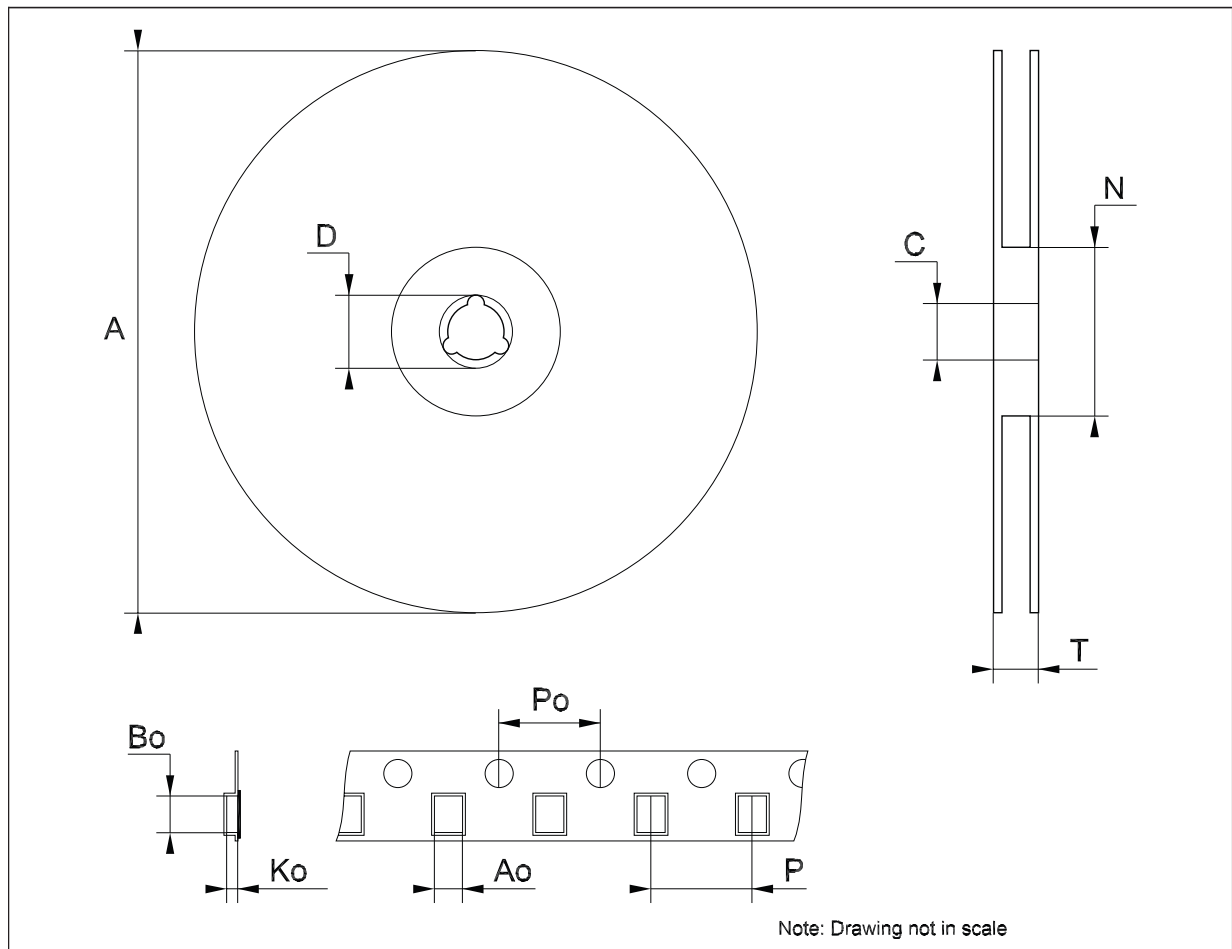
**TSSOP16 mechanical data**

| 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  |



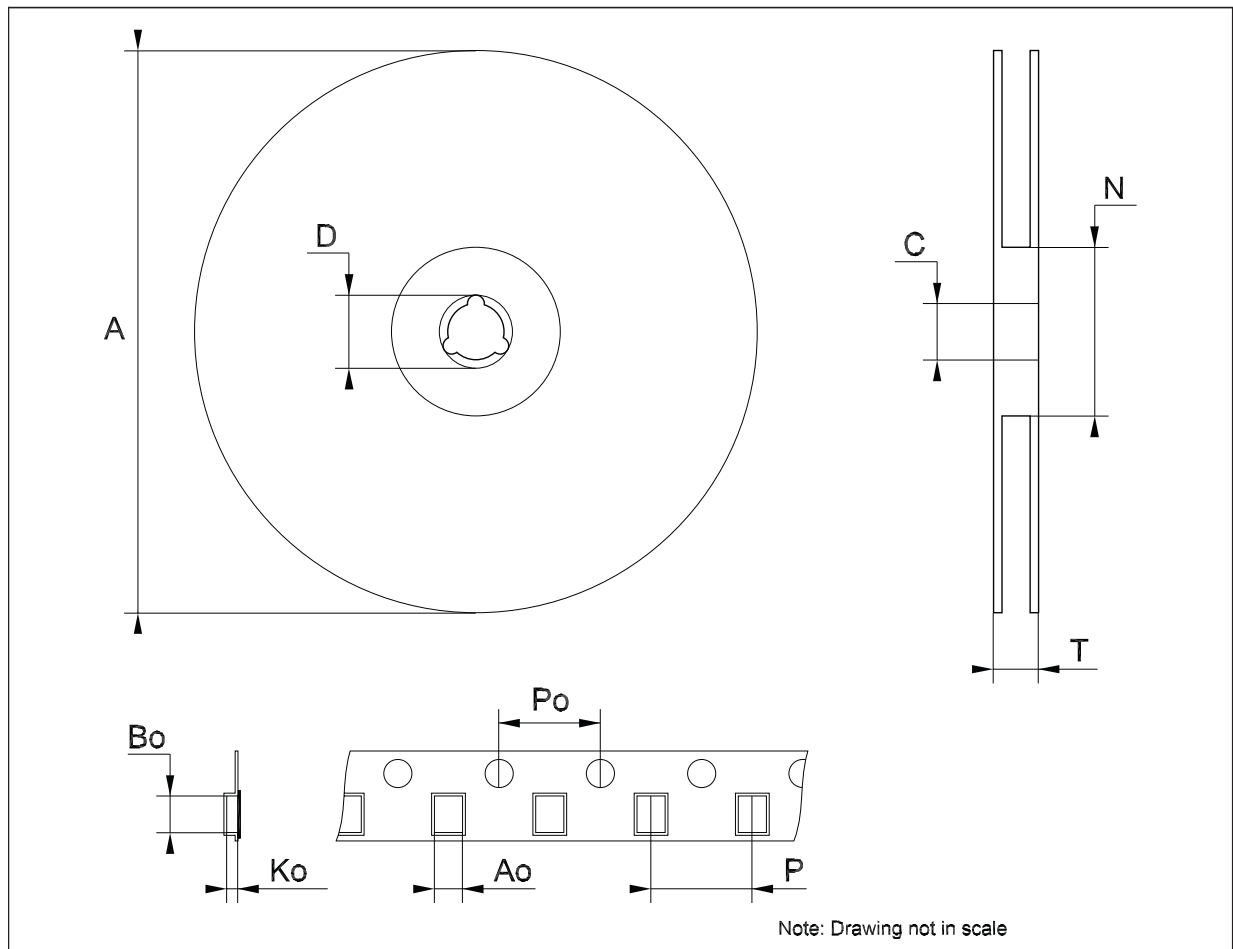
**Tape & reel SO-16 mechanical data**

| 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   | 6.45 |      | 6.65 | 0.254 |      | 0.262  |
| Bo   | 10.3 |      | 10.5 | 0.406 |      | 0.414  |
| 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  |



**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 8. Revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 07-Jul-2004 | 9        | $t_r$ and $t_f$ description changed in table 6 - pag 7.                    |
| 05-Dec-2005 | 10       | Temperature Range has been changed in cover page, add $I_{CS}$ on table 5. |
| 28-Mar-2006 | 11       | Order code updated and new template.                                       |
| 20-Mar-2007 | 12       | Title in cover page updated.   |
| 28-Aug-2007 | 13       | Added <a href="#">Table 1</a> . in cover page.                             |



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