



# ST3243EB ST3243EC

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

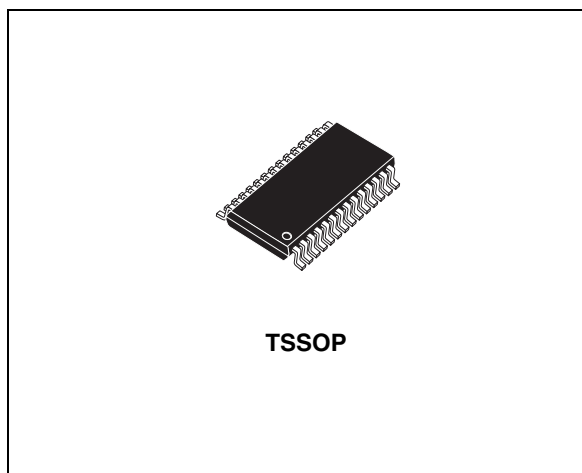
## Features

- 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

## 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 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 FORCEOFF is set low, both drivers and receivers (except 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 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 .....	3
2	Truth tables .....	5
3	Maximum ratings .....	6
4	Electrical characteristics .....	7
5	Application circuits .....	10
6	Timing diagrams .....	11
7	Package mechanical data .....	12
8	Revision history .....	15

# 1 Pin configuration

Figure 1. Pin configuration

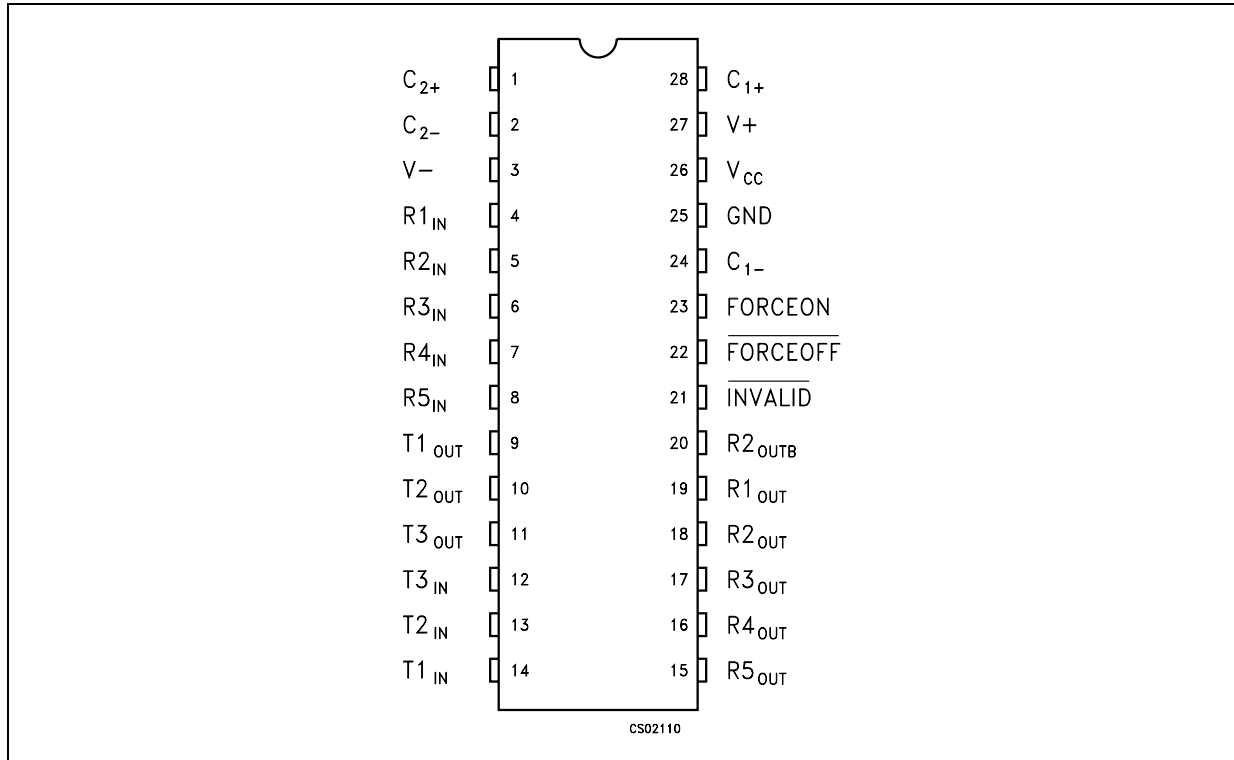


Table 2. Pin description

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-	-5.5 V 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

Table 2. Pin description (continued)

Pin n°	Symbol	Name and function
15	R5 <sub>OUT</sub>	Fifth receiver output voltage
16	R4 <sub>OUT</sub>	Fourth receiver output voltage
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 over-rides 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+	5.5 V Generated by the charge pump
28	C <sub>1+</sub>	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 <sub>OUT</sub>	R <sub>OUT</sub>	R <sub>2OUTB</sub>
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
FORCEON, 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
$R_{OUT}$ $R_{OUTB}$ 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	$\pm 15$			kV
ESD	ESD protection voltage	IEC 1000-4-2 (contact discharge)	$\pm 8$			kV

## 4 Electrical characteristics

C1 - C4 = 0.1  $\mu$ F,  $V_{CC}$  = 3 V to 5.5 V,  $T_A$  = -40 to 85  $^{\circ}$ C, unless otherwise specified.  
Typical values are referred to  $T_A$  = 25  $^{\circ}$ 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	$\mu$ A
$I_{SUPPLY}$	Supply current	$\overline{FORCEON} = \overline{FORCEOFF} = V_{CC}$		0.3	1	mA
$I_{SHDN}$	Shutdown supply current	$\overline{FORCEOFF} = GND$		1	10	$\mu$ A

C1 - C4 = 0.1  $\mu$ F,  $V_{CC}$  = 3 V to 5.5 V,  $T_A$  = -40 to 85  $^{\circ}$ C, unless otherwise specified.  
Typical values are referred to  $T_A$  = 25  $^{\circ}$ C.

**Table 8. Logic input electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{TIL}$	Input logic threshold low	T-IN, $\overline{FORCEON}$ , $\overline{FORCEOFF}$			0.8	V
$V_{TIH}$	Input logic threshold high	T-IN, $\overline{FORCEON}$ , $\overline{FORCEOFF}$ $V_{CC} = 3.3$ 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, $\overline{FORCEON}$ , $\overline{FORCEOFF}$		$\pm 0.01$	$\pm 1.0$	$\mu$ A
$I_{OL}$	Output leakage current	Receiver disabled		$\pm 0.05$	$\pm 10$	$\mu$ A
$V_{OL}$	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<sub>CC</sub> = 3 V to 5.5 V, T<sub>A</sub> = -40 to 85 °C, unless otherwise specified.  
 Typical values are referred to T<sub>A</sub> = 25 °C, FORCEON = GND, FORCEOFF = V<sub>CC</sub>.

**Table 9. Auto power-down electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>RITE</sub>	Receiver input threshold to <b>INVALID</b> output voltage HIGH (see <a href="#">Figure 3</a> )	Positive threshold			2.7	V
		Negative threshold	2.7			V
V <sub>RITD</sub>	Receiver input threshold to <b>INVALID</b> output voltage LOW (see <a href="#">Figure 3</a> )		-0.3		0.3	V
V <sub>IO<sub>L</sub></sub>	<b>INVALID</b> output voltage LOW	I <sub>OUT</sub> = 1.6 mA			0.4	V
V <sub>IO<sub>H</sub></sub>	<b>INVALID</b> output voltage HIGH	I <sub>OUT</sub> = -1 mA	V <sub>CC</sub> -0.6			V
t <sub>WU</sub>	Receiver or transmitter edge transmitter enabled (see <a href="#">Figure 3</a> )			100		μs
t <sub>INVH</sub>	Receiver positive or negative threshold to <b>INVALID HIGH</b> (see <a href="#">Figure 3</a> )			0.2		μs
t <sub>INVL</sub>	Receiver positive or negative threshold to <b>INVALID LOW</b> (see <a href="#">Figure 3</a> )			30		μs

C1 - C4 = 0.1 μF, V<sub>CC</sub> = 3 V to 5.5 V, T<sub>A</sub> = -40 to 85 °C, unless otherwise specified.  
 Typical values are referred to T<sub>A</sub> = 25 °C.

**Table 10. Transmitter electrical characteristics**

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



C1 - C4 = 0.1  $\mu$ F,  $V_{CC}$  = 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	$T_A = 25^\circ\text{C}$ , $V_{CC} = 3.3\text{ V}$ $T_A = 25^\circ\text{C}$ , $V_{CC} = 5.0\text{ V}$	0.6 0.8	1.1 1.4		V
$V_{RIH}$	RS-232 Input threshold high	$T_A = 25^\circ\text{C}$ , $V_{CC} = 3.3\text{ V}$ $T_A = 25^\circ\text{C}$ , $V_{CC} = 5.0\text{ V}$		1.6 1.9	2.4 2.4	V
$V_{RIHYS}$	Input hysteresis			0.5		V
$R_{RIN}$	Input resistance	$T_A = 25^\circ\text{C}$	3	5	7	k $\Omega$

C1 - C4 = 0.1  $\mu$ F,  $V_{CC}$  = 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	$R_L = 3\text{k}\Omega$ , $C_L = 1000\text{ pF}$ one transmitter switching	250	400		kbps
$t_{PHL}$ $t_{PLH}$	Receiver propagation delay	$R_{IN}$ to $R_{OUT}$ , $C_L = 150\text{ pF}$		0.15		$\mu$ s
$t_{T\_SKEW}$	Transmitter skew			150		ns
$t_{R\_SKEW}$	Receiver skew			70		ns
$S_{RT}$	Transition slew rate	$T_A = 25^\circ\text{C}$ $R_L = 3\text{k}$ to $7\text{k}\Omega$ , $V_{CC} = 3.3\text{ V}$ measured from +3 V to -3 V or -3 V to +3 V $C_L = 150\text{ pF}$ to $1000\text{ pF}$ $C_L = 150\text{ pF}$ to $2500\text{ pF}$	6 4		30 30	V/ $\mu$ s V/ $\mu$ s

# 5 Application circuits

Figure 2. Application circuits

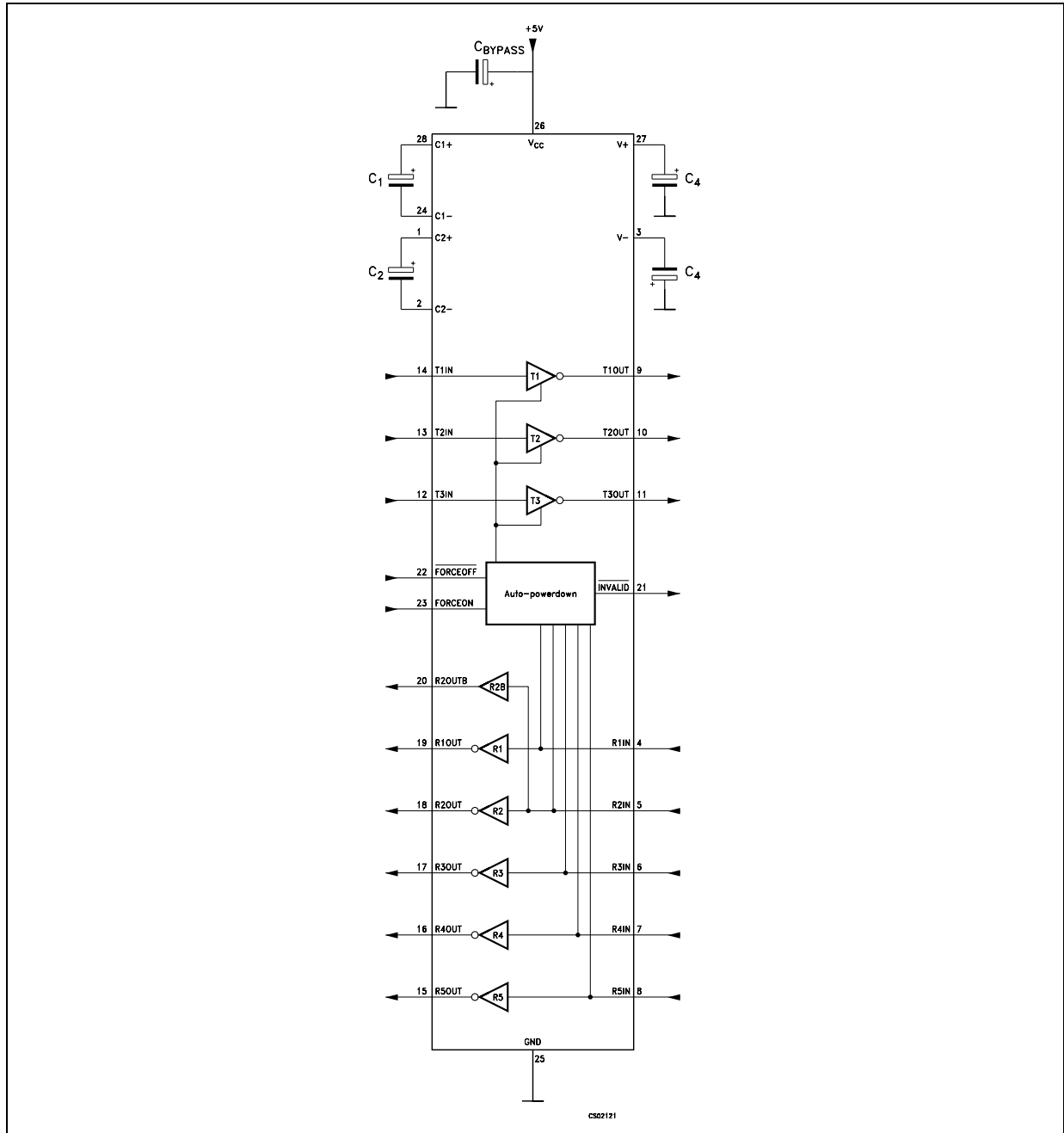


Table 13. Required minimum capacitance value (μF)

V <sub>CC</sub> (V)	C <sub>1</sub>	C <sub>2</sub> , C <sub>3</sub> , C <sub>4</sub> , C <sub>BYPASS</sub>
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

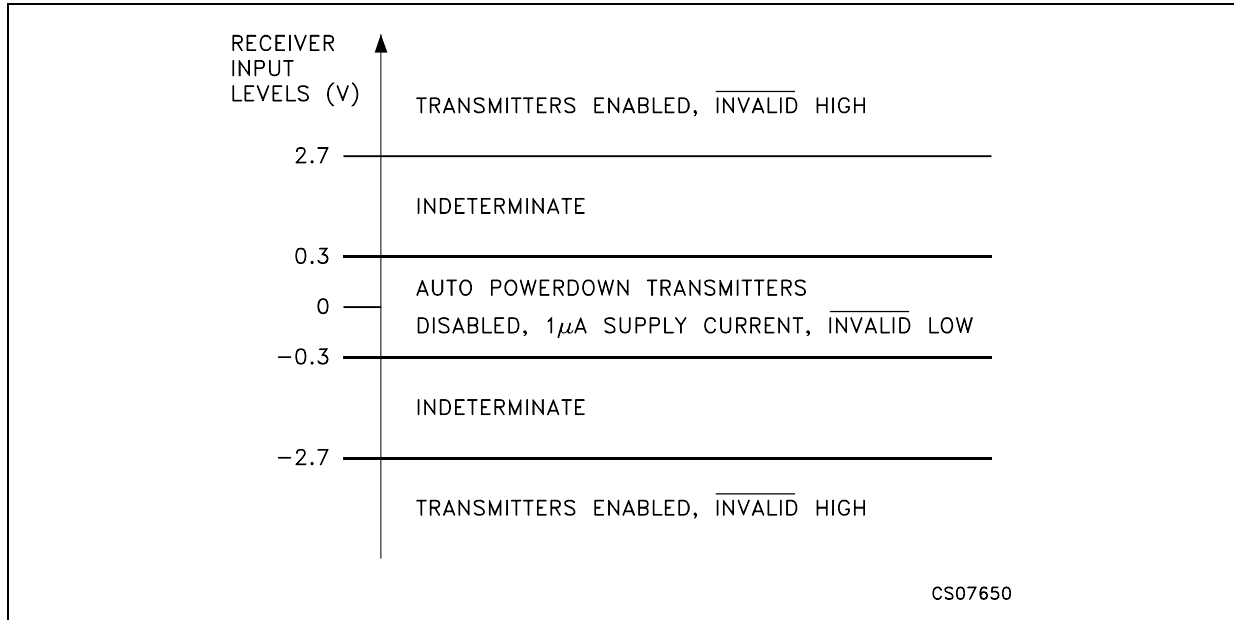
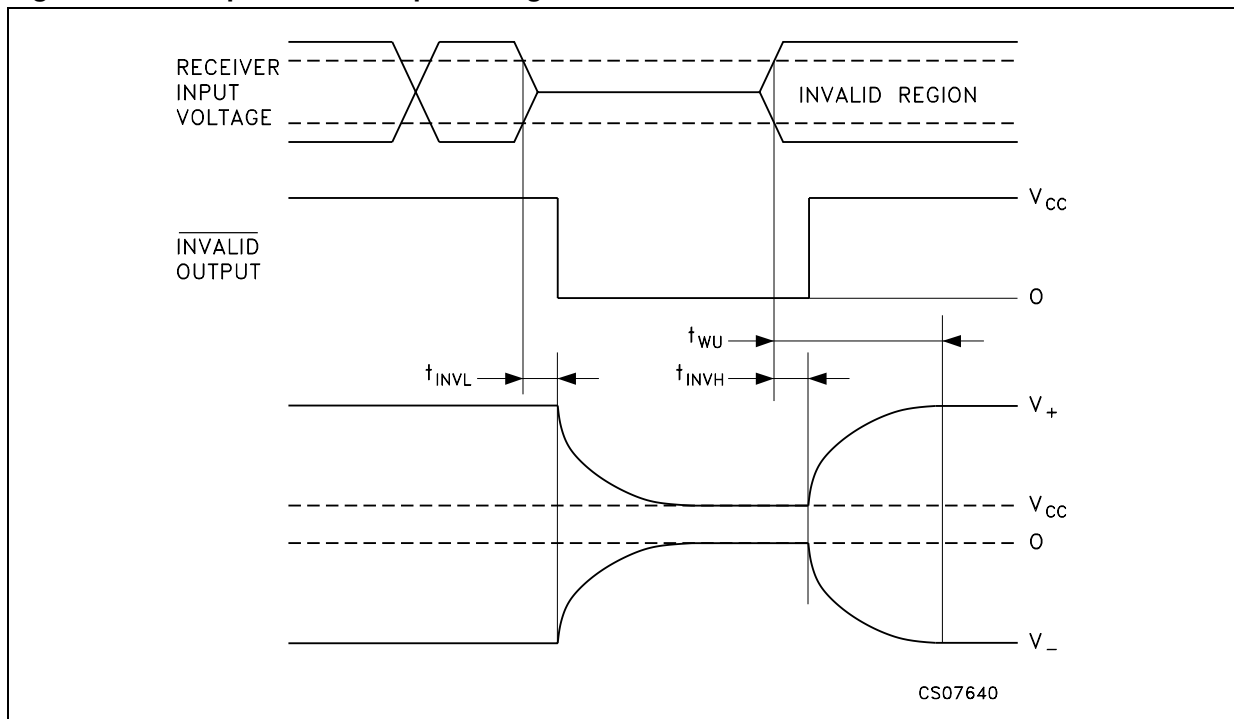


Figure 4. Auto power-down input timing

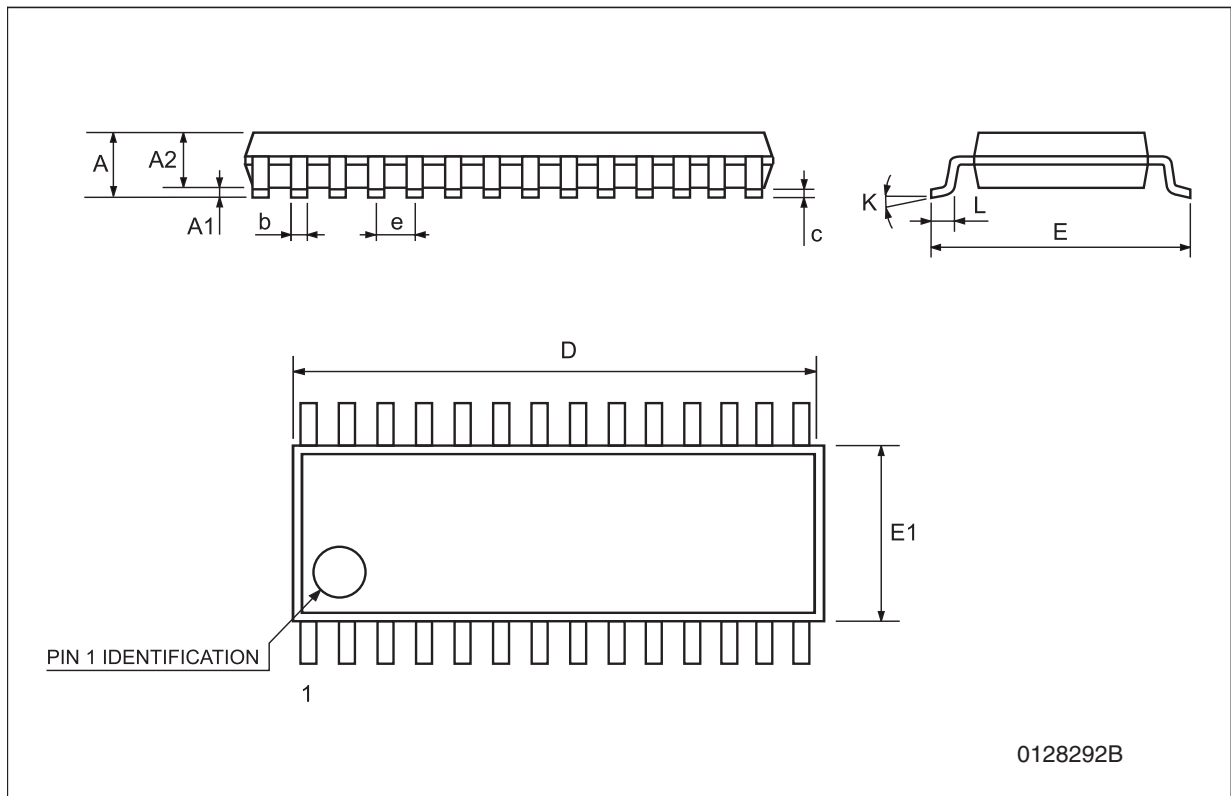


## 7 Package mechanical data

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

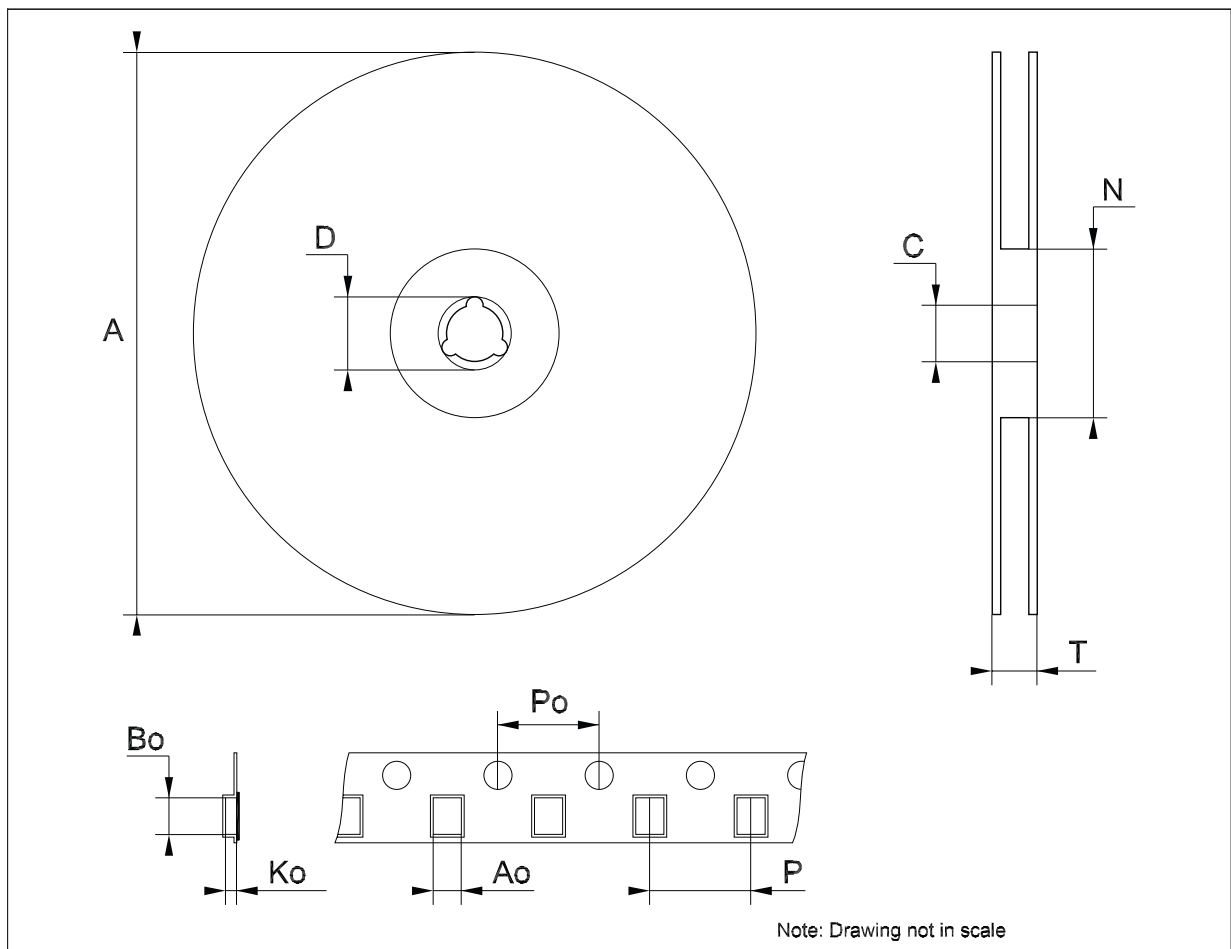
**TSSOP28 mechanical data**

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



## 8 Revision history

**Table 14. Document revision history**

Date	Revision	Changes
21-Jun-2004	6	Page 6 - $I_L$ (output leakage current) mA ==> $\mu A$
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 <a href="#">Table 1 on page 1</a> .
16-Oct-2009	12	Modified <a href="#">Table 9 on page 8</a> .

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