

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

Datasheet - production data



### Features

- ESD protection for RS-232 I/O pins
  - ±8 kV IEC61000-4-2 contact discharge
  - ±15 kV IEC61000-4-2 air discharge
- 1 µA supply current achieved when in auto-power-down
- 250 kbps minimum guaranteed data rate
- Guaranteed 6 V/µs slew rate range
- Guaranteed mouse drive ability
- 0.1 µF external capacitors
- Meet EIA/TIA-232 specifications down to 3 V
- Available in SSOP-28 package

### Description

The ST3243B/ST3243C devices consist of 3 drivers, 5 receivers and a dual charge pump circuit. The devices meet 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 inputs are protected to ±8 kV using IEC61000-4-2 contact discharge and ±15 kV IEC61000-4-2 air discharge.

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

The ST3243B/ST3243C devices have 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 devices are 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, 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

*Note:* For new designs, we recommend the use of the ST3243EB and ST3243EC which have a temperature range of -40 to 85 °C and 0 to 70 °C respectively.

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# 1 Pin configuration

Figure 1. Pin configuration

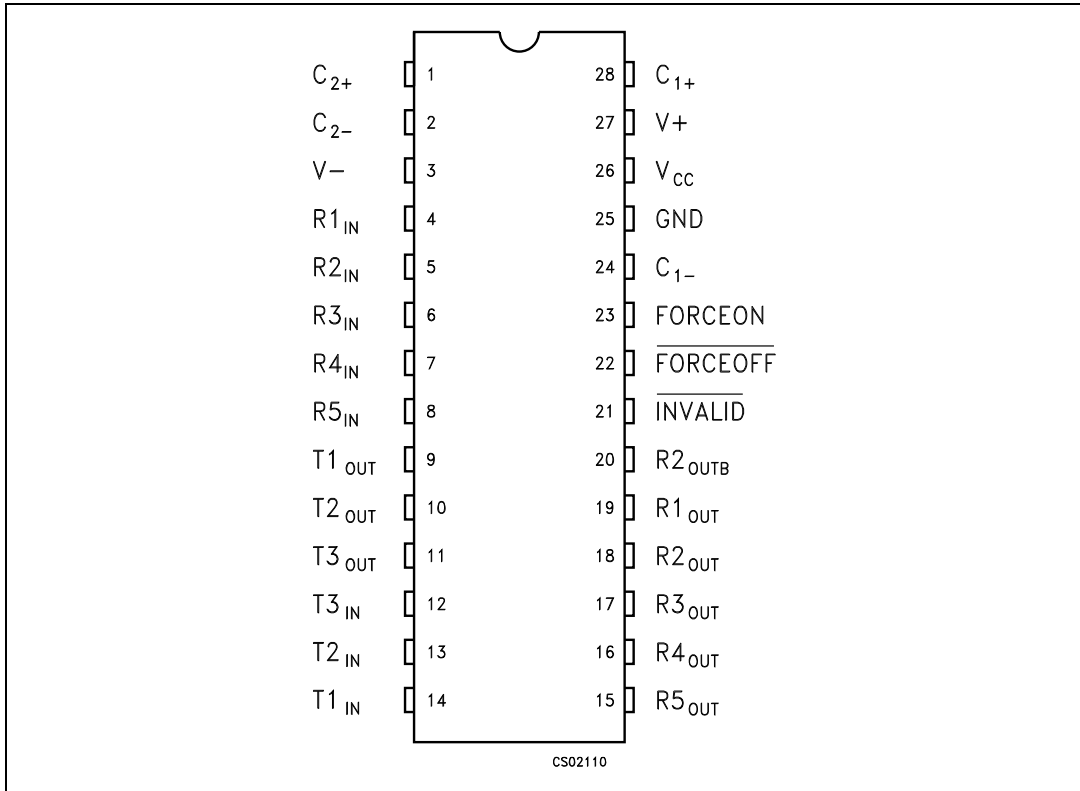


Table 2. Pin description

Pin no	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
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 wakeup
21	$\overline{\text{INVALID}}$	Output of the valid signal detector. Indicates if a valid RS-232 level is present on receiver inputs logic "1"
22	$\overline{\text{FORCEOFF}}$	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+	5.5 V generated by the charge pump
28	C <sub>1+</sub>	Positive terminal of voltage charge pump capacitor

Table 3. Truth table

$\overline{\text{FORCEOFF}}$	$T_{\text{OUT}}$	$R_{\text{OUT}}$	$R_{2\text{OUTB}}$
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 ( $\overline{\text{FORCEOFF}} = V_{\text{CC}}$ ,  $\text{FORCEON} = \text{GND}$ ) 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-	Inverted voltage terminal	0.3 to -7	
$V+ +  V- $		13	
FORCEON, FORCEOFF, $T_{IN}$	Input voltage	-0.3 to 6	
$R_{IN}$	Receiver input voltage range	$\pm 25$	
$T_{OUT}$	Transmitter output voltage range	$\pm 13.2$	
$R_{OUT}$ $R_{OUTB}$ INVALID	Receiver output voltage range	-0.3 to $(V_{CC} + 0.3)$	
$t_{SHORT}$	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. V+ and V- can have a maximum magnitude of +7 V, but their absolute addition can not exceed 13 V.

Table 5. ESD performance: transmitter outputs, receiver inputs

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
ESD	ESD protection voltage	IEC61000-4-2 air discharge	$\pm 15$	—	—	kV
ESD	ESD protection voltage	IEC61000-4-2 (contact discharge)	$\pm 8$			

### 3 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  $T_A = 25 \text{ }^\circ\text{C}$ .

**Table 6. Electrical characteristics**

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

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

**Table 7. Logic input electrical characteristics**

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

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

**Table 8. Auto-power-down electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{RITE}$	Receiver input threshold to transmitter enabled	Positive threshold Negative threshold	2.7		2.7	V
$V_{RITD}$	Receiver input threshold to transmitter disabled	1 $\mu\text{A}$ supply current	-0.3		0.3	
$V_{IOL}$	$\overline{\text{INVALID}}$ output voltage LOW				0.4	
$V_{IOH}$	$\overline{\text{INVALID}}$ output voltage HIGH		$V_{CC} - 0.6$			
$t_{WU}$	Receiver threshold to transmitter enabled	$I_{OUT} = 1.6 \text{ mA}$		250		$\mu\text{s}$
$t_{INVH}$	Receiver positive or negative threshold to $\overline{\text{INVALID}}$ HIGH	$I_{OUT} = -1 \text{ mA}$		1		
$t_{INVL}$	Receiver positive or negative threshold to $\overline{\text{INVALID}}$ LOW			30		

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

**Table 9. Transmitter electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{TOUT}$	Output voltage swing	All transmitter outputs are loaded with 3 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	10 M		$\Omega$
$I_{SC}$	Output short-circuit current			$\pm 35$	$\pm 60$	mA
$V_{OT}$	Transmitter output voltage	T1IN = T2IN = GND, T3IN = $V_{CC}$ T3OUT loaded with 3 k $\Omega$ to GND T1OUT and T2OUT loaded with 2.5 mA each	$\pm 5$			V



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

Table 10. Receiver electrical characteristics

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

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

Table 11. Timing characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$D_{\text{R}}$	Maximum data rate	$R_L = 3 \text{ k}\Omega$ , $C_L = 1000 \text{ pF}$ one transmitter switching	250	400		kbps
$t_{\text{PHL}}$ $t_{\text{PLH}}$	Receiver propagation delay	$R_{\text{IN}}$ to $R_{\text{OUT}}$ , $C_L = 150 \text{ pF}$		0.15		$\mu\text{s}$
$t_{\text{T\_SKEW}}$	Transmitter skew			100		ns
$t_{\text{R\_SKEW}}$	Receiver skew			50		
$t_{\text{INVH}}$	Receiver positive or negative threshold to <u>INVALID HIGH</u>			1		$\mu\text{s}$
$t_{\text{INVL}}$	Receiver positive or negative threshold to <u>INVALID LOW</u>			30		
$S_{\text{RT}}$	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	V/ $\mu\text{s}$

# 4 Application

Figure 2. Application circuit

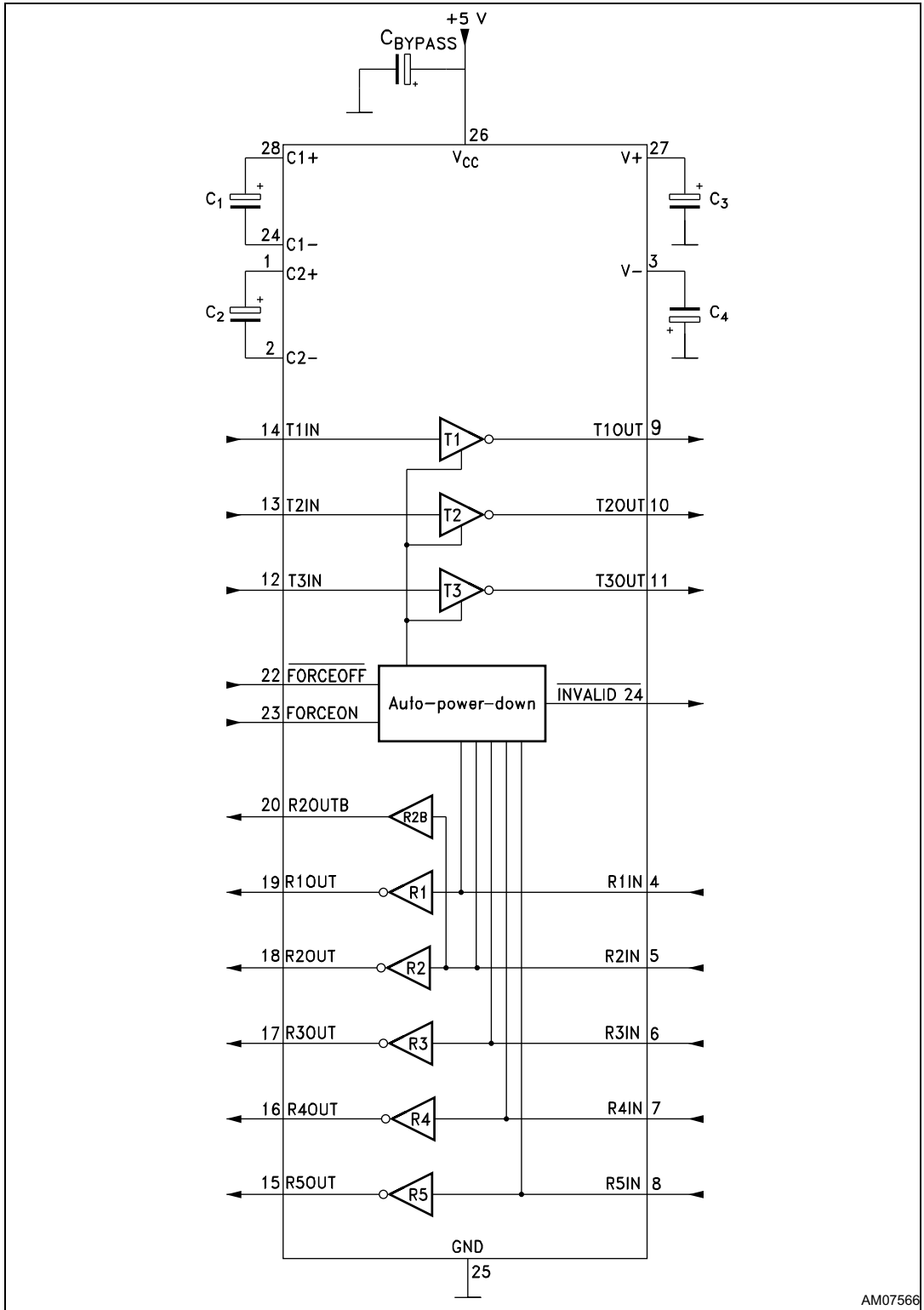
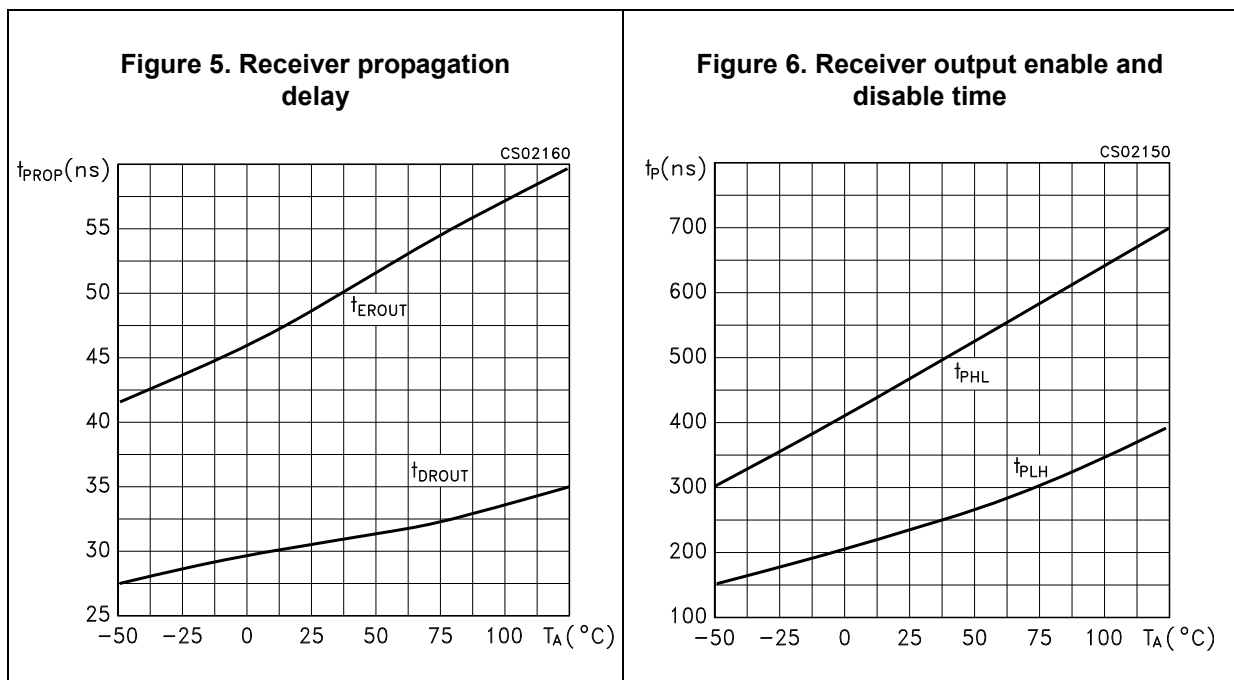
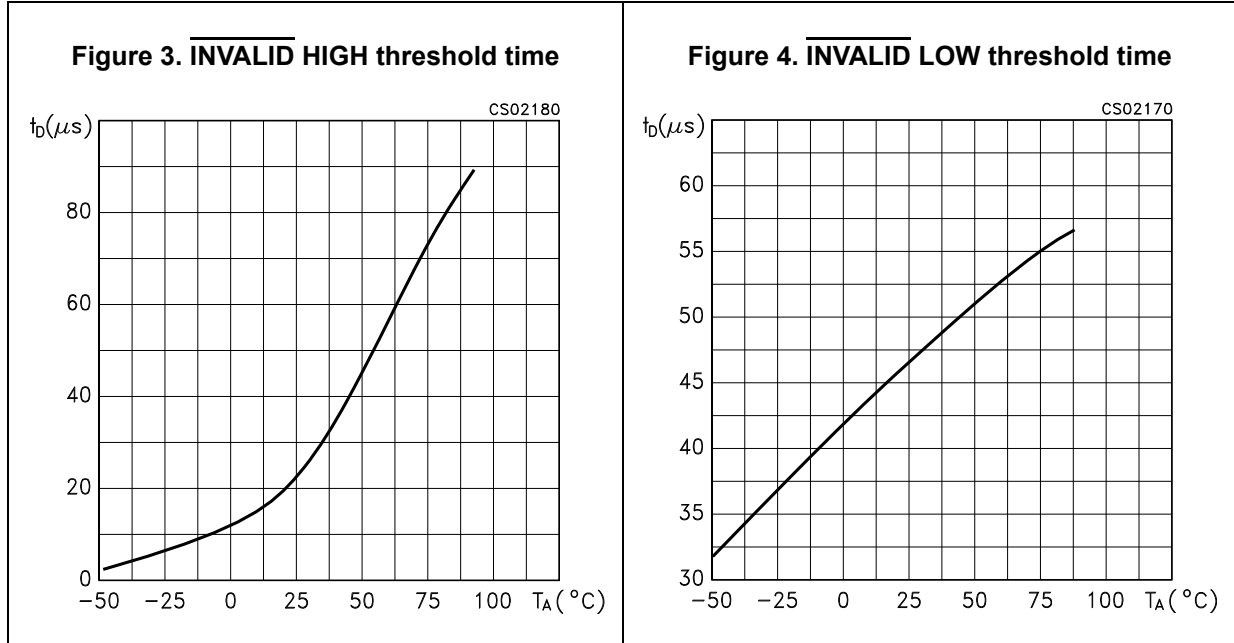


Table 12. Capacitance value ( $\mu\text{F}$ )

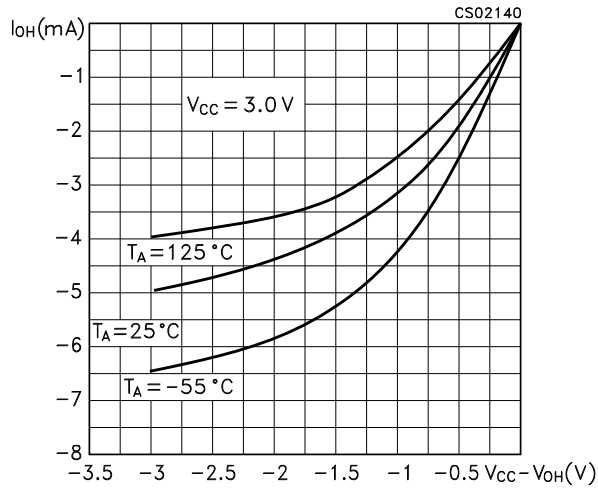
$V_{CC}$	C1	C2	C3	C4	Cbypass
3.0 to 3.6	0.1	0.1	0.1	0.1	0.1
4.5 to 5.5	0.047	0.33	0.33	0.33	0.33
3.0 to 5.5	0.22	1.0	1.0	1.0	0.22

## 5 Typical performance characteristics

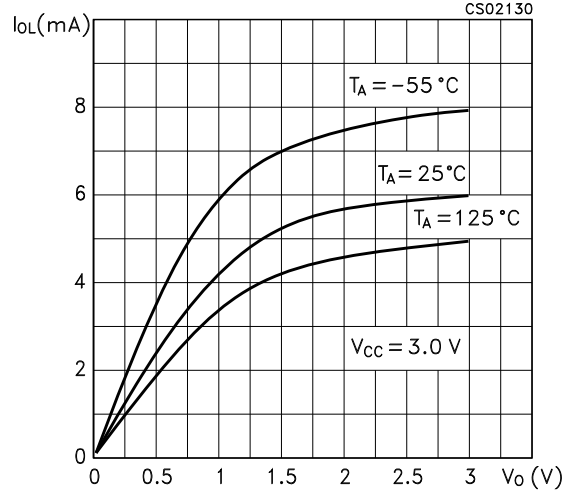
Unless otherwise specified  $T_J = 25\text{ }^\circ\text{C}$ .



**Figure 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 different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

Figure 9. SSOP-28 package mechanical drawing

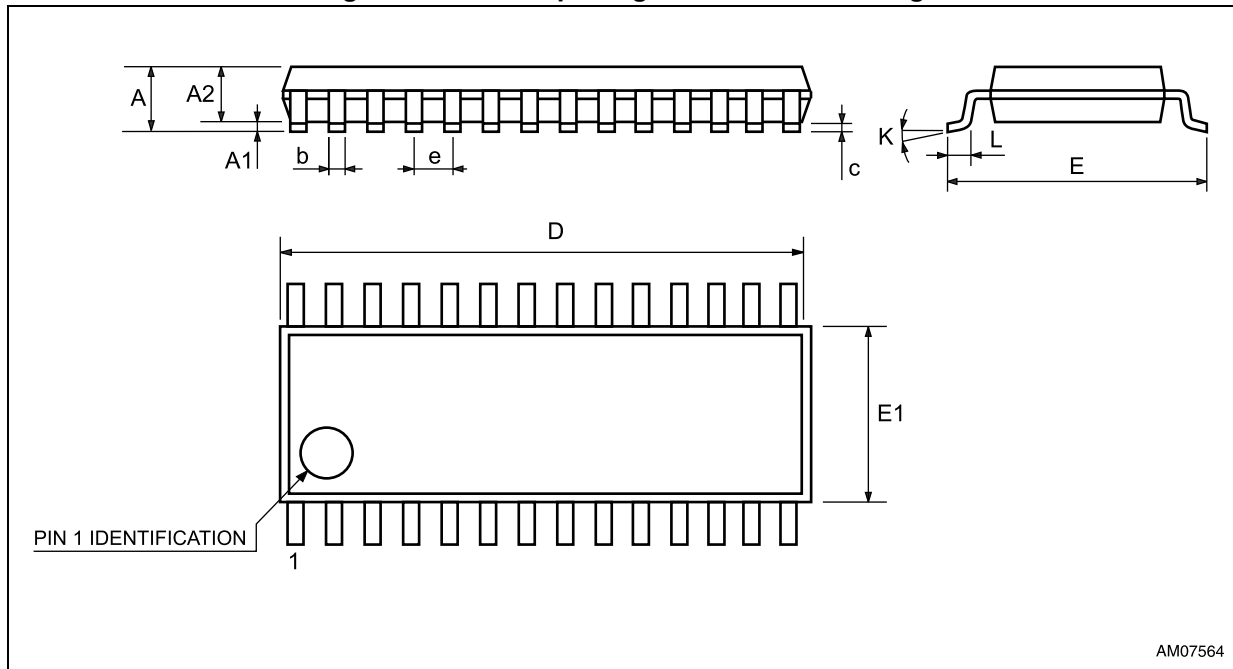
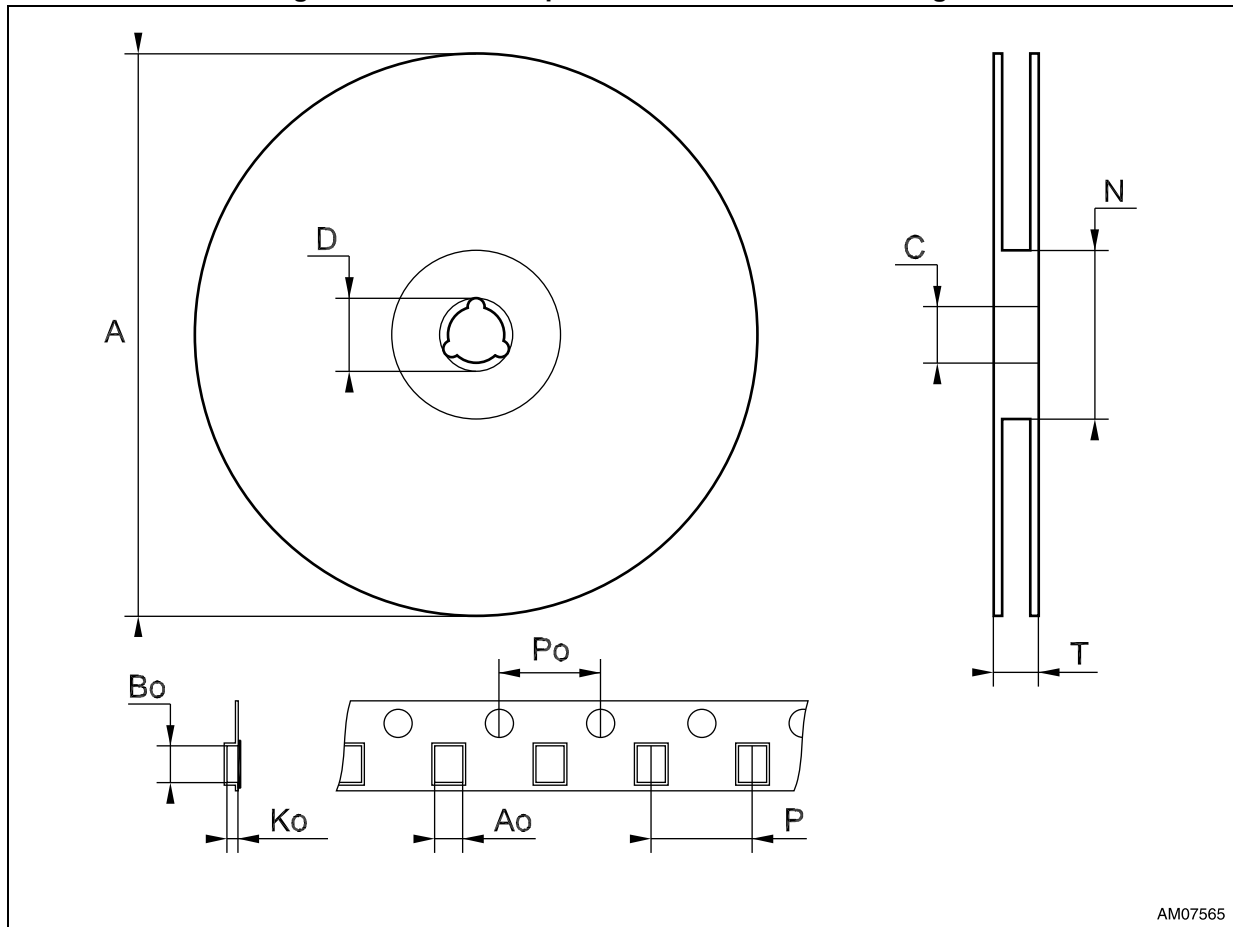


Table 13. SSOP-28 package mechanical data

Symbol	Dimensions					
	mm			inches		
	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

Figure 10. SSOP-28 tape and reel mechanical drawing<sup>(1)</sup>



AM07565

1. Drawing not in scale.

Table 14. SSOP-28 tape and reel mechanical data

Symbol	Dimensions					
	mm			inches		
	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



## 7 Revision history

**Table 15. 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> .
21-Oct-2009	9	Modified <a href="#">Table 1: Device summary</a>
07-Oct-2011	10	Added ST3243B device, document reformatted, updated/added <a href="#">Figure 9</a> and <a href="#">Figure 10</a> , <a href="#">Table 13</a> and <a href="#">Table 14</a> , minor text and typo modifications throughout the document.
15-Feb-2013	11	Updated title, <a href="#">Features</a> , <a href="#">Description</a> and <a href="#">Table 5</a> (added ESD protection, replaced "Human body model" by "±15 kV IEC61000-4-2 air discharge", IEC1000-4-2 replaced by IEC61000-4-2). Removed Note 2 below <a href="#">Table 4</a> . Added <a href="#">Table 5</a> . Corrected typ. and max. mm value of E symbol in <a href="#">Table 13</a> . Minor corrections throughout document.
02-Oct-2014	12	<a href="#">Description</a> : Replaced supply current of "1 mA" with "1 µA" <a href="#">Table 1: Device summary</a> : removed obsolete order code ST3243BPR Added <a href="#">Note: on page 1</a> Minor text updates throughout document

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