

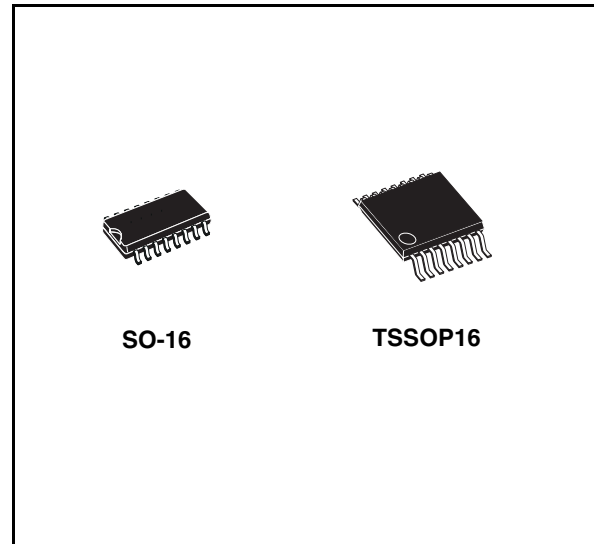
## Very high speed, ultra low power consumption 5 V powered RS-232 drivers and receivers

### Features

- Supply voltage range: 4.5 to 5.5 V
- Supply current no load (typ.): 1.5 mA
- Transmitter output voltage swing (typ.):  $\pm 9$  V
- Transition slew rate (typ.): 12 V/ $\mu$ s
- Receiver propagation delay (typ.): 0.1  $\mu$ s
- Receiver input voltage range:  $\pm 30$  V
- Data rate (typ.): 400 kbps/s
- Operating temperature range:
  - -40 to 85 °C
  - 0 to 70 °C

### Description

The ST232AB/AC is a 2 driver, 2 receiver device following EIA/TIA-232 and V.28 communication standard. It is particularly suitable for applications where  $\pm 12$  V is not available. The ST232AB/AC uses a single 5 V power supply and only four external capacitors (0.1  $\mu$ F). Typical applications are in: portable computers, low power modems, interfaces translation, battery powered RS-232 networks.



**Table 1. Device summary**

| Order codes | Temperature range | Packages                | Packaging           |
|-------------|-------------------|-------------------------|---------------------|
| ST232ACDR   | 0 to 70 °C        | SO-16 (tape and reel)   | 2500 parts per reel |
| ST232ABDR   | -40 to 85 °C      | SO-16 (tape and reel)   | 2500 parts per reel |
| ST232ACTR   | 0 to 70 °C        | TSSOP16 (tape and reel) | 2500 parts per reel |
| ST232ABTR   | -40 to 85 °C      | TSSOP16 (tape and reel) | 2500 parts per reel |

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# 1 Pin configuration

Figure 1. Pin connections (top view)

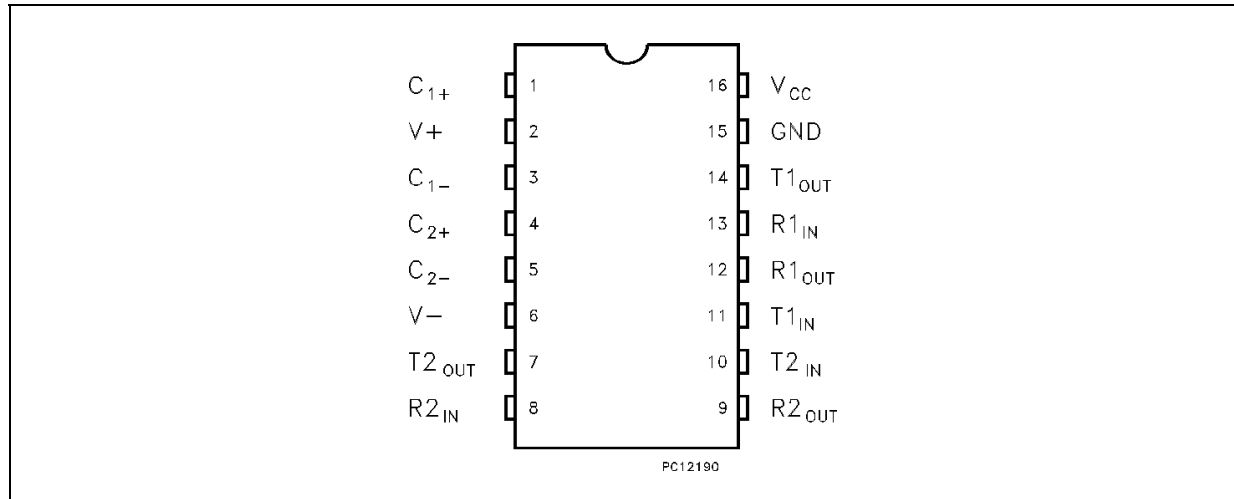


Table 2. Pin description

| Pin n° | Symbol             | Note   |
|--------|--------------------|--|
| 1      | C <sub>1+</sub>    | Positive terminal for the first charge pump capacitor  |
| 2      | V+                 | Doubled voltage terminal                               |
| 3      | C <sub>1-</sub>    | Negative terminal for the first charge pump capacitor  |
| 4      | C <sub>2+</sub>    | Positive terminal for the second charge pump capacitor |
| 5      | C <sub>2-</sub>    | Negative terminal for the second charge pump capacitor |
| 6      | V-                 | Inverted voltage terminal                              |
| 7      | T <sub>2</sub> OUT | Second transmitter output voltage                      |
| 8      | R <sub>2</sub> IN  | Second receiver input voltage                          |
| 9      | R <sub>2</sub> OUT | Second receiver output voltage                         |
| 10     | T <sub>2</sub> IN  | Second transmitter input voltage                       |
| 11     | T <sub>1</sub> IN  | First transmitter input voltage                        |
| 12     | R <sub>1</sub> OUT | First receiver output voltage                          |
| 13     | R <sub>1</sub> IN  | First receiver input voltage                           |
| 14     | T <sub>1</sub> OUT | First transmitter output voltage                       |
| 15     | GND                | Ground   |
| 16     | V <sub>CC</sub>    | Supply voltage   |

## 2 Maximum ratings

**Table 3. Absolute maximum ratings**

| Symbol       | Parameter                           | Value                             | Unit |
|--------------|-------------------------------------|-----------------------------------|------|
| $V_{CC}$     | Supply voltage                      | -0.3 to 6                         | V    |
| $V_{+}$      | Extra positive voltage              | $(V_{CC} - 0.3 \text{ to } 13.2)$ | V    |
| $V_{-}$      | Extra negative voltage              | 0.3 to -13.2                      | V    |
| $T_{IN}$     | Transmitter input voltage range     | -0.3 to $(V_{CC} + 0.3)$          | V    |
| $R_{IN}$     | Receiver input voltage range        | $\pm 30$                          | V    |
| $T_{OUT}$    | Transmitter output voltage range    | $\pm 15$                          | V    |
| $R_{OUT}$    | Receiver output voltage range       | -0.3 to $(V_{CC} + 0.3)$          | V    |
| $T_{SCTOUT}$ | Short circuit duration on $T_{OUT}$ | infinite                          |      |

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

### 3 Electrical characteristics

**Table 4. Electrical characteristics**

( $C_1 - C_4 = 0.1 \mu\text{F}$ ,  $V_{\text{CC}} = 5 \text{ V} \pm 10 \%$ ,  $T_A = -40$  to  $85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ ).

| Symbol              | Parameter                            | Test condition                    | Min. | Typ. | Max. | Unit |
|---------------------|--------------------------------------|-----------------------------------|------|------|------|------|
| $I_{\text{SUPPLY}}$ | $V_{\text{CC}}$ power supply current | No Load, $T_A = 25^\circ\text{C}$ |      | 1.5  | 4    | mA   |

**Table 5. Transmitter electrical characteristics**

( $C_1 - C_4 = 0.1 \mu\text{F}$ ,  $V_{\text{CC}} = 5 \text{ V} \pm 10 \%$ ,  $T_A = -40$  to  $85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ ).

| Symbol                 | Parameter                                | Test condition   | Min.    | Typ.     | Max. | Unit                   |
|------------------------|--|--|---------|----------|------|------------------------|
| $V_{\text{TOUT}}$      | Output voltage swing                     | All transmitter outputs are loaded with $3\text{k}\Omega$ to GND   | $\pm 5$ | $\pm 9$  |      | V                      |
| $I_{\text{TIL}}$       | Logic pull-up current                    | $T_{\text{IN}} = 0\text{V}$  |         | 5        | 40   | $\mu\text{A}$          |
| $V_{\text{TIL}}$       | Input logic threshold low                |  | 0.8     | 1.4      |      | V                      |
| $V_{\text{TIH}}$       | Input logic threshold high               |  |         | 1.4      | 2    | V                      |
| $\text{SR}_{\text{T}}$ | Transition slew rate                     | $T_A = 25^\circ\text{C}$ , $V_{\text{CC}} = 5\text{V}$<br>$R_L = 3$ to $7\text{k}\Omega$ , $C_L = 50$ to $2500\text{pF}$ (1) | 6       | 12       | 30   | $\text{V}/\mu\text{s}$ |
| $D_{\text{R}}$         | Data rate                                | (2)  | 200     | 400      |      | kbits/s                |
| $R_{\text{TOUT}}$      | Transmitter output resistance            | $V_{\text{CC}} = V_+ = V_- = 0\text{V}$ $V_{\text{OUT}} = \pm 2\text{V}$   | 300     |          |      | $\Omega$               |
| $I_{\text{SC}}$        | Transmitter output short circuit current | One $T_{\text{XOUT}}$ to GND   | $\pm 7$ | $\pm 22$ |      | mA                     |
| $t_{\text{DT}}$        | Propagation delay time                   | TTL-CMOS IN to RS-232 OUT<br>$C_L = 150\text{pF}$ (50% to 50%)   |         | 1.3      | 3.5  | $\mu\text{s}$          |

1. Measured from 3 V to -3 V or from -3 V to 3 V.

2. One transmitter output is loaded with  $R_L = 3 \text{ k}\Omega$  to  $7 \text{ k}\Omega$ ,  $C_L = 50$  to  $1000 \text{ pF}$ .

**Table 6. Receiver electrical characteristics**

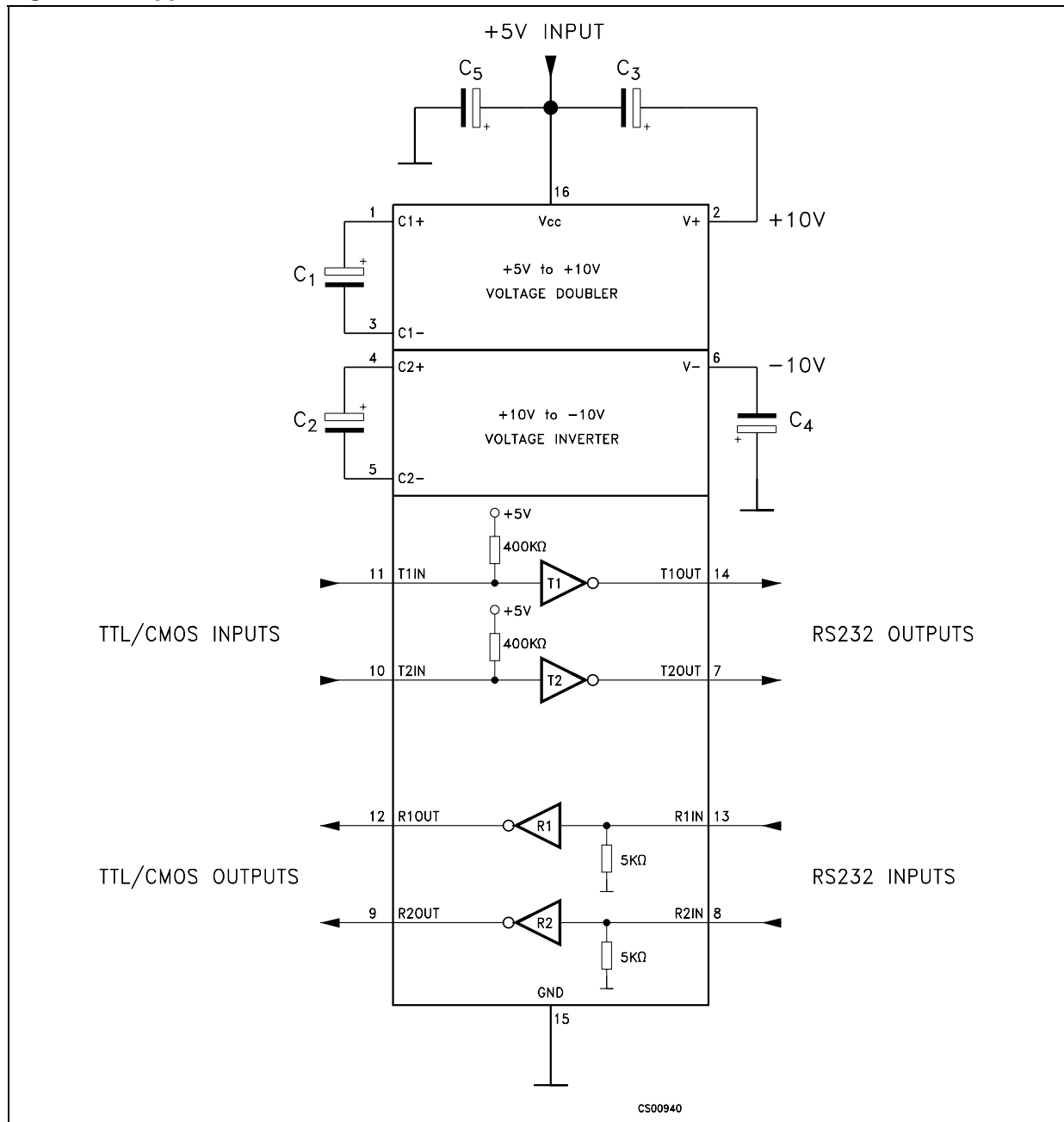
( $C_1 - C_4 = 0.1 \mu\text{F}$ ,  $V_{CC} = 5 \text{ V} \pm 10 \%$ ,  $T_A = -40$  to  $85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ ).

| Symbol      | Parameter                              | Test condition                          | Min. | Typ.         | Max. | Unit          |
|-------------|--|---|------|--------------|------|---------------|
| $V_{RIN}$   | Receiver input voltage operating range |   | -30  |              | 30   | V             |
| $R_{RIN}$   | RS-232 input resistance                | $T_A = 25^\circ\text{C}$                | 3    | 5            | 7    | k $\Omega$    |
| $V_{RIL}$   | RS-232 input threshold low             |   | 0.8  | 1.3          |      | V             |
| $V_{RIH}$   | RS-232 input threshold high            |   |      | 1.8          | 2.4  | V             |
| $V_{RIHYS}$ | RS-232 input hysteresis                | $V_{CC} = 5\text{V}$                    | 0.2  | 0.5          | 1    | V             |
| $V_{ROL}$   | TTL/CMOS output voltage low            | $I_{OUT} = 3.2\text{mA}$ (to $V_{CC}$ ) |      | 0.2          | 0.4  | V             |
| $V_{ROH}$   | TTL/CMOS output voltage high           | $I_{OUT} = -1\text{mA}$ (to GND)        | 3.5  | $V_{CC}-0.2$ |      | V             |
| $I_{SCR}$   | Receiver output short circuit current  | to GND                                  | 2    | 10           |      | mA            |
|             |  | to $V_{CC}$                             | 10   | 30           |      |               |
| $t_{DR}$    | Propagation delay time                 | $C_L = 150\text{pF}$ <sup>(1)</sup>     |      | 0.1          | 0.5  | $\mu\text{s}$ |

1. RS-232 in to TTL-CMOS out (from 50% to 50%)

# 4 Typical application

Figure 2. Application circuit (1) (2)



1. C<sub>1-4</sub> capacitors can even be 1μF ones
2. C<sub>1-4</sub> can be common or biased capacitors

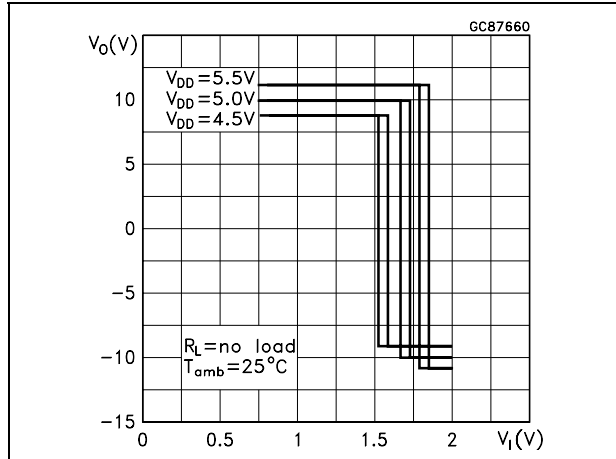
Table 7. Capacitance value (μF)

| C1  | C2  | C3  | C4  | C5  |
|-----|-----|-----|-----|-----|
| 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |

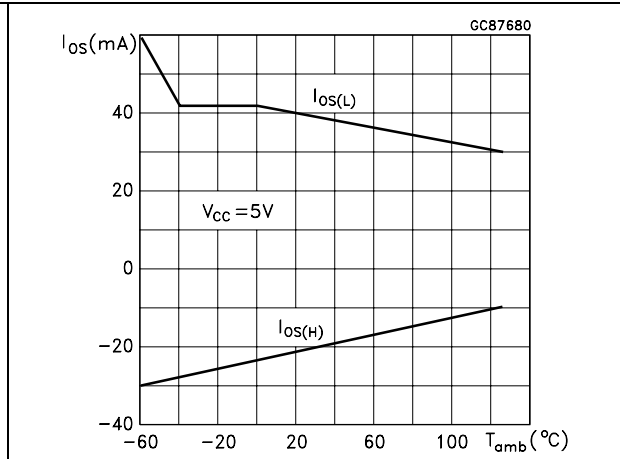
# 5 Typical performance characteristics

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

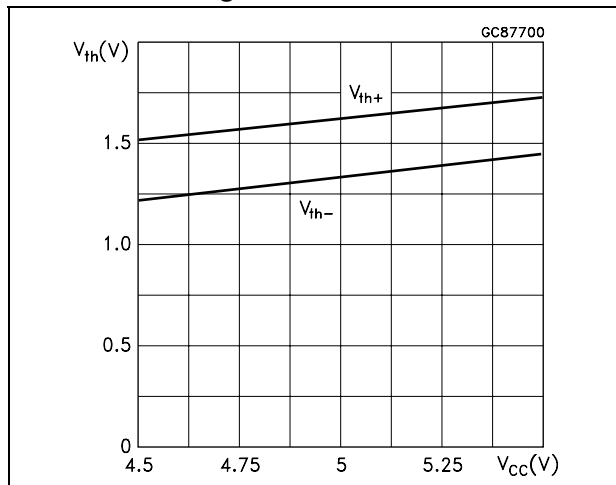
**Figure 3. Driver voltage transfer characteristics**



**Figure 4. Drive short circuit output current vs temperature**



**Figure 5. Receiver threshold vs supply voltage**



**Figure 6. Driver output capability current vs output voltage**

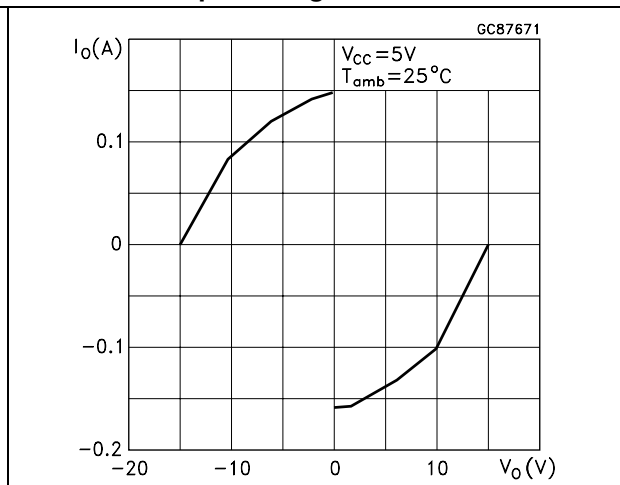


Figure 7. Driver short circuit supply current vs temperature

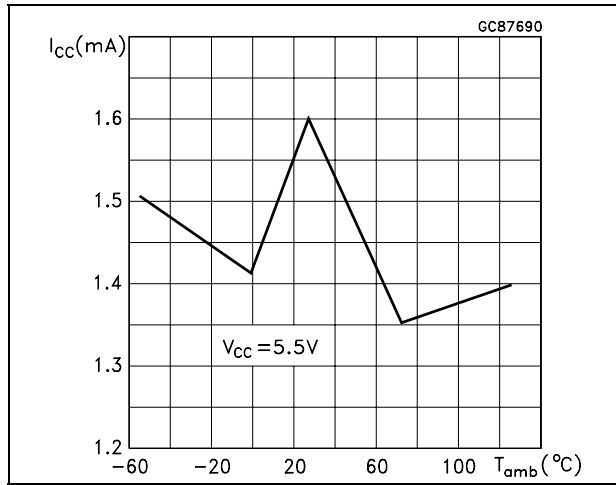
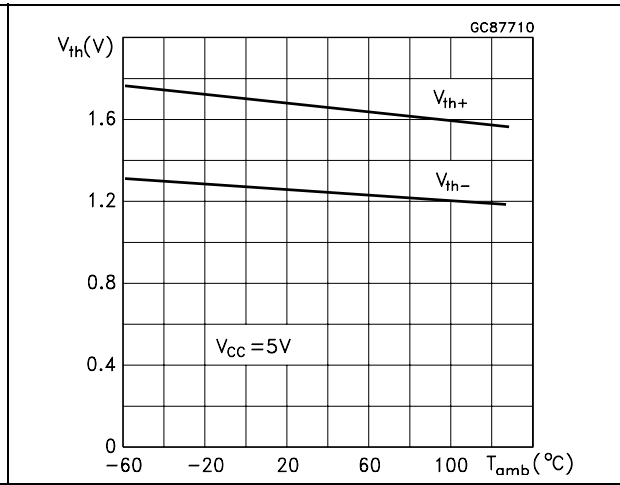


Figure 8. Receiver threshold vs temperature

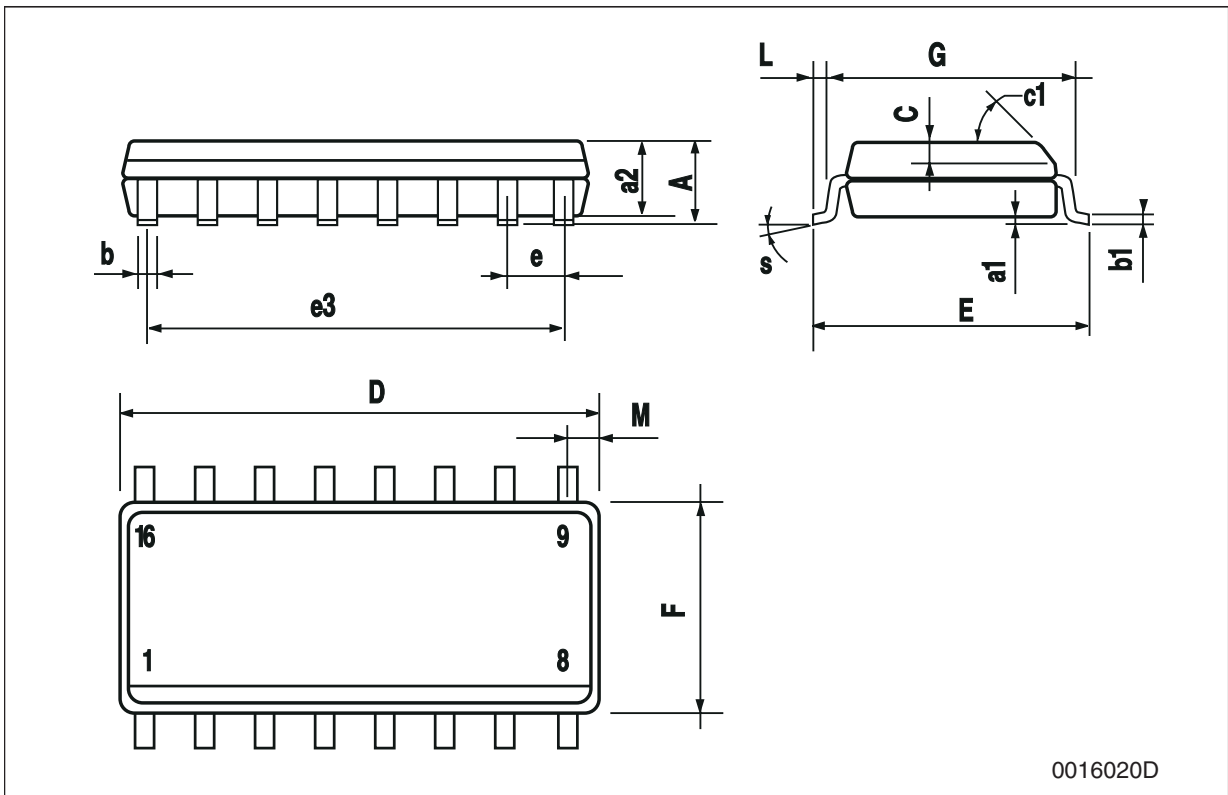


## 6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® 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).

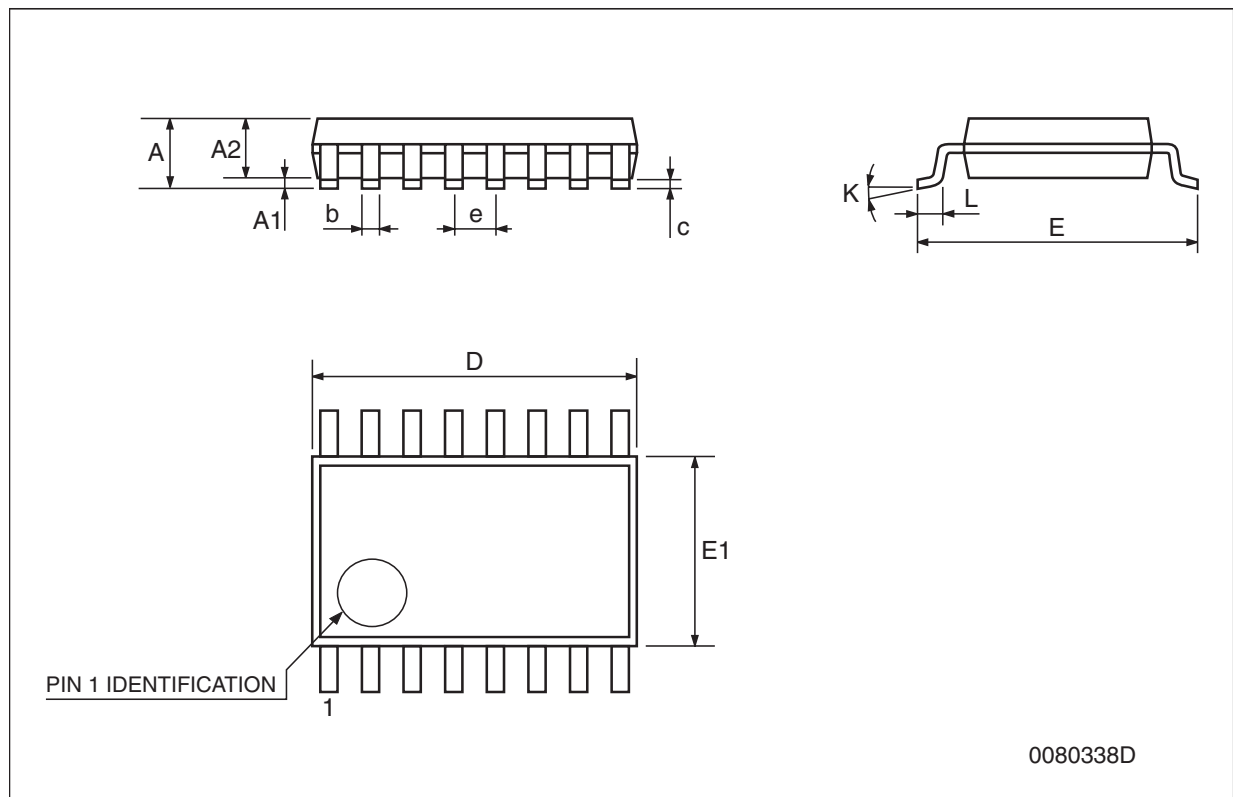
**SO-16 mechanical data**

| 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.)  |      |      |       |       |       |



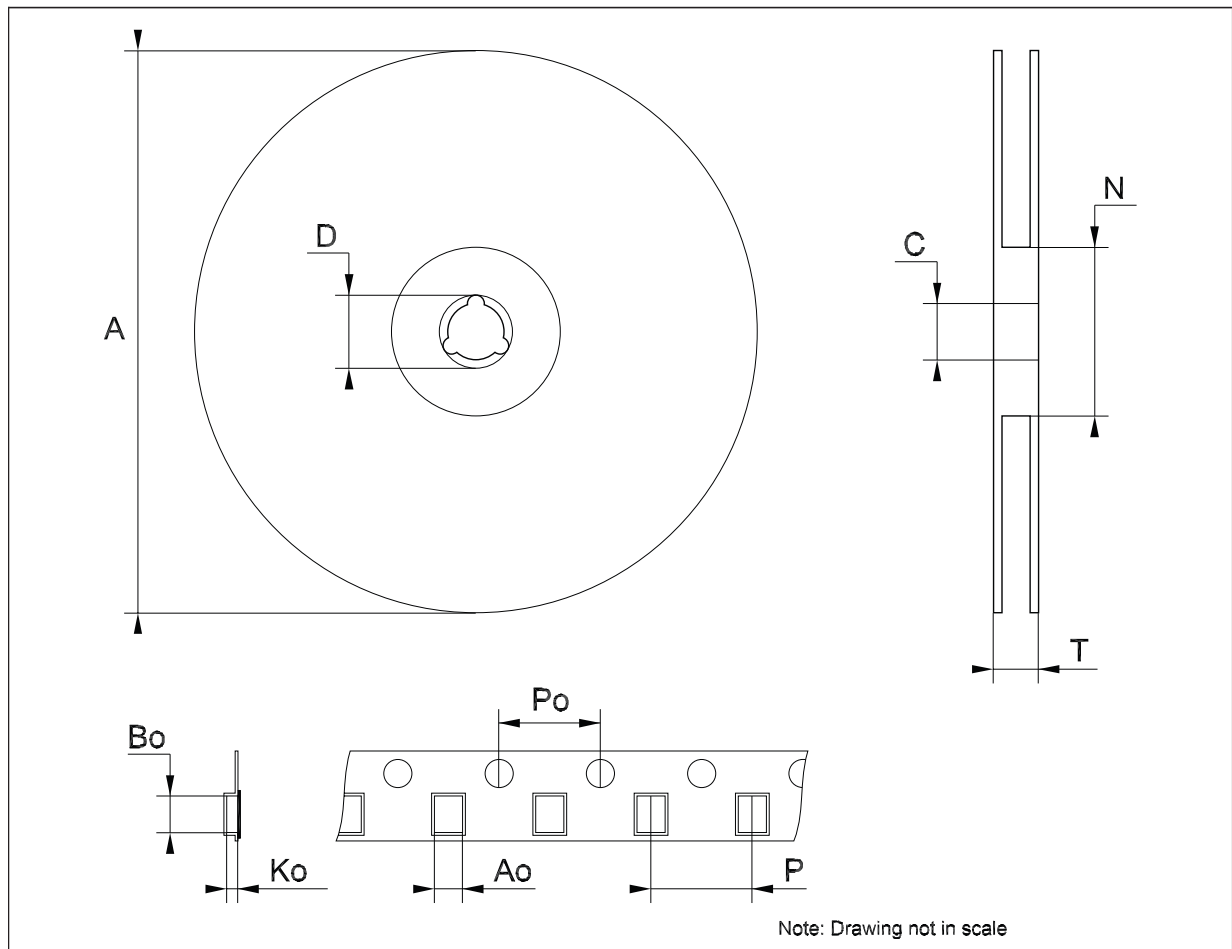
**TSSOP16 mechanical data**

| 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  |



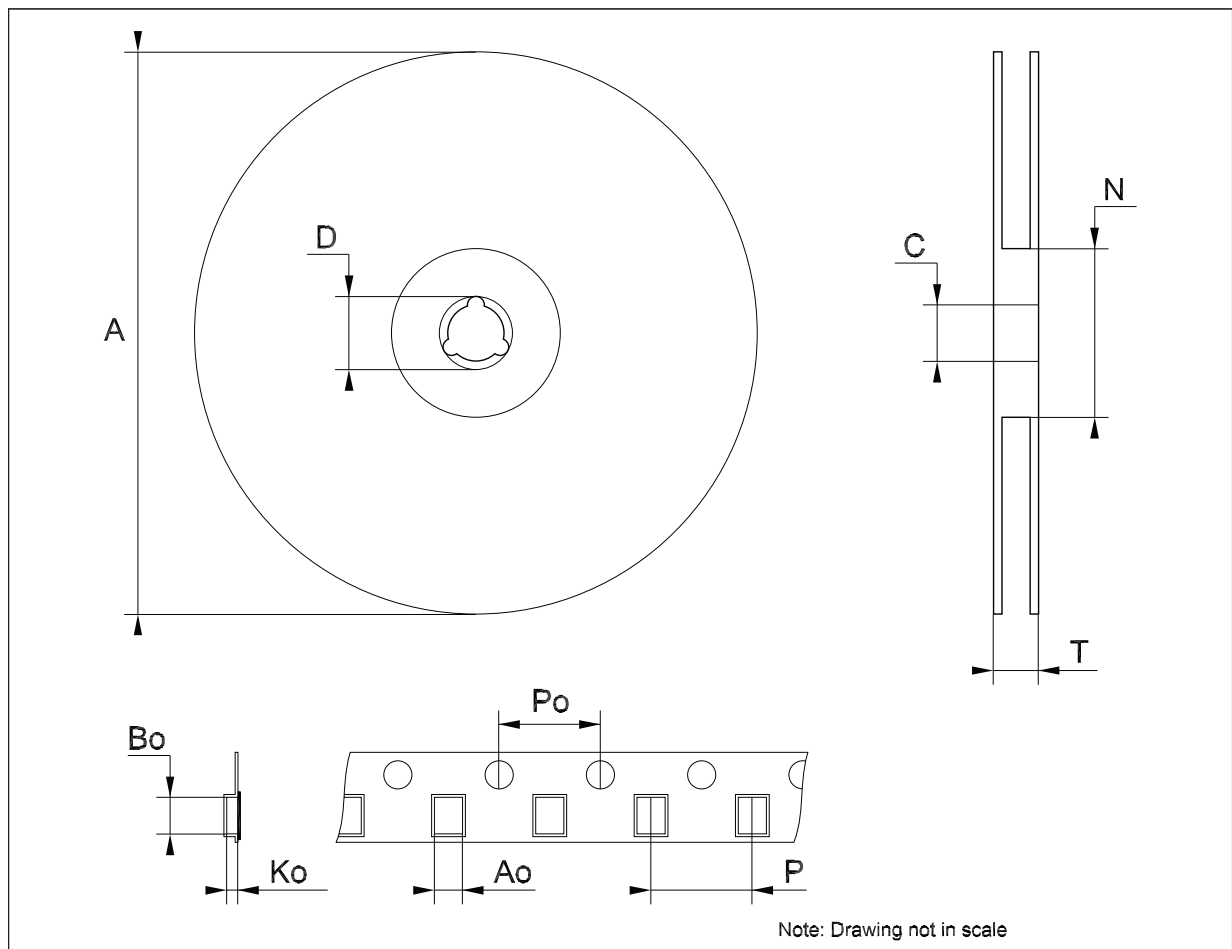
**Tape & reel SO-16 mechanical data**

| 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. Document revision history**

| Date        | Revision | Changes                                       |
|-------------|----------|---|
| 27-Oct-2006 | 7        | Order codes updated.                          |
| 14-Nov-2007 | 8        | Added <a href="#">Table 1</a> .               |
| 08-Feb-2008 | 9        | Modified: <a href="#">Table 1 on page 1</a> . |

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