

## 3 to 5.5 V, 400 Kbps, RS-232 transceiver with auto-power-down

### Features

- 1  $\mu$ A supply current achieved when in auto-power-down
- 250 kbps minimum guaranteed data rate
- Guaranteed 6 V/ $\mu$ s slew rate range
- Guaranteed mouse drive ability
- 0.1  $\mu$ F external capacitors
- Meet EIA/TIA-232 specifications down to 3 V
- Available in SSOP-28 and TSSOP28

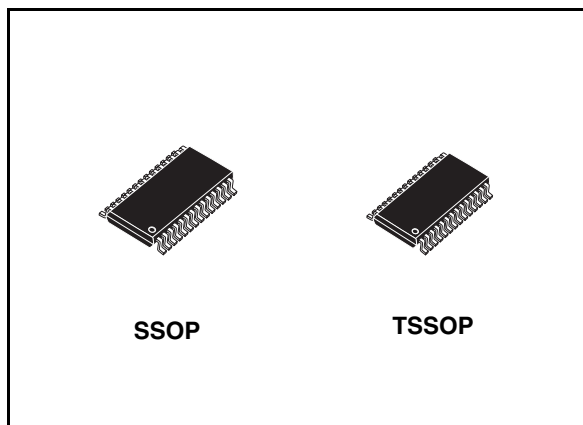
### Description

The ST3243 device consists of 3 drivers, 5 receivers and a dual charge-pump circuit. The device meets the requirements of EIA/TIA and V.28/V.24 communication standards providing high data rate capability.

The receiver R2 is always active to implement a wake-up feature for serial port.

The ST3243 has a proprietary low-dropout transmitter output stage enabling true RS-232 performance from a 3.0 V to 5.5 V supply with a dual charge pump. The device is guaranteed to run at data rates of 250 kbps while maintaining RS-232 output levels.

The Auto-power-down feature functions when  $\overline{\text{FORCEON}}$  is low and  $\overline{\text{FORCEOFF}}$  is high. During this mode of operation, if the device does not sense a valid RS-232 signal, the driver outputs are disabled. If  $\overline{\text{FORCEOFF}}$  is set low, both drivers and receivers (except R2B) are shut off, and supply current is reduced to 1 mA. Disconnecting the serial port or turning off the



peripheral drives causes the auto-power-down condition to occur.

Auto-power-down can be disabled when  $\overline{\text{FORCEON}}$  and  $\overline{\text{FORCEOFF}}$  are high, and should be done when driving a serial mouse. With Auto-power-down enabled, the device is activated automatically when a valid signal is applied to any receiver input.

Typical application are in notebook, sub-notebook, palmtop computers, battery-powered equipment, hand-held equipment, peripherals and printers.

**Table 1. Device summary**

| Order code | Temperature range | Package                 | Packaging           |
|------------|-------------------|-------------------------|---------------------|
| ST3243CPR  | 0 to 70 °C        | SSOP-28 (tape and reel) | 1350 parts per reel |
| ST3243BTR  | -40 to 85 °C      | TSSOP28 (tape and reel) | 2500 parts per reel |

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# 1 Pin configuration

Figure 1. Pin configuration

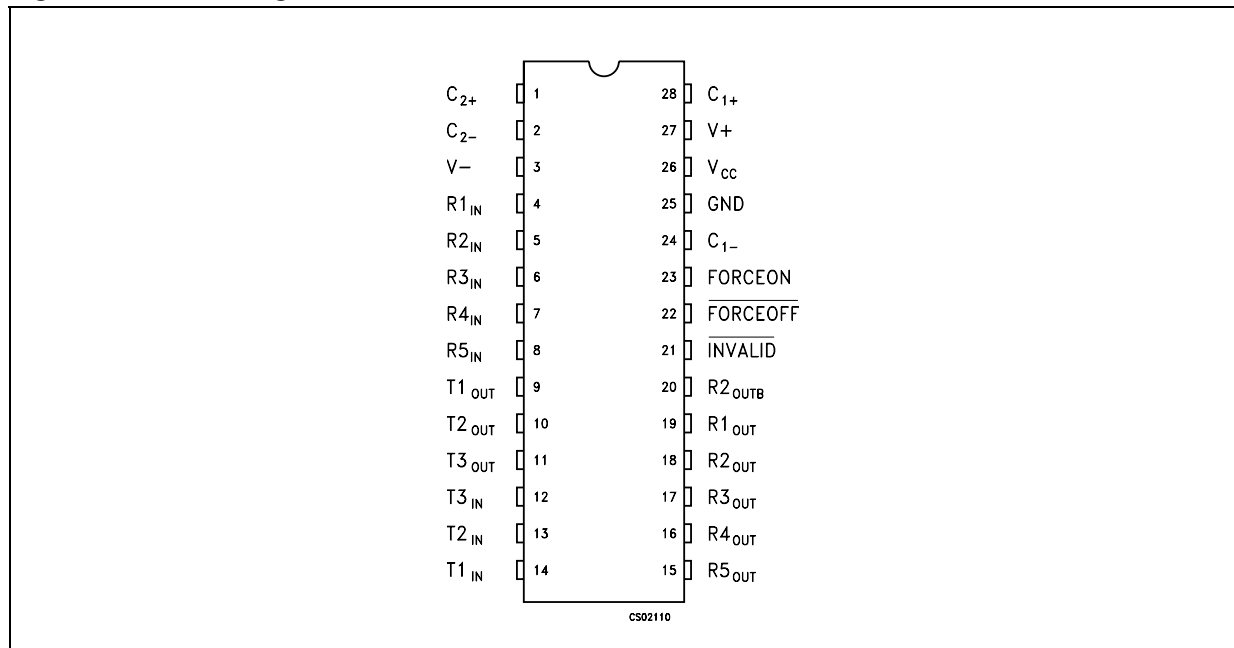


Table 2. Pin description

| Pin n° | Symbol            | Name and function                                    |
|--------|-------------------|------------------------------------------------------|
| 1      | C <sub>2+</sub>   | Positive terminal of inverting charge pump capacitor |
| 2      | C <sub>2-</sub>   | Negative terminal of inverting charge pump capacitor |
| 3      | V <sub>-</sub>    | -5.5V Generated by the charge pump                   |
| 4      | R1 <sub>IN</sub>  | First receiver input voltage                         |
| 5      | R2 <sub>IN</sub>  | Second receiver input voltage                        |
| 6      | R3 <sub>IN</sub>  | Third receiver input voltage                         |
| 7      | R4 <sub>IN</sub>  | Fourth receiver input voltage                        |
| 8      | R5 <sub>IN</sub>  | Fifth receiver input voltage                         |
| 9      | T1 <sub>OUT</sub> | First transmitter output voltage                     |
| 10     | T2 <sub>OUT</sub> | Second transmitter output voltage                    |
| 11     | T3 <sub>OUT</sub> | Third transmitter output voltage                     |
| 12     | T3 <sub>IN</sub>  | Third transmitter input voltage                      |
| 13     | T2 <sub>IN</sub>  | Second transmitter input voltage                     |
| 14     | T1 <sub>IN</sub>  | First transmitter input voltage                      |
| 15     | R5 <sub>OUT</sub> | Fifth receiver output voltage                        |
| 16     | R4 <sub>OUT</sub> | Fourth receiver output voltage                       |

**Table 2. Pin description (continued)**

| Pin n° | Symbol             | Name and function                                                                                                 |
|--------|--------------------|-------------------------------------------------------------------------------------------------------------------|
| 17     | R3 <sub>OUT</sub>  | Third receiver output voltage                                                                                     |
| 18     | R2 <sub>OUT</sub>  | Second receiver output voltage                                                                                    |
| 19     | R1 <sub>OUT</sub>  | First receiver output voltage                                                                                     |
| 20     | R2 <sub>OUTB</sub> | Non-inverting complementary receiver output, always active for wake-up                                            |
| 21     | INVALID            | Output of the valid signal detector. Indicates if a valid RS-232 level is present on receiver inputs logic "1"    |
| 22     | FORCEOFF           | Drive low to shut down transmitters and on-board power supply. This overrides all automatic circuitry and FORCEON |
| 23     | FORCEON            | Drive high to override automatic circuitry keeping transmitters on (FORCEOFF must be high)                        |
| 24     | C <sub>1</sub> -   | Negative terminal of voltage-charge pump capacitor                                                                |
| 25     | GND                | Ground                                                                                                            |
| 26     | V <sub>CC</sub>    | Supply voltage                                                                                                    |
| 27     | V+                 | 5.5V Generated by the charge pump                                                                                 |
| 28     | C <sub>1</sub> +   | Positive terminal of voltage-charge pump capacitor                                                                |

**Table 3. Truth table**

| FORCE OFF | T <sub>OUT</sub>      | R <sub>OUT</sub>      | R2 <sub>OUTB</sub>    |
|-----------|-----------------------|-----------------------|-----------------------|
| 0         | HIGH Z                | HIGH Z                | ACTIVE <sup>(1)</sup> |
| 1         | ACTIVE <sup>(1)</sup> | ACTIVE <sup>(1)</sup> | ACTIVE <sup>(1)</sup> |

1. If the part is in auto-power-down mode (FORCE OFF = V<sub>CC</sub>, FORCE ON = GND) it is shutdown, if no valid RS-232 levels are present on all receiver input

## 2 Maximum ratings

**Table 4. Absolute maximum ratings**

| Symbol                          | Parameter                                           | Value                      | Unit |
|---------------------------------|-----------------------------------------------------|----------------------------|------|
| $V_{CC}$                        | Supply voltage                                      | -0.3 to 6                  | V    |
| V+                              | Doubled voltage terminal                            | ( $V_{CC} - 0.3$ ) to 7    | V    |
| V-                              | Inverted voltage terminal                           | 0.3 to -7                  | V    |
| $V+ +  V- $                     |                                                     | 13                         | V    |
| FORCEON,<br>FORCEOFF, $T_{IN}$  | Input voltage                                       | -0.3 to 6                  | V    |
| $R_{IN}$                        | Receiver input voltage range                        | $\pm 25$                   | V    |
| $T_{OUT}$                       | Transmitter output voltage range                    | $\pm 13.2$                 | V    |
| $R_{OUT}$ $R_{OUTB}$<br>INVALID | Receiver output voltage range                       | -0.3 to ( $V_{CC} + 0.3$ ) | V    |
| $t_{SHORT}$                     | Short circuit duration on $T_{OUT}$ (one at a time) | Continuous                 |      |
| $T_{stg}$                       | Storage temperature range                           | -65 to 150                 | °C   |

**Note:** 1 *Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied. V+ and V- can have a maximum magnitude of +7 V, but their absolute addition can not exceed 13 V.*

2 *The device doesn't meet 1 kV ESD HBM*

### 3 Electrical characteristics

**Table 5. Electrical characteristics**

( $C_1 - C_4 = 0.1 \mu\text{F}$ ,  $V_{CC} = 3 \text{ V to } 5.5 \text{ V}$ ,  $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ )

| Symbol      | Parameter                               | Test conditions                                                                                                                        | Min. | Typ. | Max. | Unit          |
|-------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| $I_{ASHDN}$ | Supply current auto-power-down          | $V_{CC} = 3.3 \text{ or } 5.0\text{V}$ , $T_A = 25^\circ\text{C}$<br>All $R_{IN}$ open, $\overline{\text{FORCEOFF}} = V_{CC}$          |      | 1    | 10   | $\mu\text{A}$ |
| $I_{SHDN}$  | Shutdown supply current                 | $V_{CC} = 3.3 \text{ or } 5.0\text{V}$ , $T_A = 25^\circ\text{C}$<br>All $R_{IN}$ open, $\overline{\text{FORCEOFF}} = \text{GND}$      |      | 1    | 10   | $\mu\text{A}$ |
| $I_{SHDN}$  | Supply current auto-power-down disabled | $V_{CC} = 3.3 \text{ or } 5.0\text{V}$ , $T_A = 25^\circ\text{C}$<br>$\text{FORCEON} = \overline{\text{FORCEOFF}} = V_{CC}$<br>No Load |      | 0.3  | 1    | $\text{mA}$   |

**Table 6. Logic input electrical characteristics**

( $C_1 - C_4 = 0.1 \mu\text{A}$ ,  $V_{CC} = 3 \text{ V to } 5.5 \text{ V}$ ,  $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ )

| Symbol     | Parameter                    | Test conditions                                                                                         | Min.         | Typ.         | Max.      | Unit          |
|------------|------------------------------|---------------------------------------------------------------------------------------------------------|--------------|--------------|-----------|---------------|
| $V_{TIL}$  | Input logic threshold low    | T-IN, $\text{FORCEON}$ , $\overline{\text{FORCEOFF}}$                                                   |              |              | 0.8       | V             |
| $V_{TIH}$  | Input logic threshold high   | T-IN, $\text{FORCEON}$ , $\overline{\text{FORCEOFF}}$<br>$V_{CC} = 3.3\text{V}$<br>$V_{CC} = 5\text{V}$ | 2<br>2.4     |              |           | V<br>V        |
| $V_{THYS}$ | Transmitter input hysteresis |                                                                                                         |              | 0.5          |           | V             |
| $I_{IL}$   | Input leakage current        | T-IN, $\text{FORCEON}$ , $\overline{\text{FORCEOFF}}$                                                   |              | $\pm 0.01$   | $\pm 1.0$ | $\mu\text{A}$ |
| $I_{OL}$   | Output leakage current       | Receiver Disabled                                                                                       |              | $\pm 0.05$   | $\pm 10$  | $\mu\text{A}$ |
| $V_{OL}$   | Output voltage low           | $I_{OUT} = 1.6\text{mA}$                                                                                |              |              | 0.4       | V             |
| $V_{OH}$   | Output voltage high          | $I_{OUT} = -1\text{mA}$                                                                                 | $V_{CC}-0.6$ | $V_{CC}-0.1$ |           | V             |

**Table 7. Auto-power-down electrical characteristics**

( $C_1 - C_4 = 0.1 \mu\text{F}$ ,  $V_{CC} = 3 \text{ V to } 5.5 \text{ V}$ ,  $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ )

| Symbol     | Parameter                                        | Test conditions                          | Min.         | Typ. | Max. | Unit   |
|------------|--------------------------------------------------|------------------------------------------|--------------|------|------|--------|
| $V_{RITE}$ | Receiver input threshold to transmitter enabled  | Positive threshold<br>Negative threshold | 2.7          |      | 2.7  | V<br>V |
| $V_{RITD}$ | Receiver input threshold to transmitter disabled | 1 $\mu\text{A}$ Supply Current           | -0.3         |      | 0.3  | V      |
| $V_{IOL}$  | $\overline{\text{INVALID}}$ Output voltage LOW   |                                          |              |      | 0.4  | V      |
| $V_{IOH}$  | $\overline{\text{INVALID}}$ Output voltage HIGH  |                                          | $V_{CC}-0.6$ |      |      | V      |
| $t_{WU}$   | Receiver threshold to transmitter enabled        | $I_{OUT} = 1.6\text{mA}$                 |              | 250  |      | ms     |

**Table 7. Auto-power-down electrical characteristics**

( $C_1 - C_4 = 0.1 \mu\text{F}$ ,  $V_{CC} = 3 \text{ V}$  to  $5.5 \text{ V}$ ,  $T_A = -40$  to  $85^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25^\circ\text{C}$ )

| Symbol     | Parameter                                               | Test conditions         | Min. | Typ. | Max. | Unit |
|------------|---------------------------------------------------------|-------------------------|------|------|------|------|
| $t_{invh}$ | Receiver positive or negative threshold to INVALID HIGH | $I_{OUT} = -1\text{mA}$ |      | 1    |      | ms   |
| $t_{invL}$ | Receiver positive or negative threshold to INVALID LOW  |                         |      | 30   |      | ms   |

**Table 8. Transmitter electrical characteristics**

( $C_1 - C_4 = 0.1 \mu\text{F}$ ,  $V_{CC} = 3 \text{ V}$  to  $5.5 \text{ V}$ ,  $T_A = -40$  to  $85^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25^\circ\text{C}$ )

| Symbol     | Parameter                    | Test conditions                                                                                                                                     | Min.    | Typ.      | Max.     | Unit     |
|------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------|----------|----------|
| $V_{TOUT}$ | Output voltage swing         | All transmitter outputs are loaded with $3\text{K}\Omega$ to GND                                                                                    | $\pm 5$ | $\pm 5.4$ |          | V        |
| $R_{OUT}$  | Output Resistance            | $V_{CC} = V_+ = V_- = 0\text{V}$ , $V_{OUT} = \pm 2\text{V}$                                                                                        | 300     | 10M       |          | $\Omega$ |
| $I_{SC}$   | Output short circuit current |                                                                                                                                                     |         | $\pm 35$  | $\pm 60$ | mA       |
| $V_{OT}$   | Transmitter output voltage   | $T1IN = T2IN = \text{GND}$ , $T3IN = V_{CC}$<br>$T3OUT$ loaded with $3\text{K}\Omega$ to GND<br>$T1OUT$ and $T2OUT$ loaded with $2.5\text{mA}$ each | $\pm 5$ |           |          | V        |

**Table 9. Receiver electrical characteristics**

( $C_1 - C_4 = 0.1 \mu\text{F}$ ,  $V_{CC} = 3 \text{ V}$  to  $5.5 \text{ V}$ ,  $T_A = -40$  to  $85^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25^\circ\text{C}$ )

| Symbol      | Parameter                              | Test conditions                                                                                        | Min.       | Typ.       | Max.       | Unit             |
|-------------|----------------------------------------|--------------------------------------------------------------------------------------------------------|------------|------------|------------|------------------|
| $V_{RIN}$   | Receiver input voltage operating range |                                                                                                        | -25        |            | 25         | V                |
| $V_{RIL}$   | RS-232 Input threshold low             | $T_A = 25^\circ\text{C}$ , $V_{CC} = 3.3\text{V}$<br>$T_A = 25^\circ\text{C}$ , $V_{CC} = 5.0\text{V}$ | 0.6<br>0.8 | 1.2<br>1.2 |            | V                |
| $V_{RIH}$   | RS-232 Input threshold high            | $T_A = 25^\circ\text{C}$ , $V_{CC} = 3.3\text{V}$<br>$T_A = 25^\circ\text{C}$ , $V_{CC} = 5.0\text{V}$ |            | 1.5<br>1.8 | 2.4<br>2.4 | V                |
| $V_{RIHYS}$ | Input hysteresis                       |                                                                                                        |            | 0.5        |            | V                |
| $R_{RIN}$   | Input resistance                       | $T_A = 25^\circ\text{C}$                                                                               | 3          | 5          | 7          | $\text{k}\Omega$ |

**Table 10. Timing characteristics**

( $C_1 - C_4 = 0.1 \mu\text{F}$ ,  $V_{CC} = 3 \text{ V}$  to  $5.5 \text{ V}$ ,  $T_A = -40$  to  $85 \text{ }^\circ\text{C}$ , unless otherwise specified. Typical values are referred to  $T_A = 25 \text{ }^\circ\text{C}$ )

| Symbol                 | Parameter                                                      | Test conditions                                                                                                                                                                                                                                            | Min.   | Typ. | Max.     | Unit                                             |
|------------------------|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|----------|--------------------------------------------------|
| $D_R$                  | Maximum data rate                                              | $R_L = 3\text{K}\Omega$ , $C_L = 1000\text{pF}$<br>one transmitter switching                                                                                                                                                                               | 250    | 400  |          | kbps                                             |
| $t_{PHL}$<br>$t_{PLH}$ | Receiver propagation delay                                     | $R_{IN}$ to $R_{OUT}$ , $C_L = 150\text{pF}$                                                                                                                                                                                                               |        | 0.15 |          | $\mu\text{s}$                                    |
| $t_{T\_SKEW}$          | Transmitter skew                                               |                                                                                                                                                                                                                                                            |        | 100  |          | ns                                               |
| $t_{R\_SKEW}$          | Receiver skew                                                  |                                                                                                                                                                                                                                                            |        | 50   |          | ns                                               |
| $t_{INVH}$             | Receiver positive or negative threshold to <u>INVALID HIGH</u> |                                                                                                                                                                                                                                                            |        | 1    |          | ms                                               |
| $t_{INVL}$             | Receiver positive or negative threshold to <u>INVALID LOW</u>  |                                                                                                                                                                                                                                                            |        | 30   |          | ms                                               |
| $S_{RT}$               | Transition slew rate                                           | $T_A = 25^\circ\text{C}$ $R_L = 3\text{K}$ to $7\text{K}\Omega$ $V_{CC} = 3.3\text{V}$<br>measured from $+3\text{V}$ to $-3\text{V}$ or $-3\text{V}$ to $+3\text{V}$<br>$C_L = 150\text{pF}$ to $1000\text{pF}$<br>$C_L = 150\text{pF}$ to $2500\text{pF}$ | 6<br>4 |      | 30<br>30 | $\text{V}/\mu\text{s}$<br>$\text{V}/\mu\text{s}$ |



# 4 Application

Figure 2. Application circuits

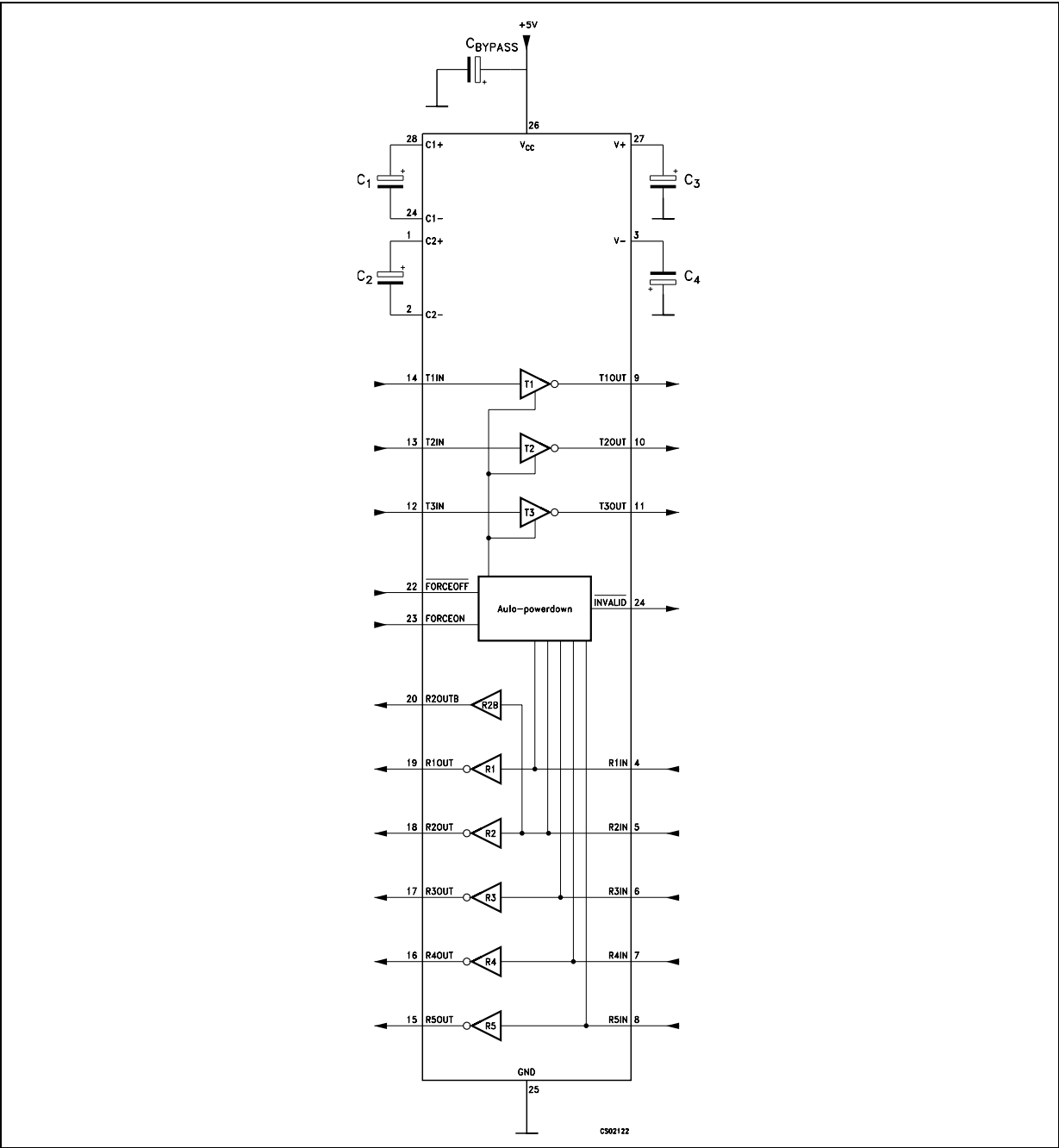


Table 11. Capacitance value (μF)

| V <sub>CC</sub> | C1  | C2  | C3  | C4  | Cbypass |
|-----------------|-----|-----|-----|-----|---------|
| 3.0 to 3.6      | 0.1 | 0.1 | 0.1 | 0.1 | 0.1     |

**Table 11. Capacitance value ( $\mu\text{F}$ )**

| $V_{CC}$   | C1    | C2   | C3   | C4   | Cbypass |
|------------|-------|------|------|------|---------|
| 4.5 to 5.5 | 0.047 | 0.33 | 0.33 | 0.33 | 0.33    |
| 3.0 to 5.5 | 0.22  | 1.0  | 1.0  | 1.0  | 0.22    |

# 5 Typical performance characteristics

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

Figure 3. Invalid high threshold time

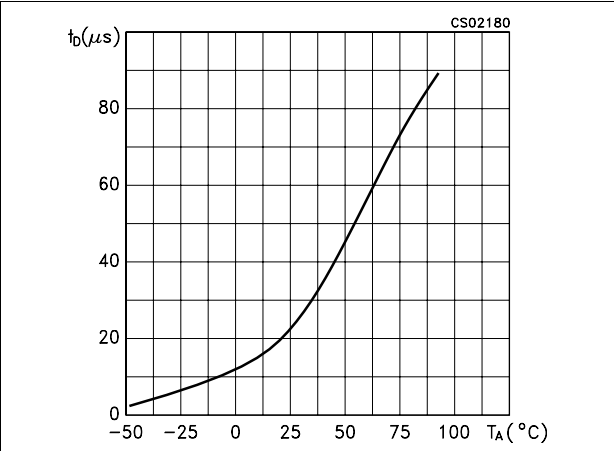


Figure 4. Invalid low threshold time

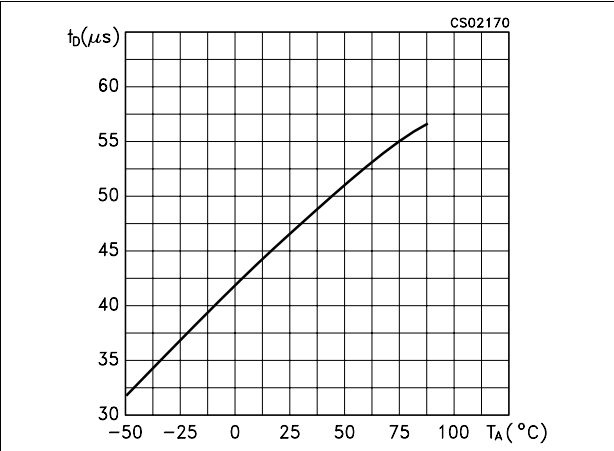


Figure 5. Receiver propagation delay

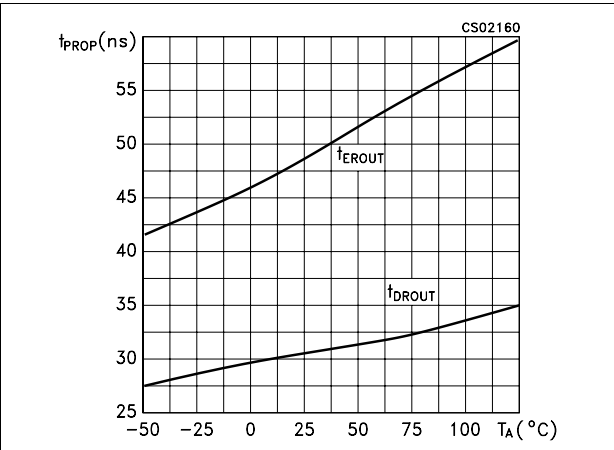


Figure 6. Receiver output enable & disable time

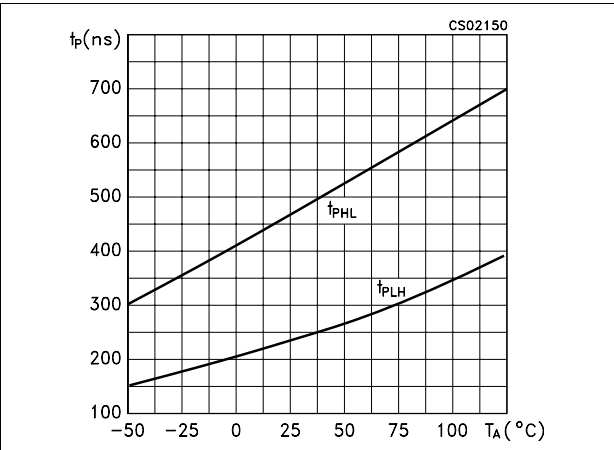


Figure 7. Output current vs output high voltage

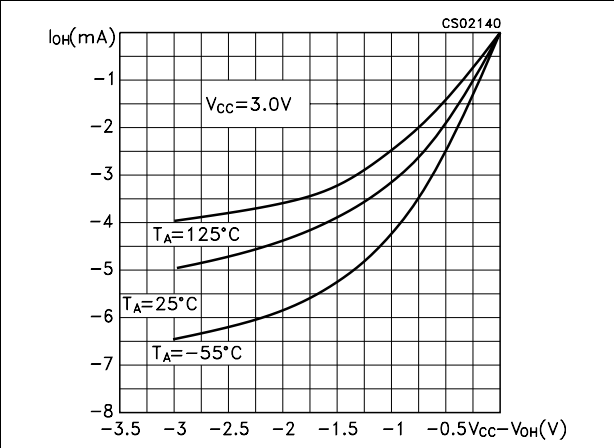
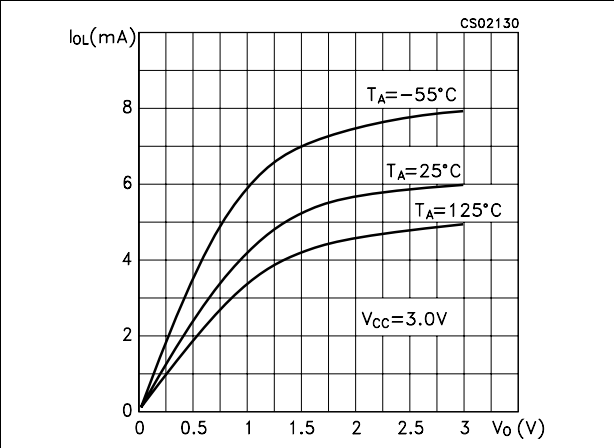


Figure 8. Output current vs output low voltage



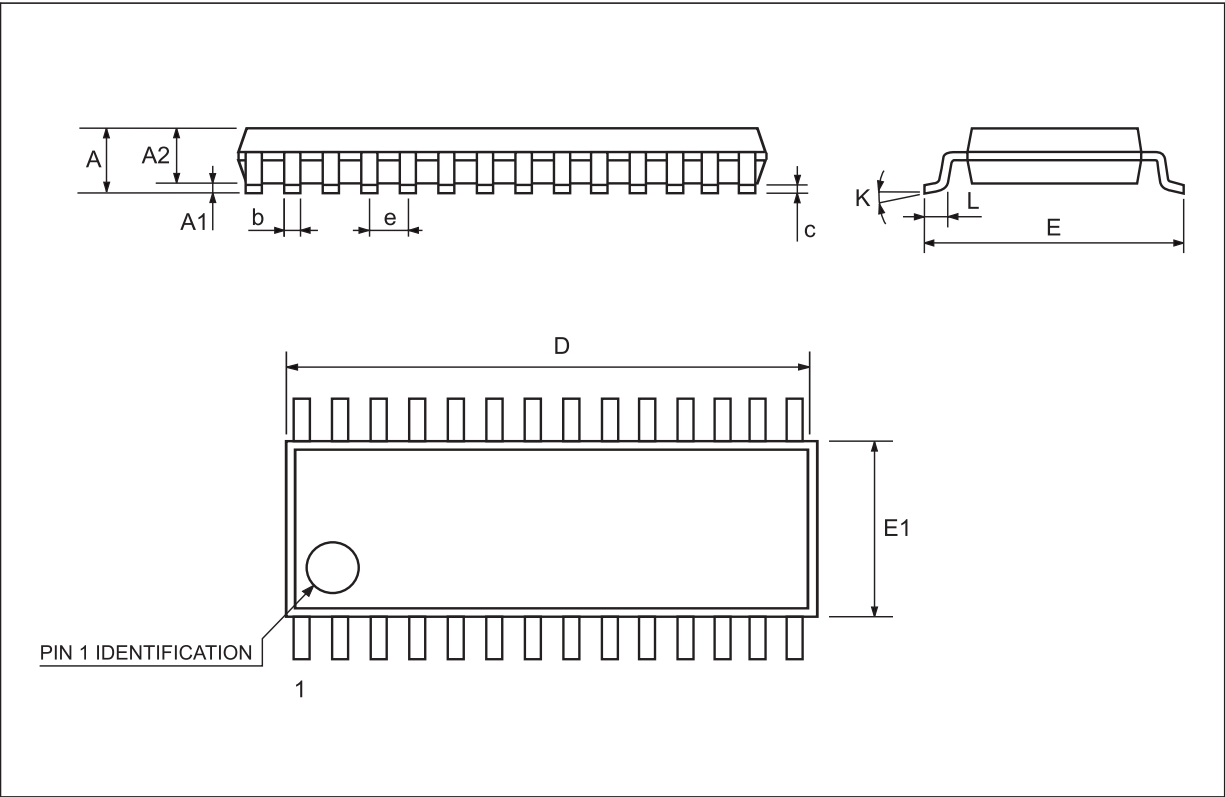
## 6 Package mechanical data

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)



SSOP28 mechanical data

| Dim. | mm.   |          |      | inch. |            |       |
|------|-------|----------|------|-------|------------|-------|
|      | Min.  | Typ.     | Max. | Min.  | Typ.       | Max.  |
| A    |       |          | 2    |       |            | 0.079 |
| A1   | 0.050 |          |      | 0.002 |            |       |
| A2   | 1.65  | 1.75     | 1.85 | 0.065 | 0.069      | 0.073 |
| b    | 0.22  |          | 0.38 | 0.009 |            | 0.015 |
| c    | 0.09  |          | 0.25 | 0.004 |            | 0.010 |
| D    | 9.9   | 10.2     | 10.5 | 0.390 | 0.402      | 0.413 |
| E    | 7.4   | 7.8      | 8.2  | 0.291 | 0.307      | 0.323 |
| E1   | 5     | 5.3      | 5.6  | 0.197 | 0.209      | 0.220 |
| e    |       | 0.65 BSC |      |       | 0.0256 BSC |       |
| K    | 0°    |          | 10°  | 0°    |            | 10°   |
| L    | 0.55  | 0.75     | 0.95 | 0.022 | 0.030      | 0.037 |

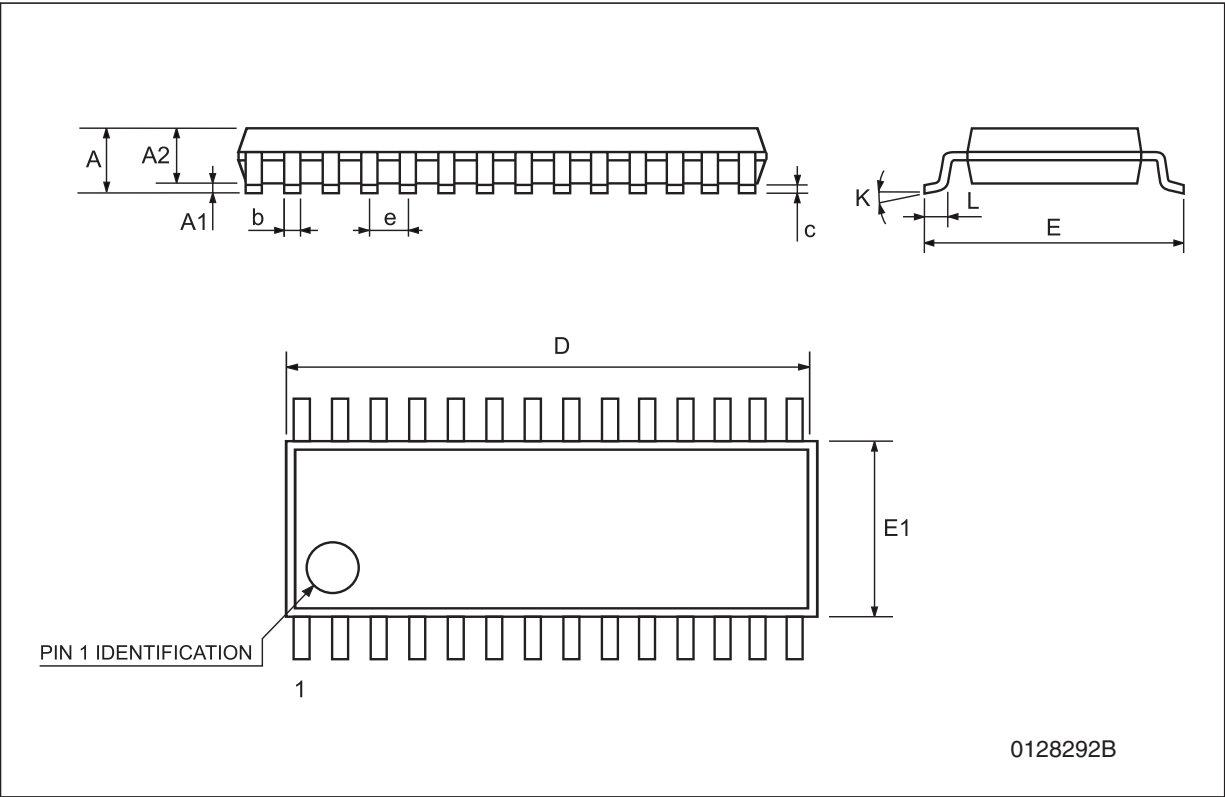






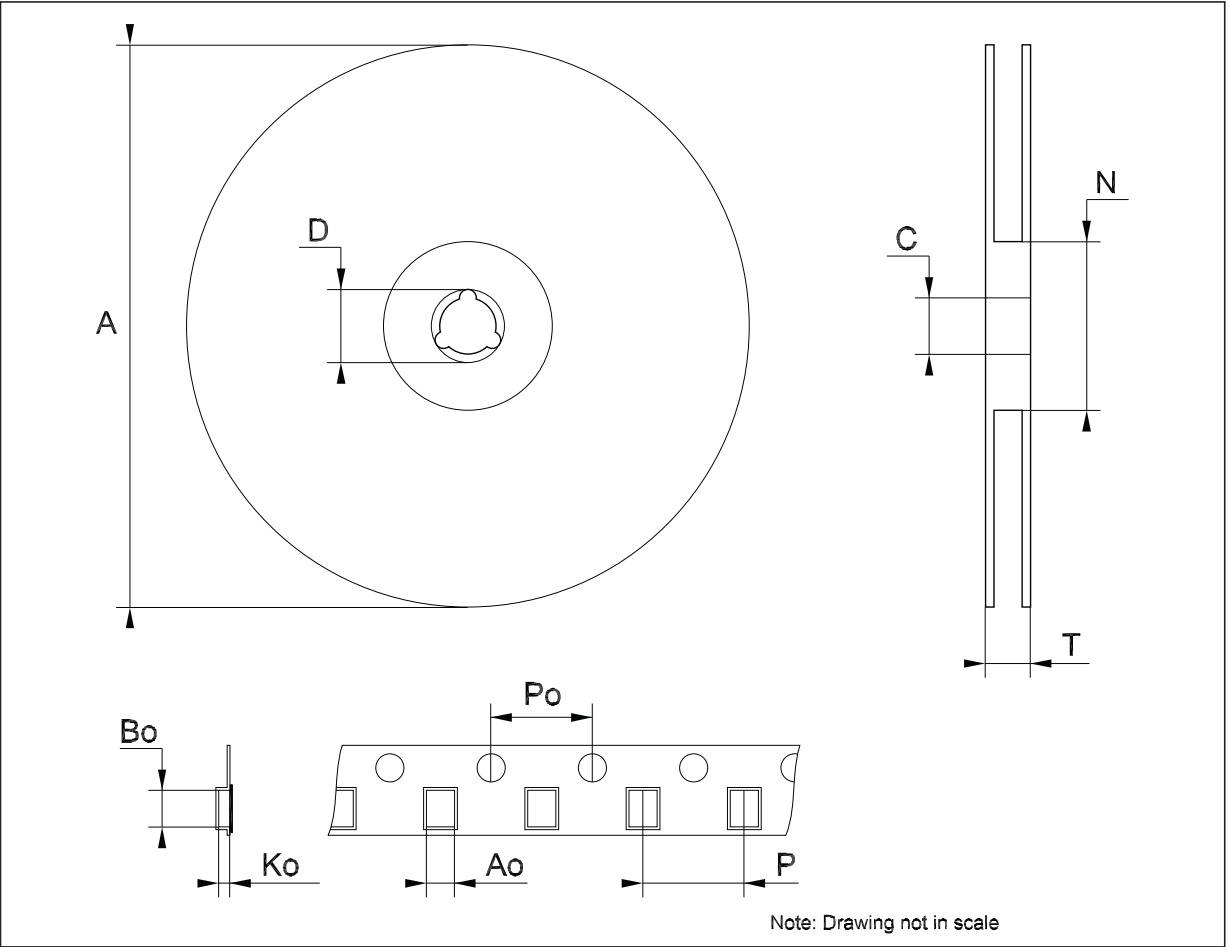
TSSOP28 mechanical data

| 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    | 9.6  | 9.7      | 9.8  | 0.378 | 0.382      | 0.386  |
| 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 SSOP28 mechanical data

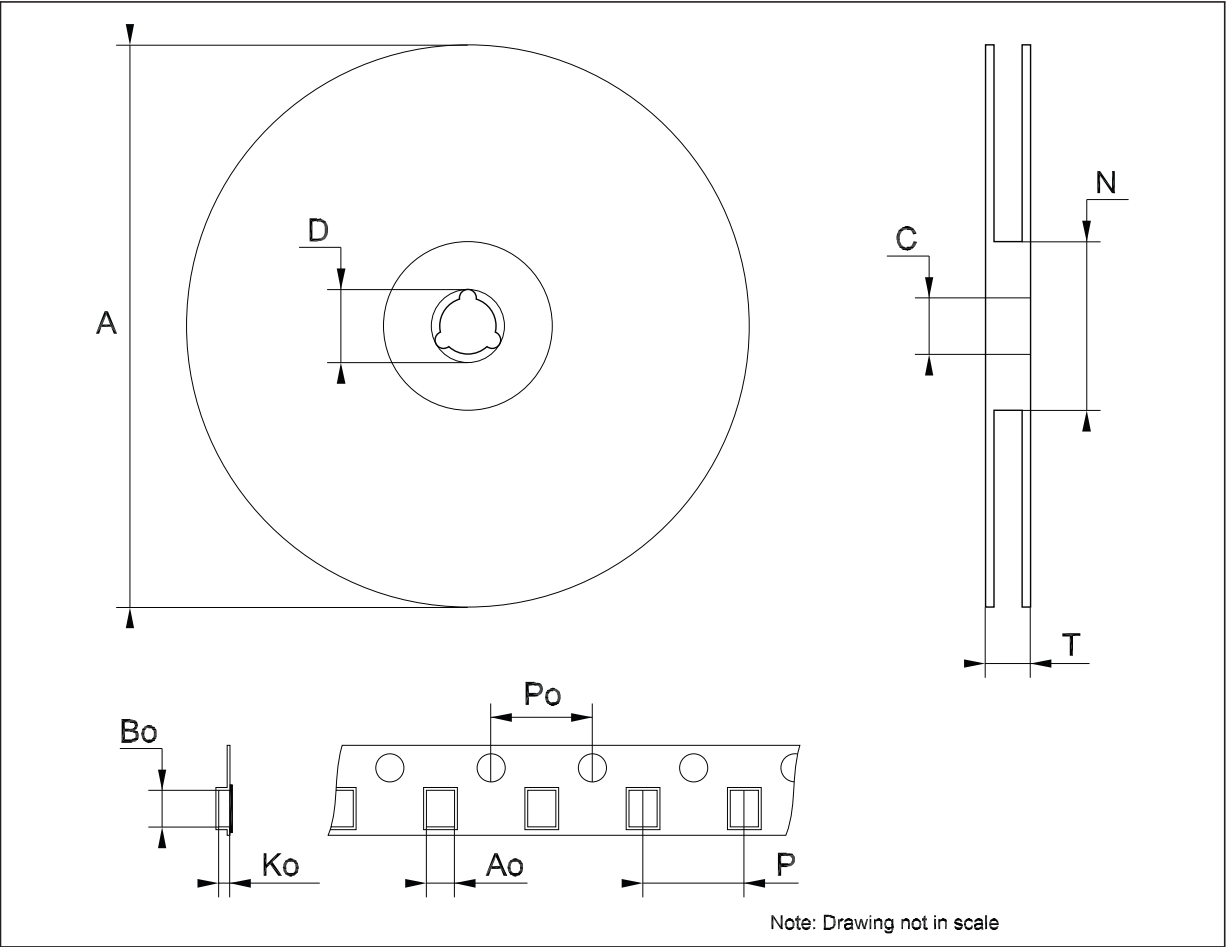
| Dim. | mm.  |      |      | inch. |      |        |
|------|------|------|------|-------|------|--------|
|      | Min. | Typ. | Max. | Min.  | Typ. | Max.   |
| A    |      |      | 330  |       |      | 12.992 |
| C    | 12.8 |      | 13.2 | 0.504 |      | 0.519  |
| D    | 20.2 |      |      | 0.795 |      |        |
| N    | 60   |      |      | 2.362 |      |        |
| T    |      |      | 22.4 |       |      | 0.882  |
| Ao   | 8.4  |      | 8.6  | 0.331 |      | 0.339  |
| Bo   | 10.7 |      | 10.9 | 0.421 |      | 0.429  |
| Ko   | 2.9  |      | 3.1  | 0.114 |      | 0.122  |
| Po   | 3.9  |      | 4.1  | 0.153 |      | 0.161  |
| P    | 11.9 |      | 12.1 | 0.468 |      | 0.476  |





Tape & reel TSSOP28 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   | 6.8  |      | 7    | 0.268 |      | 0.276  |
| Bo   | 10.1 |      | 10.3 | 0.398 |      | 0.406  |
| Ko   | 1.7  |      | 1.9  | 0.067 |      | 0.075  |
| Po   | 3.9  |      | 4.1  | 0.153 |      | 0.161  |
| P    | 11.9 |      | 12.1 | 0.468 |      | 0.476  |



## 7 Revision history

**Table 12. Document revision history**

| Date        | Revision | Changes                         |
|-------------|----------|---------------------------------|
| 19-Sep-2004 | 6        | Document updating.              |
| 31-Mar-2006 | 7        | Order codes updated.            |
| 12-Nov-2007 | 8        | Added <a href="#">Table 1</a> . |

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