



ST3222B ST3222C

3 to 3.6 V, low power, up to 400 kbps
RS-232 drivers and receivers

Features

- 300 μ A supply current
- 250 kbps minimum guarantee data rate
- 6 V/ μ s minimum guarantee slew rate
- Meet EIA/TIA-232 specification down to 3 V

Description

The ST3222 is a 3 V powered EIA/TIA-232 and V.28/V.24 communications interface with low power requirements and high data-rate capabilities. ST3222 has a proprietary low dropout transmitter output stage providing true RS-232 performance from 3 to 3.6 V power supplies. The device requires only four small 0.1 mF standard external capacitors for operating from 3 V supply. The ST3222 has two receivers and two drivers. The ST3222 features a 1 mA shutdown mode that reduces power consumption and extends battery life in portable systems. Its receivers can remain active in shutdown mode, allowing external devices such as modems to be monitored using only 1 mA supply current. The device is guaranteed to run at data rates of 250 Kbps while maintaining RS-232 output levels. Typical applications are notebooks, sub-notebooks and palmtop computers, battery powered equipment, hand-held equipment, peripherals and printers.

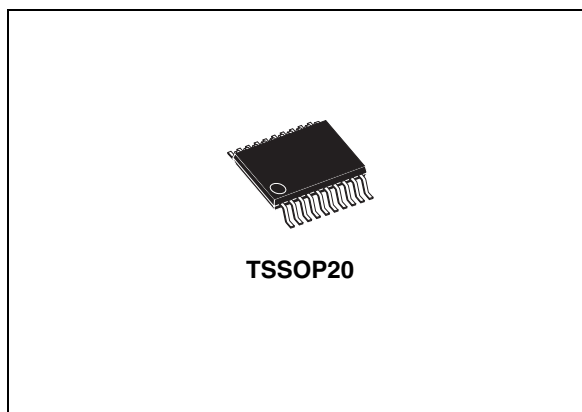


Table 1. Device summary

| Order codes | Temperature range | Package | Packaging |
|-------------|-------------------|-------------------------|---------------------|
| ST3222CTR | 0 to 70 °C | TSSOP20 (tape and reel) | 2500 parts per reel |
| ST3222BTR | -40 to 85 °C | TSSOP20 (tape and reel) | 2500 parts per reel |

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1 Pin configuration

Figure 1. Pin connections

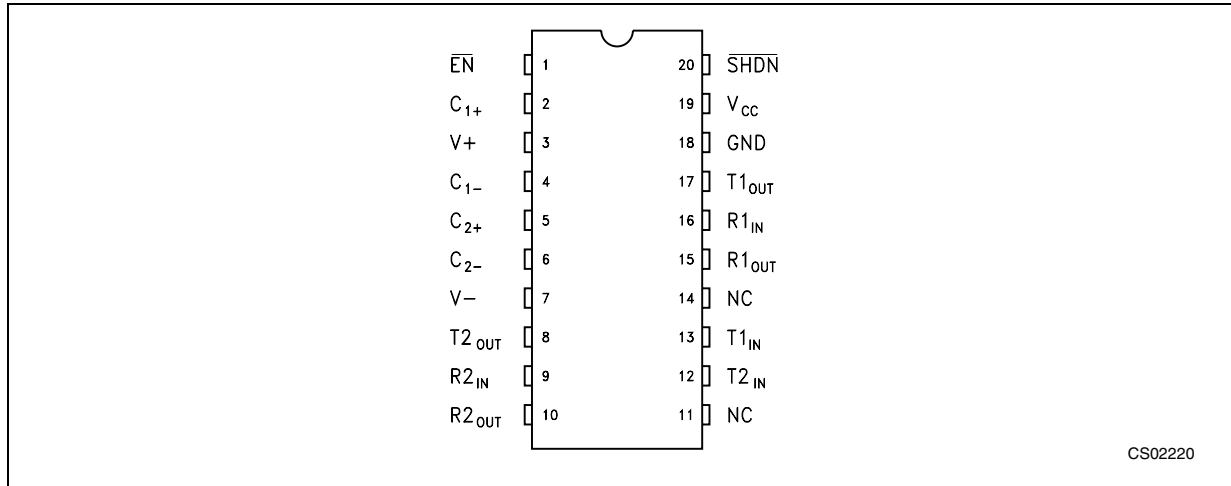


Table 2. Pin descriptions

| Pin n° | Symbol | Name and function |
|--------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 1 | EN | Receiver enable control. Drive low for normal operation. Drive high to force the receivers outputs (R_OUT) into a high-impedance state. |
| 2 | C ₁₊ | Positive terminal for the first charge pump capacitor |
| 3 | V+ | 5.5 V Generated by the charge pump. |
| 4 | C ₁₋ | Negative terminal for the first charge pump capacitor |
| 5 | C ₂₊ | Positive terminal for the second charge pump capacitor |
| 6 | C ₂₋ | Negative terminal for the second charge pump capacitor |
| 7 | V- | -5.5 V Generated by the charge pump. |
| 8 | T2 _{OUT} | Second transmitter output voltage |
| 9 | R2 _{IN} | Second receiver Input voltage |
| 10 | R2 _{OUT} | Second receiver output voltage |
| 11 | NC | Not connected |
| 12 | T2 _{IN} | Second transmitter input voltage |
| 13 | T1 _{IN} | First transmitter Input voltage |
| 14 | NC | Not connected |
| 15 | R1 _{OUT} | First receiver output voltage |
| 16 | R1 _{IN} | First receiver input voltage |
| 17 | T1 _{OUT} | First transmitter output voltage |
| 18 | GND | Ground |
| 19 | V _{CC} | Supply voltage |
| 20 | SHDN | Active low shutdown control input. Drive low to shutdown transmitter and charge pump |

2 Maximum ratings

Table 3. 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 |
| T_{IN} | Transmitter input voltage range | -0.3 to 6 | V |
| R_{IN} | Receiver input voltage range | ± 25 | V |
| T_{OUT} | Transmitter output voltage range | ± 13.2 | V |
| R_{OUT} | Receiver output voltage range | -0.3 to $(V_{CC} + 0.3)$ | V |
| t_{SHORT} | Transmitter output short to gnd time | Continuous | |

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

Externally applied $V+$ and $V-$ can have a maximum magnitude of +7 V, but their absolute addition can not exceed 13 V.

Running on internal charge pump, intrinsic self limitation allows exceeding those values without any damage.

Startup voltage sequence (V_{CC} , then $V+$, then $V-$) is critical, therefore it is not recommended to use this device using externally applied voltage to $V+$ and $V-$.

3 Electrical characteristics

Table 4. Electrical characteristics ($C_1 - C_4 = 0.1 \mu\text{F}$, $V_{CC} = 3 \text{ V}$ to 3.6 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 |
|---------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| I_{SUPPLY} | V_{CC} power supply current | No load $V_{CC} = 3.3 \text{ V}$ $T_A = 25 \text{ }^\circ\text{C}$ $\overline{\text{SHDN}} = V_{CC}$ | | 0.3 | 1 | mA |
| I_{SHDN} | SHUTDOWN supply current | No load $V_{CC} = 3.3 \text{ V}$ $T_A = 25 \text{ }^\circ\text{C}$ $\overline{\text{SHDN}} = \text{GND}$ | | 1 | 10 | μA |

Table 5. Logic input electrical characteristics ($C_1 - C_4 = 0.1 \mu\text{F}$, $V_C = 3 \text{ V}$ to 3.6 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 |
|------------------|------------------------------|--------------------------------------------------------------------------|------|------------|---------|---------------|
| V_{IL} | Input logic threshold low | T-IN, $\overline{\text{EN}}$, $\overline{\text{SHDN}}$ (<i>Note:</i>) | | | 0.8 | V |
| V_{IH} | Input logic threshold high | $V_{CC} = 3.3 \text{ V}$ | 2 | | | V |
| V_{HYS} | Transmitter input hysteresis | | | 0.5 | | V |
| I_{IL} | Input leakage current | T-IN, $\overline{\text{EN}}$, $\overline{\text{SHDN}}$ | | ± 0.01 | ± 1 | μA |

Note: Transmitter input hysteresis is typically 250 mV

Table 6. Transmitter electrical characteristics ($C_1 - C_4 = 0.1 \mu\text{A}$, $V_{CC} = 3 \text{ V}$ to 3.6 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 |
|-------------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------|---------|-----------|----------|---------------|
| V_{TOUT} | Output voltage swing | All transmitter outputs are loaded with $3 \text{ k}\Omega$ to GND | ± 5 | ± 5.4 | | V |
| R_{TOUT} | Transmitter output resistance | $V_{CC} = V_+ = V_- = 0 \text{ V}$, $V_{\text{OUT}} = \pm 2 \text{ V}$ | 300 | 10M | | Ω |
| I_{TSC} | Output short circuit current | | | | ± 60 | mA |
| I_{TOL} | Output leakage current | $V_{CC} = 0 \text{ V}$ or 3 V to 3.6 V , $V_{\text{OUT}} = \pm 12 \text{ V}$ Transmitters disable | | | ± 25 | μA |

3.1 Receiver electrical characteristics

Table 7. Receiver electrical characteristics ($C_1 - C_4 = 0.1 \mu\text{F}$, $V_{\text{CC}} = 3 \text{ V to } 3.6 \text{ V}$, $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25 \text{ }^\circ\text{C}$)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------------|----------------------------------------|---------------------------------------------------------------------|---------------------|---------------------|----------|------------------|
| I_{OL} | Output leakage current | R-OUT, $\overline{\text{EN}} = V_{\text{CC}}$, receiver disabled | | ± 0.05 | ± 10 | μA |
| V_{RIN} | Receiver Input voltage operating range | | -25 | | 25 | V |
| V_{RIL} | Input threshold low | $T_A = 25 \text{ }^\circ\text{C}$, $V_{\text{CC}} = 3.3 \text{ V}$ | 0.6 | 1.2 | | V |
| V_{RIH} | Input threshold high | $T_A = 25 \text{ }^\circ\text{C}$, $V_{\text{CC}} = 3.3 \text{ V}$ | | 1.5 | 2.4 | V |
| V_{RIHYS} | Input hysteresis | | | 0.5 | | V |
| R_{RIN} | Input resistance | $T_A = 25 \text{ }^\circ\text{C}$ | 3 | 5 | 7 | $\text{k}\Omega$ |
| V_{ROL} | TTL/CMOS output voltage low | $I_{\text{OUT}} = 1.6 \text{ mA}$ | | | 0.4 | V |
| V_{ROH} | TTL/CMOS output voltage high | $I_{\text{OUT}} = -1 \text{ mA}$ | $V_{\text{CC}}-0.6$ | $V_{\text{CC}}-0.1$ | | V |

Table 8. Timing characteristics ($C_1 - C_4 = 0.1 \mu\text{F}$, $V_{\text{CC}} = 3 \text{ V to } 3.6 \text{ V}$, $T_A = -40 \text{ to } 85 \text{ }^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25 \text{ }^\circ\text{C}$)

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------------------------|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|----------|--------------------------------------------------|
| D_{R} | Data transfer rate | $R_L = 3 \text{ k}\Omega$ $C_{L2} = 1000 \text{ pF}$ one transmitter switching | 240 | 400 | | Kbps |
| t_{PHLR} t_{PLHR} | Propagation delay input to output | R_{XIN} to R_{XOUT} , $C_L = 150 \text{ pF}$ | | 0.2 | | μs |
| $ t_{\text{PHLT}} - t_{\text{THL}} $ | Transmitter propagation delay difference (1) | | | 100 | | ns |
| t_{OER} | Receiver output enable time | Normal operation | | 200 | | ns |
| t_{ODR} | Receiver output disable time | Normal operation | | 200 | | ns |
| $ t_{\text{PHLR}} - t_{\text{THR}} $ | Receiver propagation delay difference | | | 50 | | ns |
| S_{RT} | Transition slew rate | $T_A = 25 \text{ }^\circ\text{C}$, $R_L = 3 \text{ k}\Omega$ to $7 \text{ k}\Omega$, $V_{\text{CC}} = 3.3 \text{ V}$ measured from $+3 \text{ V to } -3 \text{ V}$ or $-3 \text{ V to } +3 \text{ V}$ $C_L = 150 \text{ pF to } 1000 \text{ pF}$ $C_L = 150 \text{ pF to } 2500 \text{ pF}$ | 6 4 | | 30 30 | $\text{V}/\mu\text{s}$ $\text{V}/\mu\text{s}$ |

1. Transmitter skew is measured at the transmitter zero cross points

4 Application

Figure 2. Application circuits

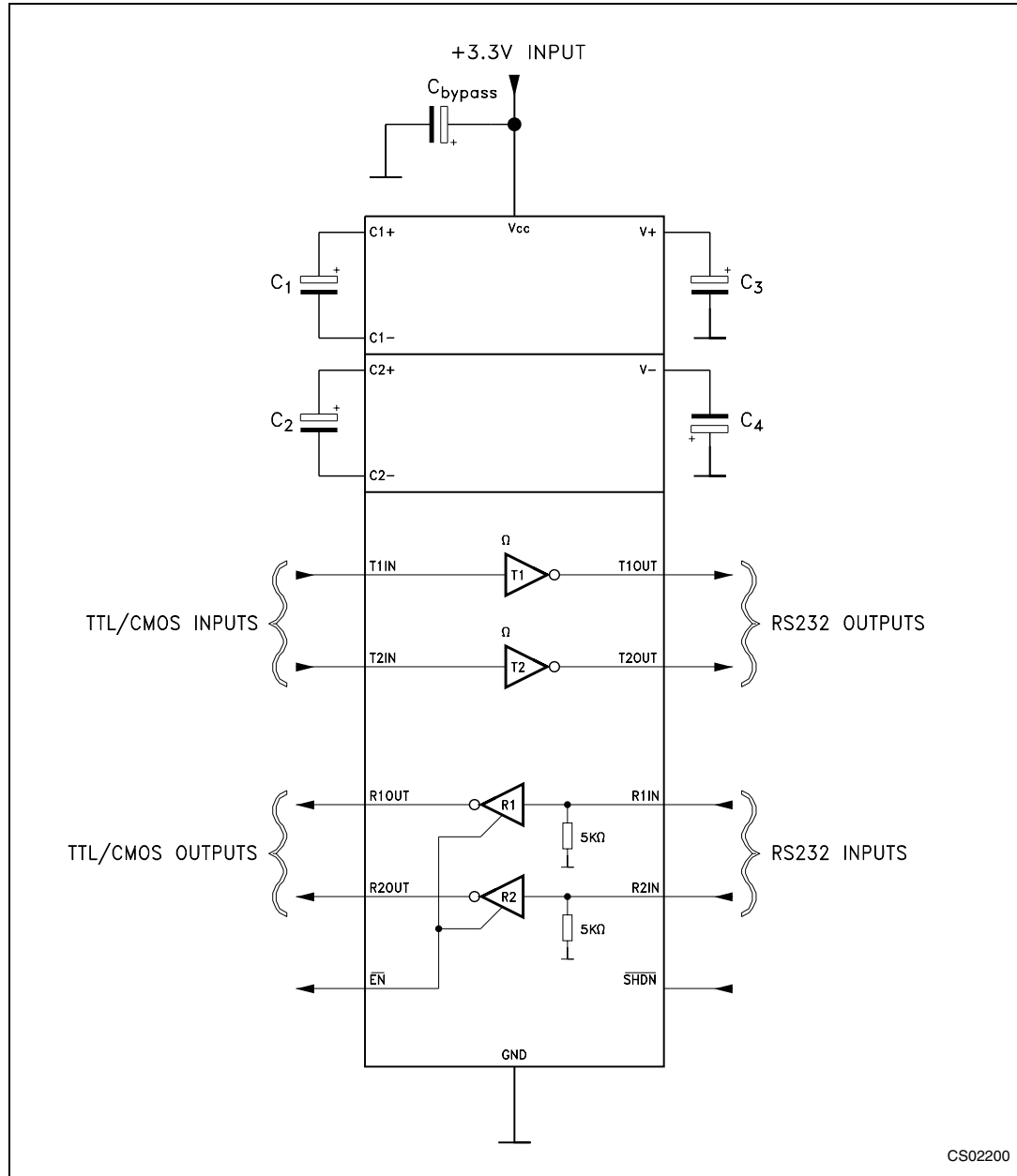


Table 9. Capacitance value (µF)

| C1 | C2 | C3 | C4 | C _{bypass} |
|-----|-----|-----|-----|---------------------|
| 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |

4.1 Typical performance characteristics

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

Figure 3. Driver voltage transfer characteristics for transmitter inputs

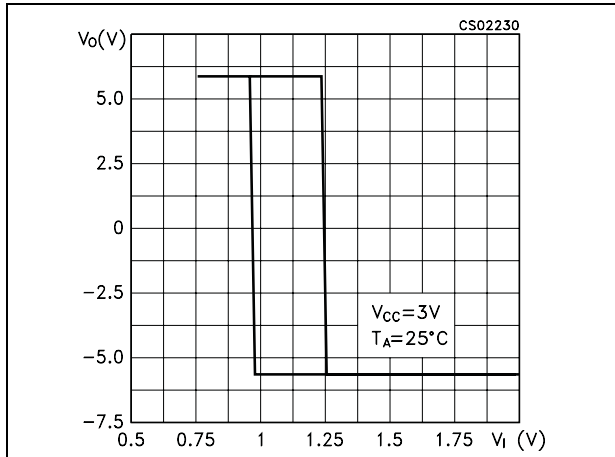


Figure 4. Driver voltage transfer characteristics for receiver inputs

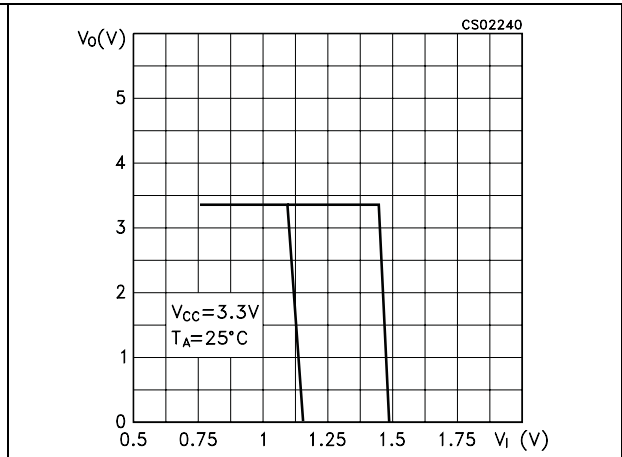


Figure 5. Output current vs. output low voltage

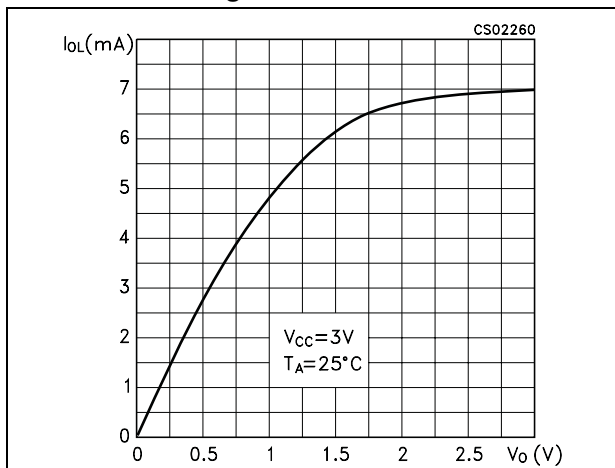
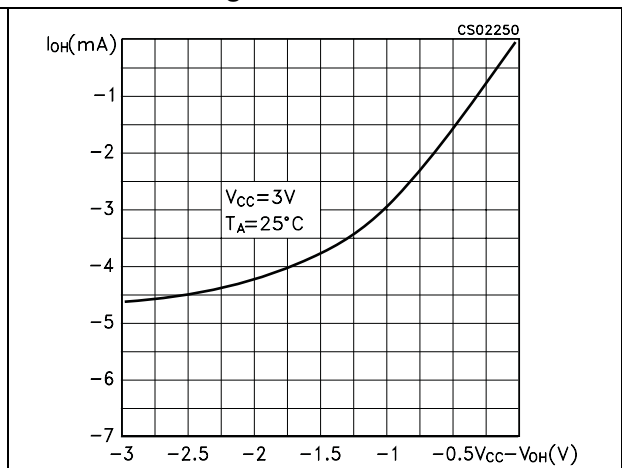


Figure 6. Output current vs. output high voltage



5 Package mechanical data

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

Table 10. TSSOP20 package mechanical data

| Dim. | mm. | | | in. | | |
|------|------|----------|------|-------|------------|--------|
| | 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 | 6.4 | 6.5 | 6.6 | 0.252 | 0.256 | 0.260 |
| 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 |

Figure 7. TSSOP20 package mechanical drawing

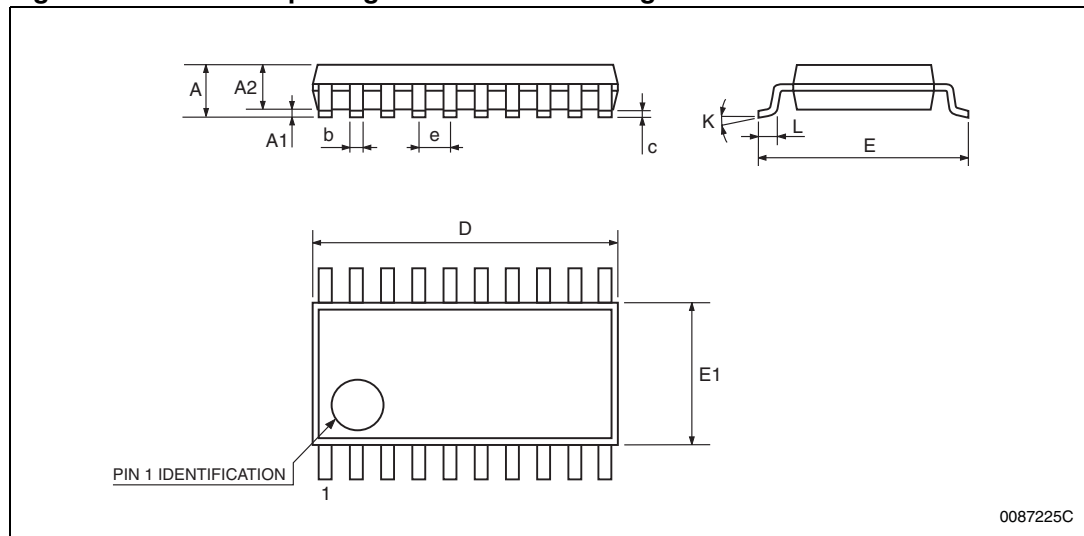
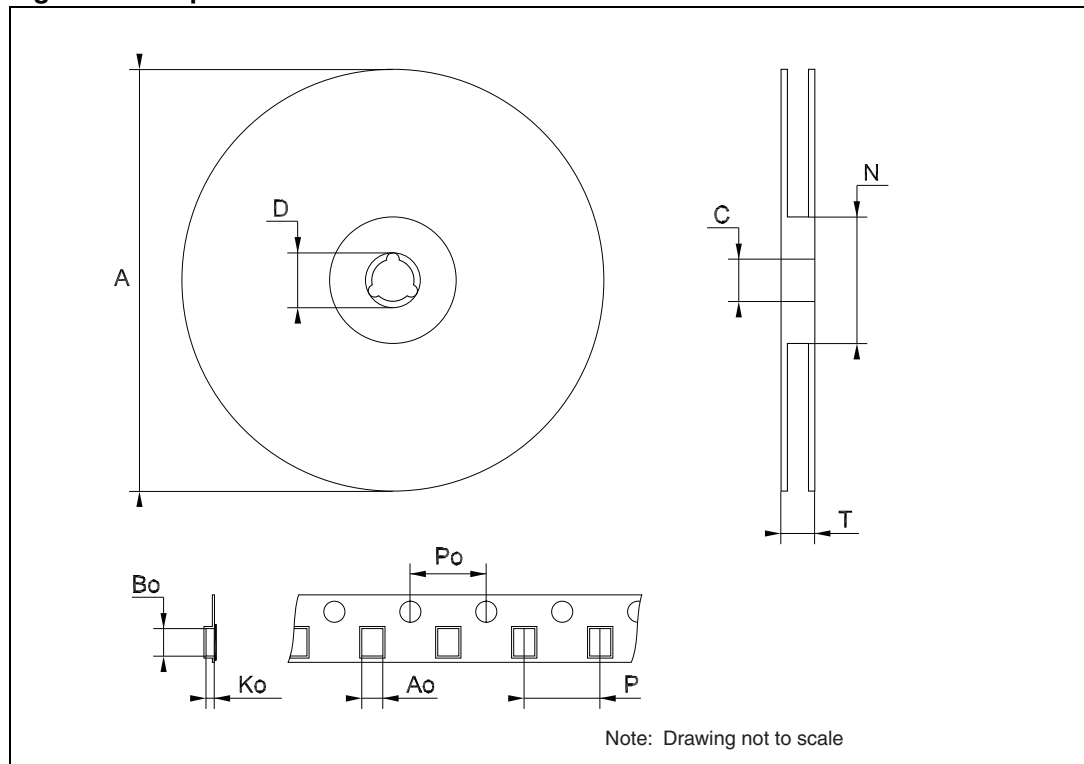


Table 11. Tape and reel TSSOP20 mechanical data

| Dim. | mm. | | | in. | | |
|----------------|------|------|------|-------|------|--------|
| | 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 |
| A ₀ | 6.8 | | 7 | 0.268 | | 0.276 |
| B ₀ | 6.9 | | 7.1 | 0.272 | | 0.280 |
| K ₀ | 1.7 | | 1.9 | 0.067 | | 0.075 |
| P ₀ | 3.9 | | 4.1 | 0.153 | | 0.161 |
| P | 11.9 | | 12.1 | 0.468 | | 0.476 |

Figure 8. Tape and reel schematic TSSOP20



6 Revision history

Table 12. Document revision history

| Date | Revision | Changes |
|-------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 22-Mar-2006 | 5 | Order codes updated. |
| 21-Jan-2008 | 6 | Modified: Table 3 and added Table 1 . |
| 25-Aug-2010 | 7 | Updated Table 4 , ECOPACK [®] text in Section 5: Package mechanical data ; reformatted document, minor textual changes. |

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