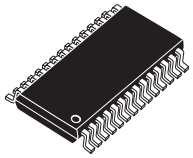
ST3243EB
ST3243EC

± 15 kV ESD protected 3 to 5.5 V, 400 kbps, RS-232 transceiver with auto power-down

Features

- ESD protection for RS-232 I/O pins:
  - ± 8 kV IEC 1000-4-2 contact discharge
  - ± 15 kV human body model
- 1 µA supply current achieved when in auto power-down
- 250 kbps minimum guaranteed data rate
- Guaranteed 6 V/ms slew rate range
- Guaranteed mouse drive ability
- 0.1 µF external capacitors
- Meet EIA/TIA-232 specifications down to 3 V
- Available in TSSOP28 package



TSSOP

Description

The ST3243E 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 and enhanced electrostatic discharge (ESD) protection. All transmitter outputs and receiver input are protected to ± 8 kV USING IEC 1000-4-2 contact discharge and ± 15 kV using the human body model. The receiver R2 is always active to implement a wake-up feature for serial port.

The ST3243E 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 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 (expert R2B) are shut off, and supply current is reduced to 1 µA. 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 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, subnotebook, palmtop computers, battery-powered equipment, handheld equipment, peripherals and printers.

Table 1. Device summary

Order codes	Temperature range	Package	Packaging
ST3243ECTR-E	0 to 70 °C	TSSOP28 (tape and reel)	2500 parts per reel
ST3243EBTR	- 40 to 85 °C	TSSOP28 (tape and reel)	2500 parts per reel

Contents

1 Pin configuration

Figure 1. Pin configuration

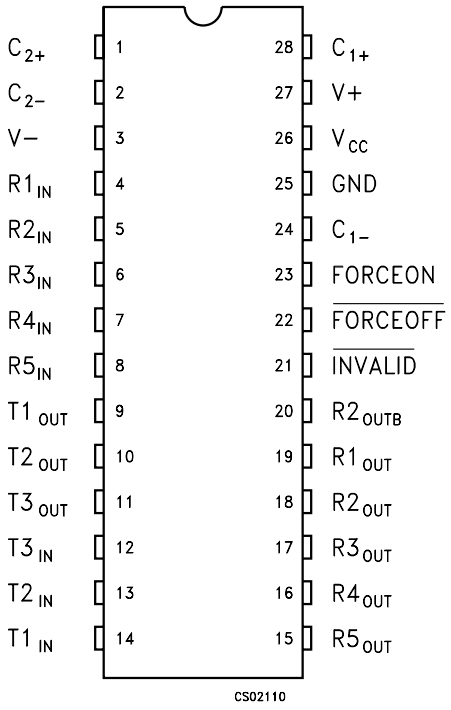


Table 2. Pin description

Pin n°	Symbol	Name and function
1	C_2+	Positive terminal of inverting charge pump capacitor
2	C_2-	Negative terminal of inverting charge pump capacitor
3	V-	-5.5 V Generated by the charge pump
4	$R1_{IN}$	First receiver input voltage
5	$R2_{IN}$	Second receiver input voltage
6	$R3_{IN}$	Third receiver input voltage
7	$R4_{IN}$	Fourth receiver input voltage
8	$R5_{IN}$	Fifth receiver input voltage
9	$T1_{OUT}$	First transmitter output voltage
10	$T2_{OUT}$	Second transmitter output voltage
11	$T3_{OUT}$	Third transmitter output voltage
12	$T3_{IN}$	Third transmitter input voltage
13	$T2_{IN}$	Second transmitter input voltage
14	$T1_{IN}$	First transmitter input voltage

Table 2. Pin description (continued)

Pin n°	Symbol	Name and function
15	$R5_{OUT}$	Fifth receiver output voltage
16	$R4_{OUT}$	Fourth receiver output voltage
17	$R3_{OUT}$	Third receiver output voltage
18	$R2_{OUT}$	Second receiver output voltage
19	$R1_{OUT}$	First receiver output voltage
20	$R2_{OUTB}$	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 over-rides all automatic circuitry and FORCEON
23	FORCEON	Drive high to override automatic circuitry keeping transmitters on ($\overline{\text{FORCEOFF}}$ must be high)
24	C_1-	Negative terminal of voltage-charge pump capacitor
25	GND	Ground
26	V_{CC}	Supply voltage
27	V+	5.5 V Generated by the charge pump
28	C_1+	Positive terminal of voltage-charge pump capacitor

2 Truth tables

Table 3. Invalid truth table

RS-232 Signal present at any receiver input	$\overline{\text{INVALID}}$ output
YES	H
NO	L

Table 4. Output control truth table

Force ON	Force OFF	Valid receiver level	Operation status	T_{OUT}	R_{OUT}	R_{2OUTB}
X	0	X	Shutdown (Force OFF)	HIGH Z	HIGH Z	ACTIVE
1	1	X	Normal operating (Force ON)	ACTIVE	ACTIVE	ACTIVE
0	1	YES	Normal operating (Auto power-down)	ACTIVE	ACTIVE	ACTIVE
0	1	NO	Shutdown (Auto power-down)	HIGH Z	ACTIVE	ACTIVE

3 Maximum ratings

Table 5. 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
$\overline{FORCEON}$, $\overline{FORCEOFF}$, T_{IN}	Input voltage	-0.3 to 6	V
R_{IN}	Receiver input voltage range	± 25	V
T_{OUT}	Transmitter output voltage range	± 13.2	V
R_{OUT} R_{OUTB} $\overline{INVALID}$	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: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

Table 6. ESD performance: transmitter outputs, receiver inputs

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
ESD	ESD protection voltage	Human body model	± 15			kV
ESD	ESD protection voltage	IEC 1000-4-2 (contact discharge)	± 8			kV

4 Electrical characteristics

C1 - C4 = 0.1 µF, V_{CC} = 3 V to 5.5 V, T_A = -40 to 85 °C, unless otherwise specified.
Typical values are referred to T_A = 25 °C.

Table 7. Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{ASHDN}	Supply current auto power-down	$\overline{FORCEOFF}$ = GND,$\overline{FORCEON}$ = V_{CC} All R_IN open or grounded		1	10	µA
I_{SUPPLY}	Supply current	FORCEON = $\overline{FORCEOFF}$ = V_{CC}		0.3	1	mA
I_{SHDN}	Shutdown supply current	$\overline{FORCEOFF}$ = GND		1	10	µA

C1 - C4 = 0.1 µF, V_{CC} = 3 V to 5.5 V, T_A = -40 to 85 °C, unless otherwise specified.
Typical values are referred to T_A = 25 °C.

Table 8. Logic input electrical characteristics

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

C1 - C4 = 0.1 µF, V_{CC} = 3 V to 5.5 V, T_A = -40 to 85 °C, unless otherwise specified.
Typical values are referred to T_A = 25 °C, FORCEON = GND, FORCEOFF = V_{CC}.

Table 9. Auto power-down electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{RITE}	Receiver input threshold to $\overline{\text{INVALID}}$ output voltage HIGH (see *Figure 3*)	Positive threshold			2.7	V
		Negative threshold	2.7			V
V_{RITD}	Receiver input threshold to $\overline{\text{INVALID}}$ output voltage LOW (see *Figure 3*)		-0.3		0.3	V
V_{IOL}	$\overline{\text{INVALID}}$ output voltage LOW	I_{OUT} = 1.6 mA			0.4	V
V_{IOH}	$\overline{\text{INVALID}}$ output voltage HIGH	I_{OUT} = -1 mA	V_{CC}-0.6			V
t_{WU}	Receiver or transmitter edge transmitter enabled (see *Figure 3*)			100		µs
t_{INVH}	Receiver positive or negative threshold to $\overline{\text{INVALID}}$ HIGH (see *Figure 3*)			0.2		µs
t_{INVL}	Receiver positive or negative threshold to $\overline{\text{INVALID}}$ LOW (see *Figure 3*)			30		µs

C1 - C4 = 0.1 µF, V_{CC} = 3 V to 5.5 V, T_A = -40 to 85 °C, unless otherwise specified.
Typical values are referred to T_A = 25 °C.

Table 10. Transmitter electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{TOUT}	Output voltage swing	All Transmitter outputs are loaded with 3kΩ to GND	± 5	± 5.4		V
R_{OUT}	Output resistance	V_{CC} = V+ = V- = 0 V, V_{OUT} = ± 2 V	300	10M		Ω
I_{SC}	Output short circuit current	V_{CC} = 3.3 V		± 40	± 60	mA
I_L	Output leakage current	V_{CC} = 0 to 5.5V, transmitter output = ±12 V, transmitter disabled			± 25	µA
V_{OT}	Transmitter output voltage	T1IN = T2IN = GND,T3IN = V_{CC} T3OUT loaded with 3 kΩ to GND T1OUT and T2OUT loaded with 2.5mA each	± 5			V

C1 - C4 = 0.1 µF, V_{CC} = 3 V to 5.5 V, T_A = -40 to 85 °C, unless otherwise specified.
Typical values are referred to T_A = 25 °C.

Table 11. Receiver electrical characteristics

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°C, V_{CC} = 3.3 V T_A = 25°C, V_{CC} = 5.0 V	0.6 0.8	1.1 1.4		V
V_{RIH}	RS-232 Input threshold high	T_A = 25°C, V_{CC} = 3.3 V T_A = 25°C, V_{CC} = 5.0 V		1.6 1.9	2.4 2.4	V
V_{RIHYS}	Input hysteresis			0.5		V
R_{RIN}	Input resistance	T_A = 25°C	3	5	7	kΩ

C1 - C4 = 0.1 µF, V_{CC} = 3 V to 5.5 V, T_A = -40 to 85 °C, unless otherwise specified.
Typical values are referred to T_A = 25 °C.

Table 12. Timing characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
D_R	Maximum data rate	R_L = 3kΩ, C_L= 1000 pF one transmitter switching	250	400		kbps
t_{PHL} t_{PLH}	Receiver propagation delay	R_{IN} to R_{OUT}, C_L = 150 pF		0.15		µs
t_{T_SKEW}	Transmitter skew			150		ns
t_{R_SKEW}	Receiver skew			70		ns
S_{RT}	Transition slew rate	T_A = 25°C R_L = 3k to 7kΩ, V_{CC} = 3.3 V measured from +3 V to -3 V or -3 V to +3 V C_L = 150 pF to 1000 pF C_L = 150 pF to 2500 pF	 6 4		 30 30	 V/µs V/µs

5 Application circuits

Figure 2. Application circuits

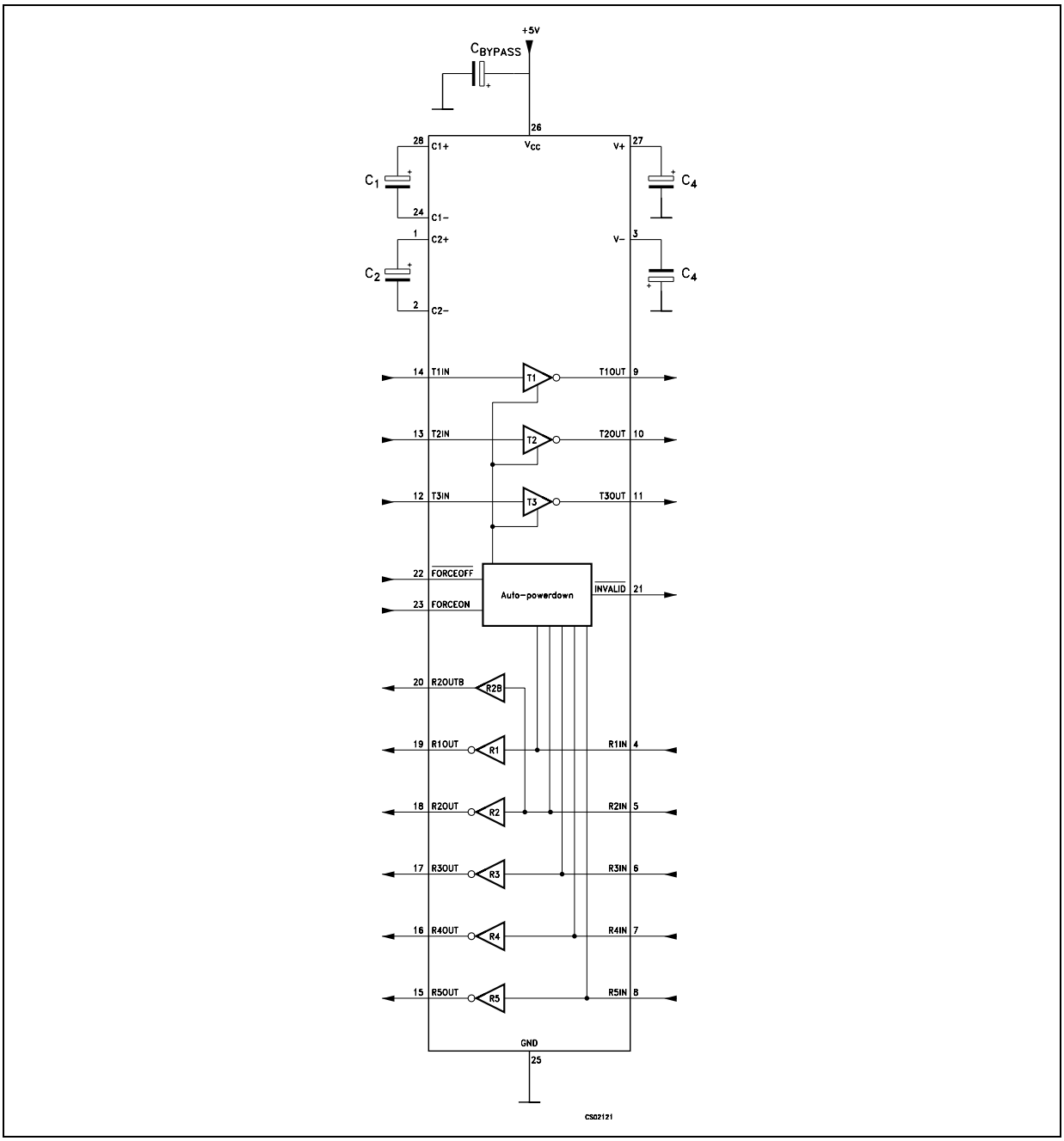


Table 13. Required minimum capacitance value (µF)

V_{CC} (V)	C_1	C_2, C_3, C_4, C_{BYPASS}
3 to 3.6	0.1	0.1
4.5 to 5.5	0.047	0.33

6 Timing diagrams

Figure 3. Auto power-down input levels

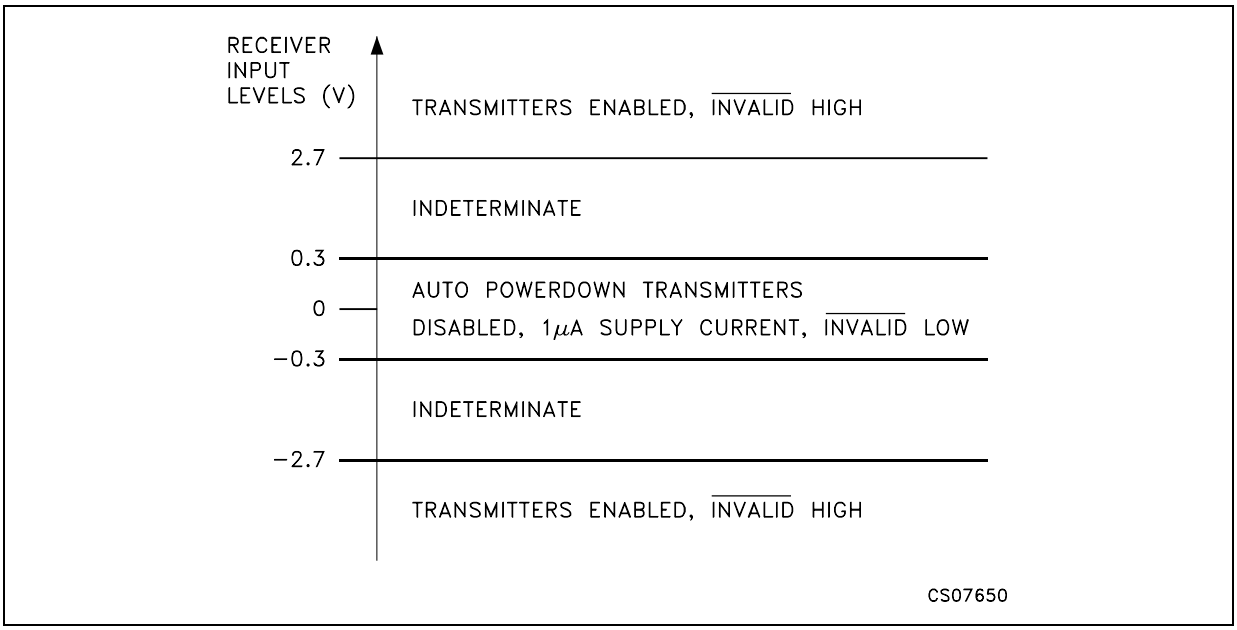
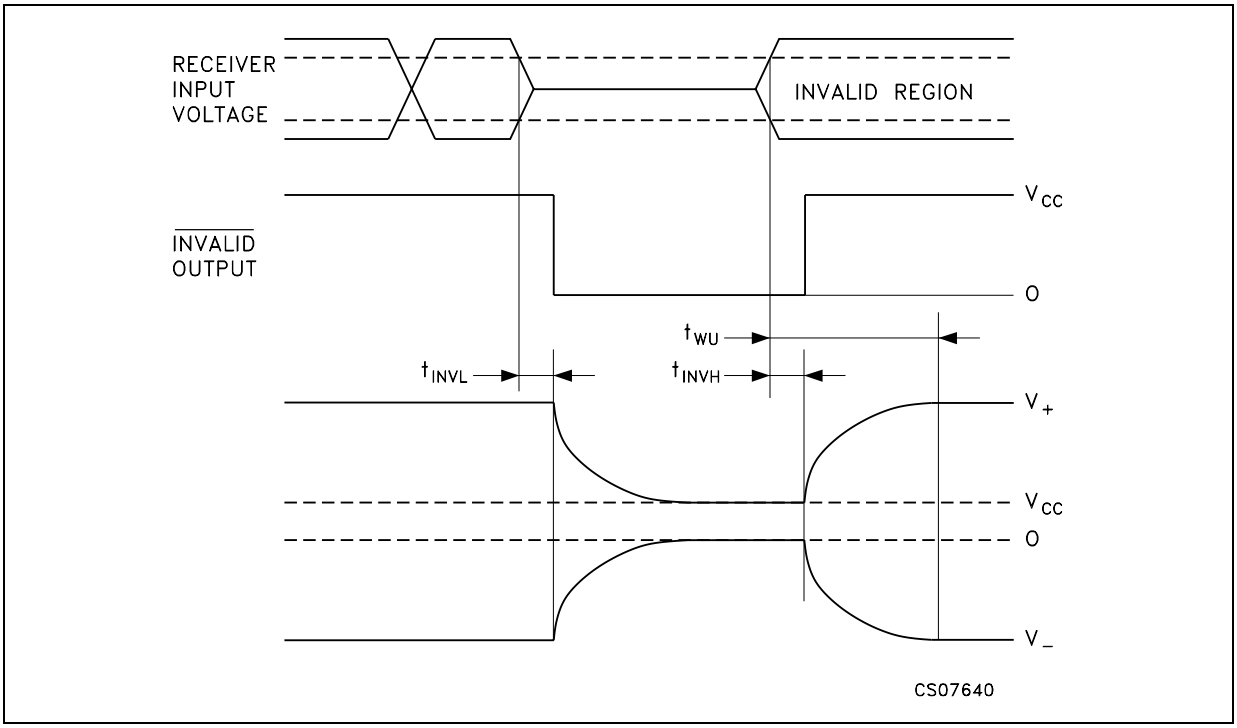


Figure 4. Auto power-down input timing

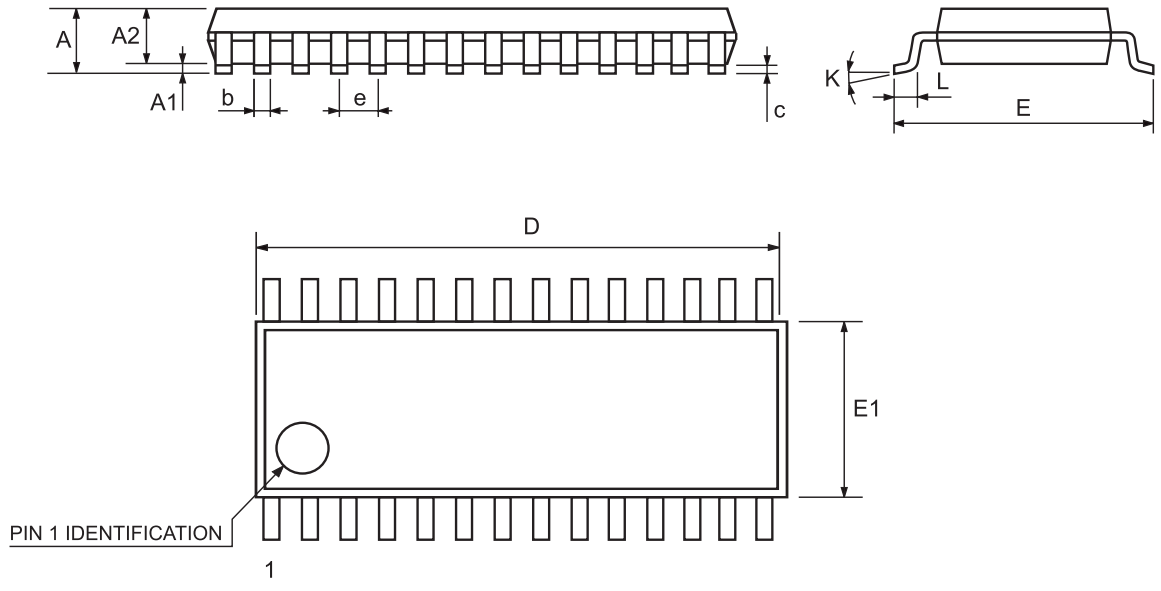


7 Package mechanical data

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.

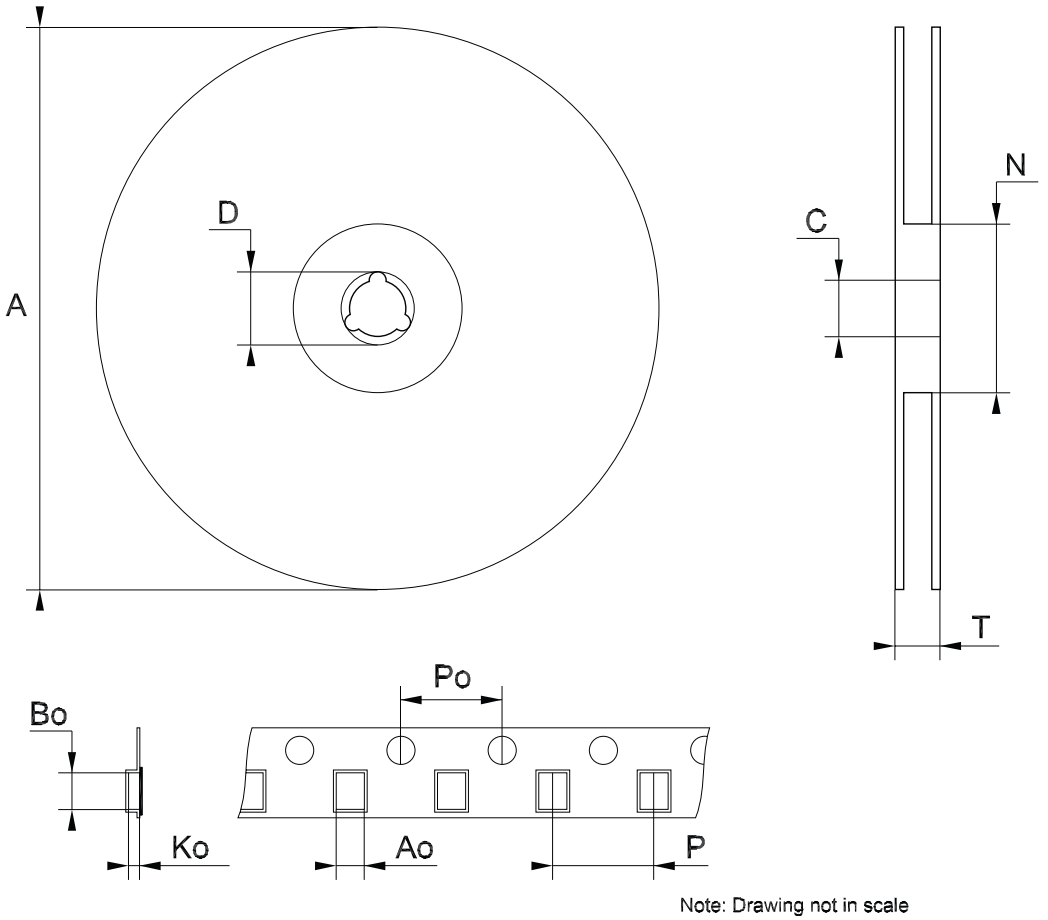
TSSOP28 mechanical data

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 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



Note: Drawing not in scale

8 Revision history

Table 14. Document revision history

Date	Revision	Changes
21-Jun-2004	6	Page 6 - I_L (output leakage current) mA ==> µA
31-Mar-2006	7	Order codes updated and new template.
25-Oct-2006	8	Order codes updated.
24-Aug-2007	9	Order codes updated.
09-Jul-2008	10	Removed: SO-28 and SSOP28 packages.
28-Jul-2009	11	Removed: Flip-chip28 package, modified *Table 1 on page 1*.
16-Oct-2009	12	Modified *Table 9 on page 8*.

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