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±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

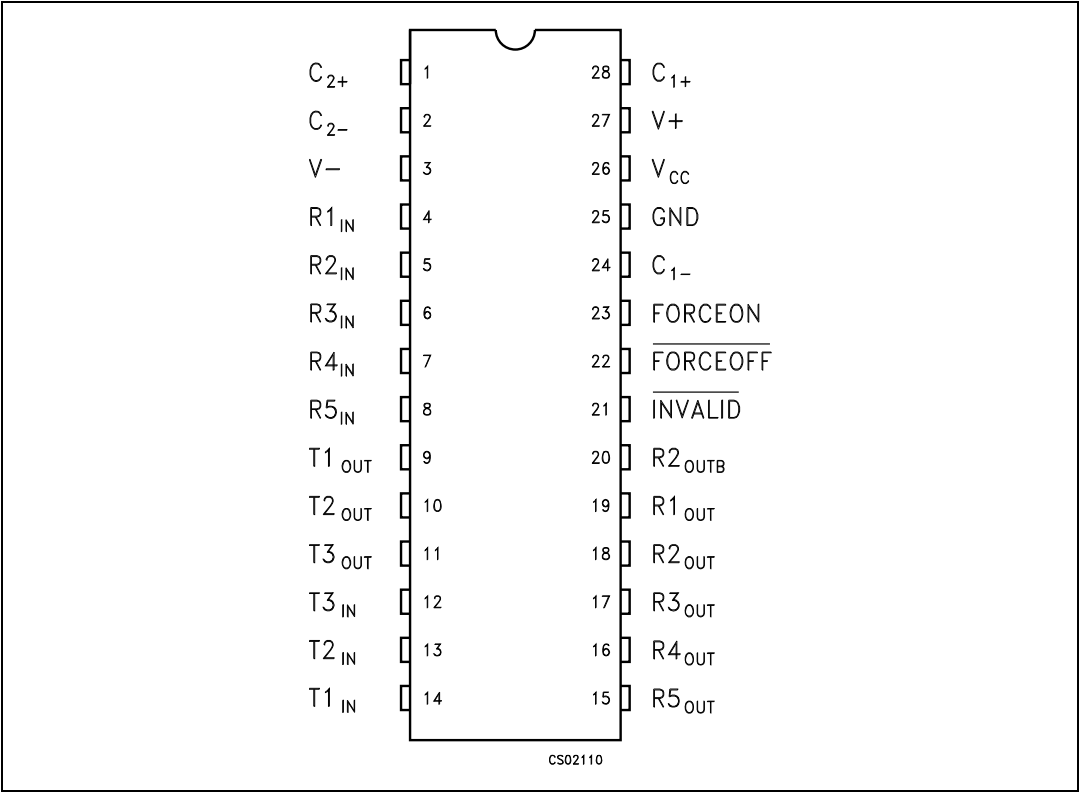


Table 2. Pin description

Pin no	Symbol	Name and function
1	C 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
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 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 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

Table 3. Truth table

$\overline{\text{FORCEOFF}}$	T_{OUT}	R_{OUT}	$R_{2\text{OUTB}}$
0	HIGH Z	HIGH Z	ACTIVE ⁽¹⁾
1	ACTIVE ⁽¹⁾	ACTIVE ⁽¹⁾	ACTIVE ⁽¹⁾

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	± 25	
T_{OUT}	Transmitter output voltage range	± 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	± 15	—	—	kV
ESD	ESD protection voltage	IEC61000-4-2 (contact discharge)	± 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	μA
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 , $\overline{\text{FORCEOFF}}$		± 0.01	± 1.0	μA
I_{OL}	Output leakage current	Receiver disabled		± 0.05	± 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 μA 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	$I_{\text{OUT}} = 1.6 \text{ mA}$		250		μs
t_{INVH}	Receiver positive or negative threshold to $\overline{\text{INVALID}}$ HIGH	$I_{\text{OUT}} = -1 \text{ mA}$		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 Ω to GND	± 5	± 5.4		V
R_{OUT}	Output resistance	$V_{CC} = V_+ = V_- = 0 \text{ V}$, $V_{\text{OUT}} = \pm 2 \text{ V}$	300	10 M		Ω
I_{SC}	Output short-circuit current			± 35	± 60	mA
V_{OT}	Transmitter output voltage	T1IN = T2IN = GND, T3IN = V_{CC} T3OUT loaded with 3 k Ω to GND T1OUT and T2OUT loaded with 2.5 mA each	± 5			V

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

Table 10. 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	$T_A = 25 \text{ }^\circ\text{C}$, $V_{CC} = 3.3 \text{ V}$ $T_A = 25 \text{ }^\circ\text{C}$, $V_{CC} = 5.0 \text{ V}$	0.6 0.8	1.2 1.2		
V_{RIH}	RS-232 Input threshold high	$T_A = 25 \text{ }^\circ\text{C}$, $V_{CC} = 3.3 \text{ V}$ $T_A = 25 \text{ }^\circ\text{C}$, $V_{CC} = 5.0 \text{ V}$		1.5 1.8	2.4 2.4	
V_{RIHYS}	Input hysteresis			0.5		
R_{RIN}	Input resistance	$T_A = 25 \text{ }^\circ\text{C}$	3	5	7	k Ω

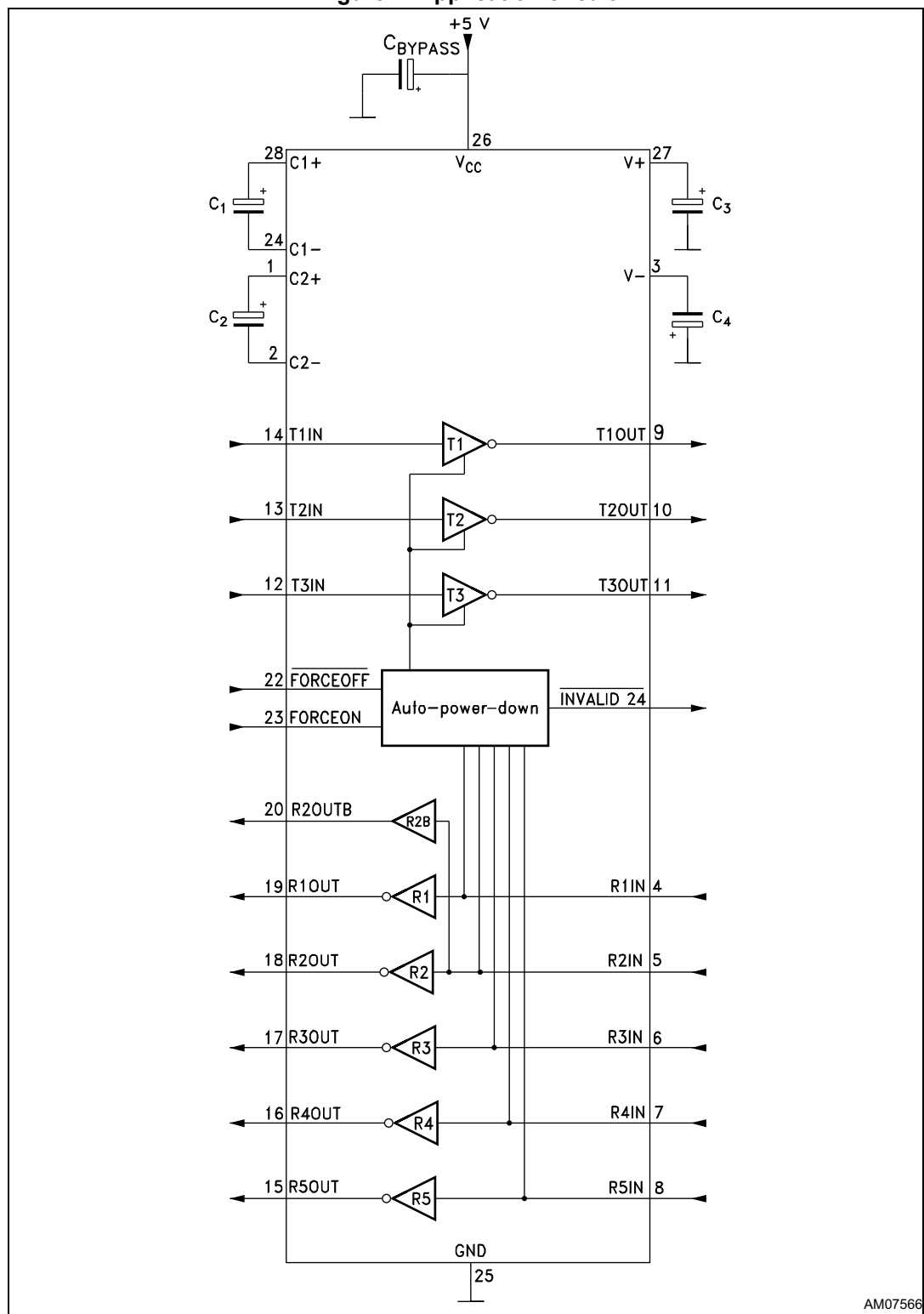
$C_1 - C_4 = 0.1 \mu\text{F}$, $V_{CC} = 3 \text{ V}$ to 5.5 V , $T_A = -40$ to $85 \text{ }^\circ\text{C}$, unless otherwise specified. Typical values are referred to $T_A = 25 \text{ }^\circ\text{C}$.

Table 11. 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		μs
t_{T_SKEW}	Transmitter skew			100		ns
t_{R_SKEW}	Receiver skew			50		
t_{INVH}	Receiver positive or negative threshold to <u>INVALID HIGH</u>			1		μs
t_{INVL}	Receiver positive or negative threshold to <u>INVALID LOW</u>			30		
S_{RT}	Transition slew rate	$T_A = 25 \text{ }^\circ\text{C}$, $R_L = 3 \text{ k}\Omega$ to $7 \text{ k}\Omega$, $V_{CC} = 3.3 \text{ V}$ measured from $+3 \text{ V}$ to -3 V or -3 V to $+3 \text{ V}$ $C_L = 150 \text{ pF}$ to 1000 pF $C_L = 150 \text{ pF}$ to 2500 pF	6 4		30 30	V/ μs

4 Application

Figure 2. Application circuit



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Table 12. Capacitance value (μF)

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

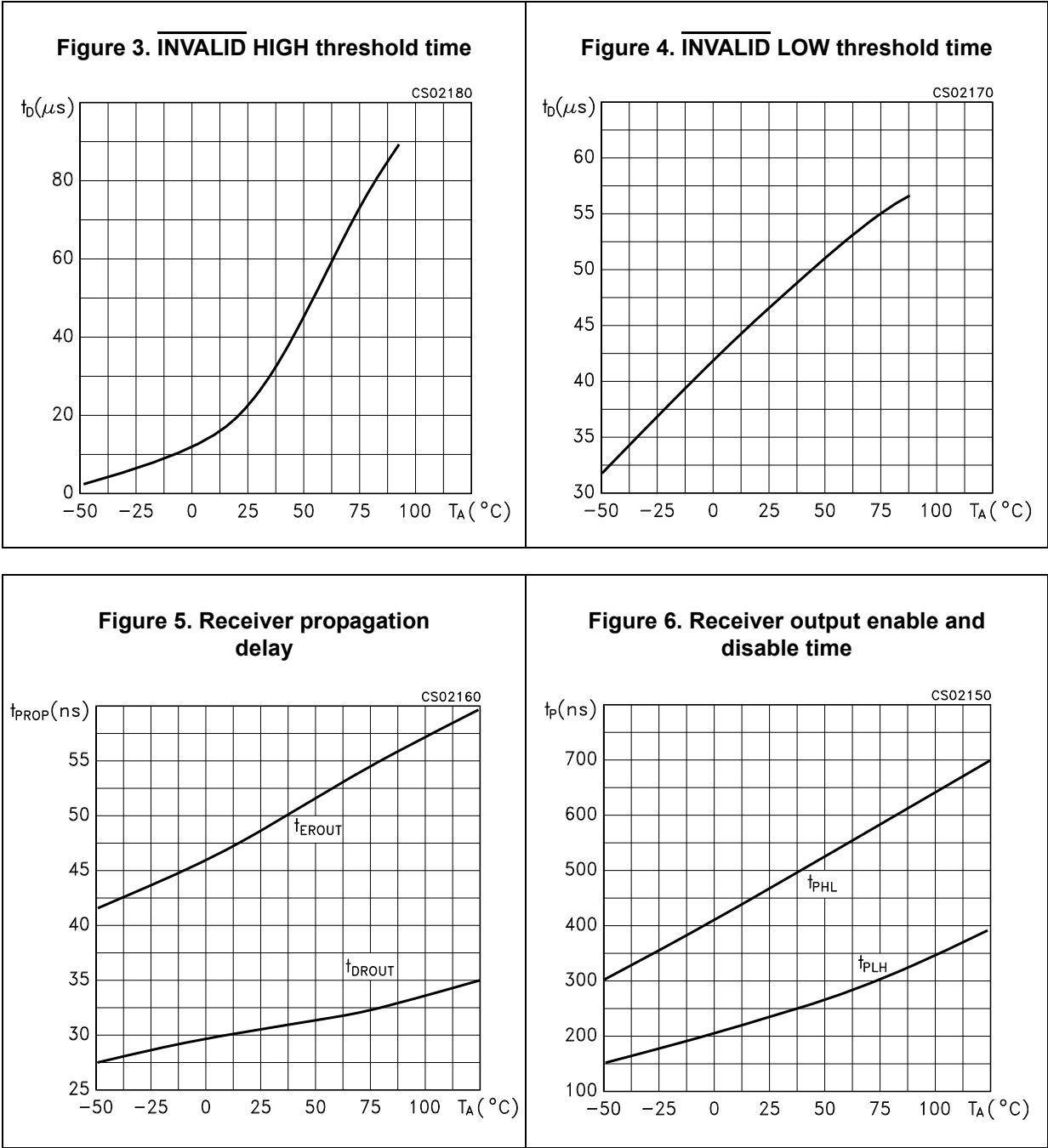


Figure 7. Output current vs. output high voltage

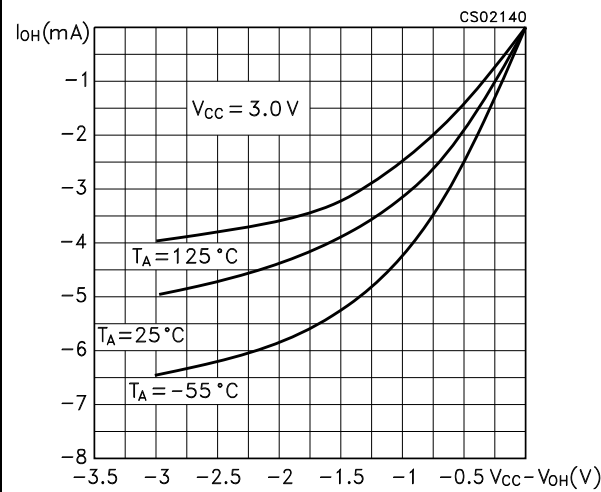
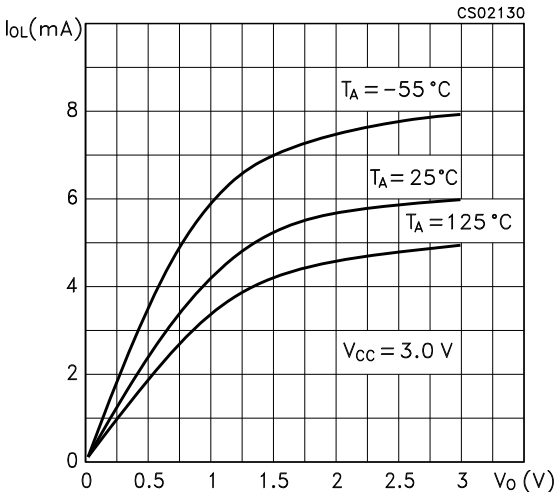


Figure 8. Output current vs. output low voltage



6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® 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.

Figure 9. SSOP-28 package mechanical drawing

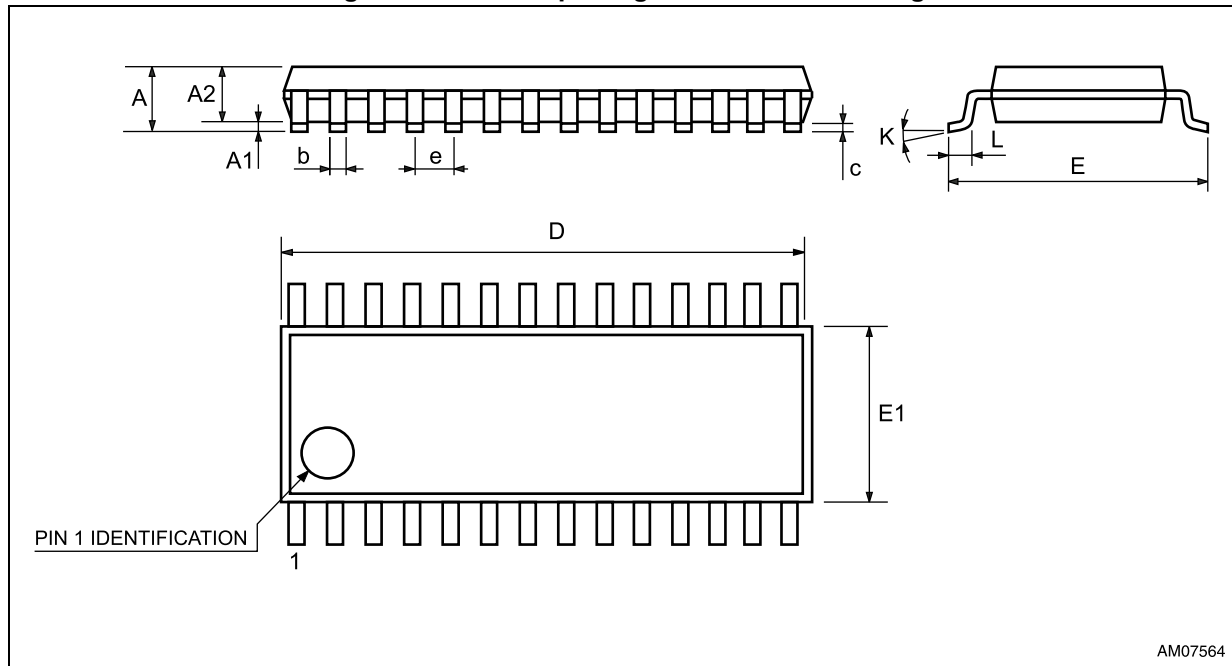
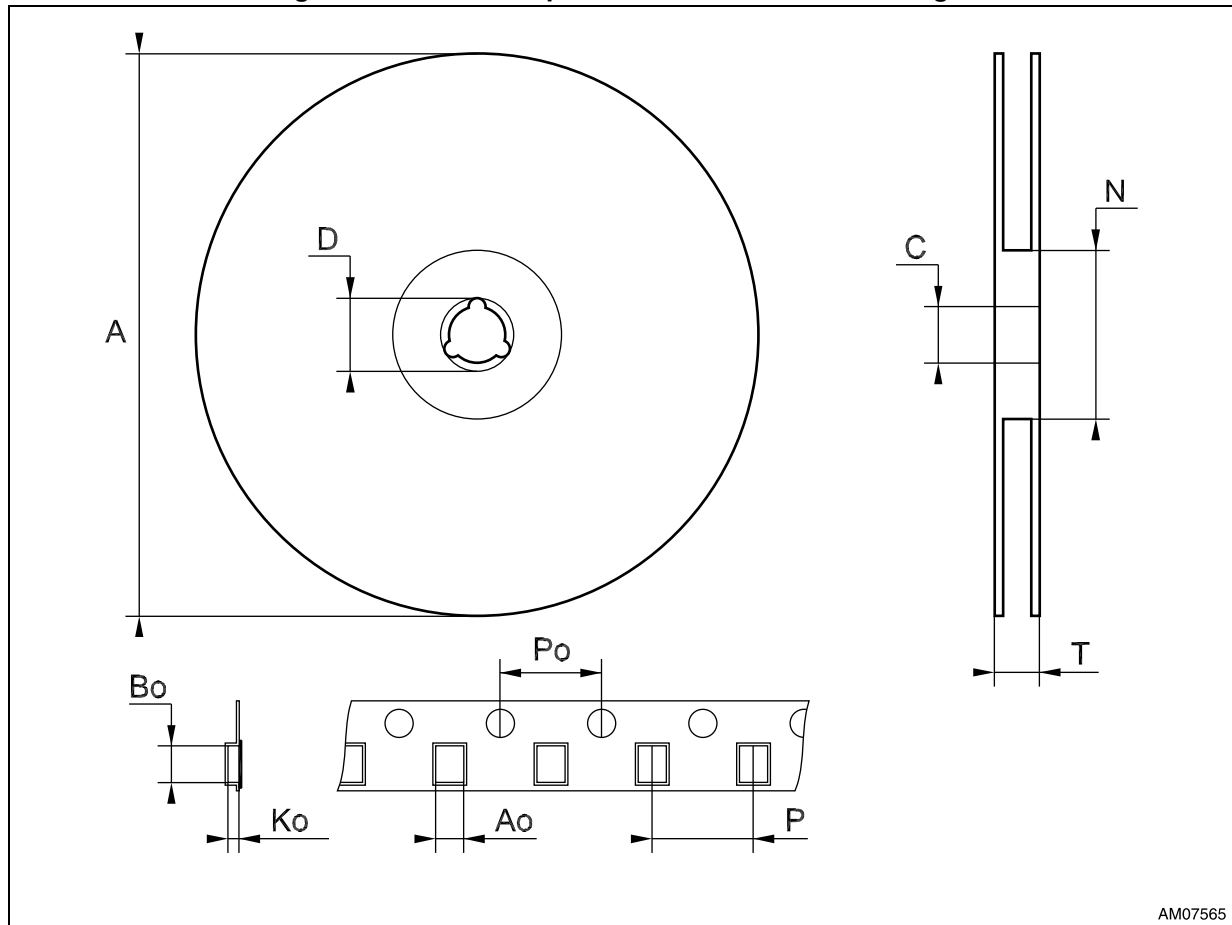


Table 13. SSOP-28 package mechanical data

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⁽¹⁾

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 Table 1 .
21-Oct-2009	9	Modified Table 1: Device summary
07-Oct-2011	10	Added ST3243B device, document reformatted, updated/added Figure 9 and Figure 10 , Table 13 and Table 14 , minor text and typo modifications throughout the document.
15-Feb-2013	11	Updated title, Features , Description and Table 5 (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 Table 4 . Added Table 5 . Corrected typ. and max. mm value of E symbol in Table 13 . Minor corrections throughout document.
02-Oct-2014	12	Description : Replaced supply current of "1 mA" with "1 µA" Table 1: Device summary : removed obsolete order code ST3243BPR Added Note: on page 1 Minor text updates throughout document

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