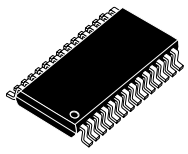
ST3243B, ST3243C

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

Datasheet - production data



SSOP-28

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 $\overline{\text{FORCEOFF}}$ 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, 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

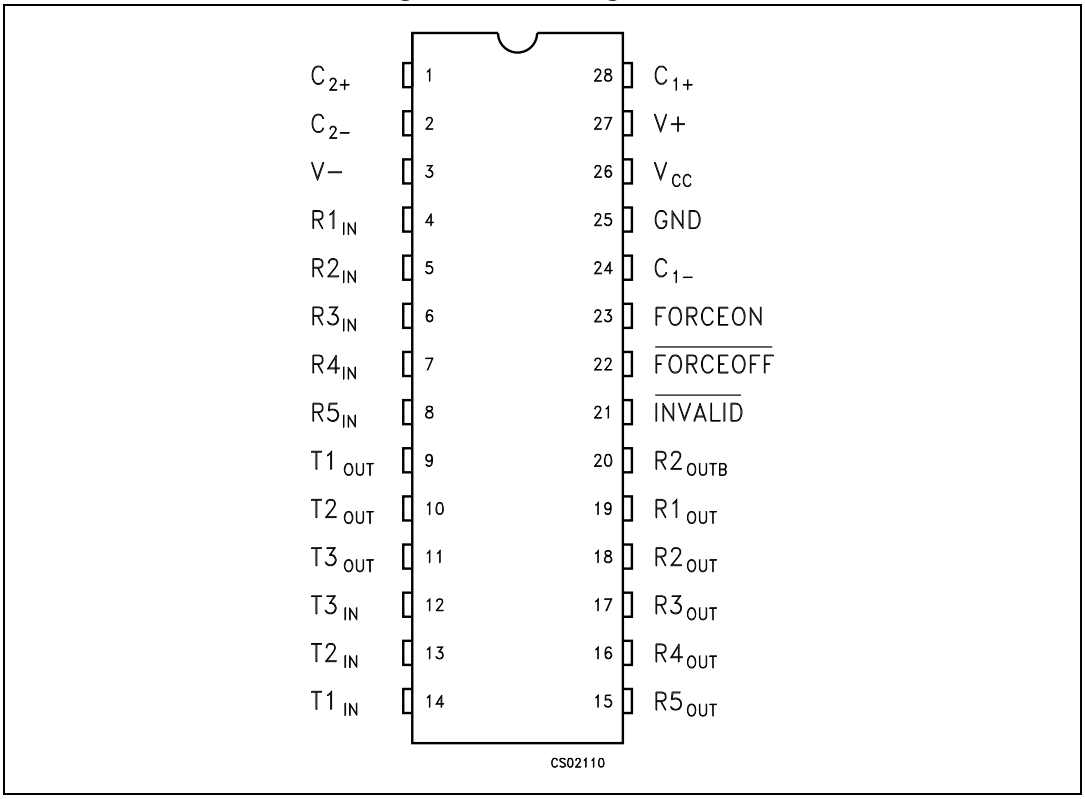


Table 2. Pin description

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 ($\overline{\text{FORCEOFF}}$ 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

Table 3. Truth table

$\overline{\text{FORCEOFF}}$	T_{OUT}	R_{OUT}	R_{2OUTB}
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_{CC}, FORCEON = 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, $\overline{\text{FORCEOFF}}$, 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} $\overline{\text{INVALID}}$	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 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 6. Electrical characteristics

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

C_1 - C_4 = 0.1 µA, 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. 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_{THYS}	Transmitter input hysteresis			0.5		
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	
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		

C_1 - C_4 = 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. 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_{OUT} = 1.6 mA		250		µs
t_{INVH}	Receiver positive or negative threshold to $\overline{\text{INVALID}}$ HIGH	I_{OUT} = -1 mA		1		
t_{INVL}	Receiver positive or negative threshold to $\overline{\text{INVALID}}$ LOW			30		

C_1 - C_4 = 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 9. Transmitter electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{TOUT}	Output voltage swing	All transmitter outputs are loaded with 3 kΩ to GND	±5	±5.4		V
R_{OUT}	Output resistance	V_{CC} = V+ = V- = 0 V, V_{OUT} = ±2 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 kΩ to GND T1OUT and T2OUT loaded with 2.5 mA each	±5			V

C_1 - C_4 = 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. 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	1.2 1.2		
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		1.5 1.8	2.4 2.4	
V_{RIHYS}	Input hysteresis			0.5		
R_{RIN}	Input resistance	T_A = 25 °C	3	5	7	kΩ

C_1 - C_4 = 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. Timing characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
D_R	Maximum data rate	R_L = 3 kΩ, 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			100		ns
t_{R_SKEW}	Receiver skew			50		
t_{INVH}	Receiver positive or negative threshold to $\overline{\text{INVALID}}$ HIGH			1		µs
t_{INVL}	Receiver positive or negative threshold to $\overline{\text{INVALID}}$ LOW			30		
S_{RT}	Transition slew rate	T_A = 25 °C, R_L = 3 kΩ to 7 kΩ, 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

4 Application

Figure 2. Application circuit

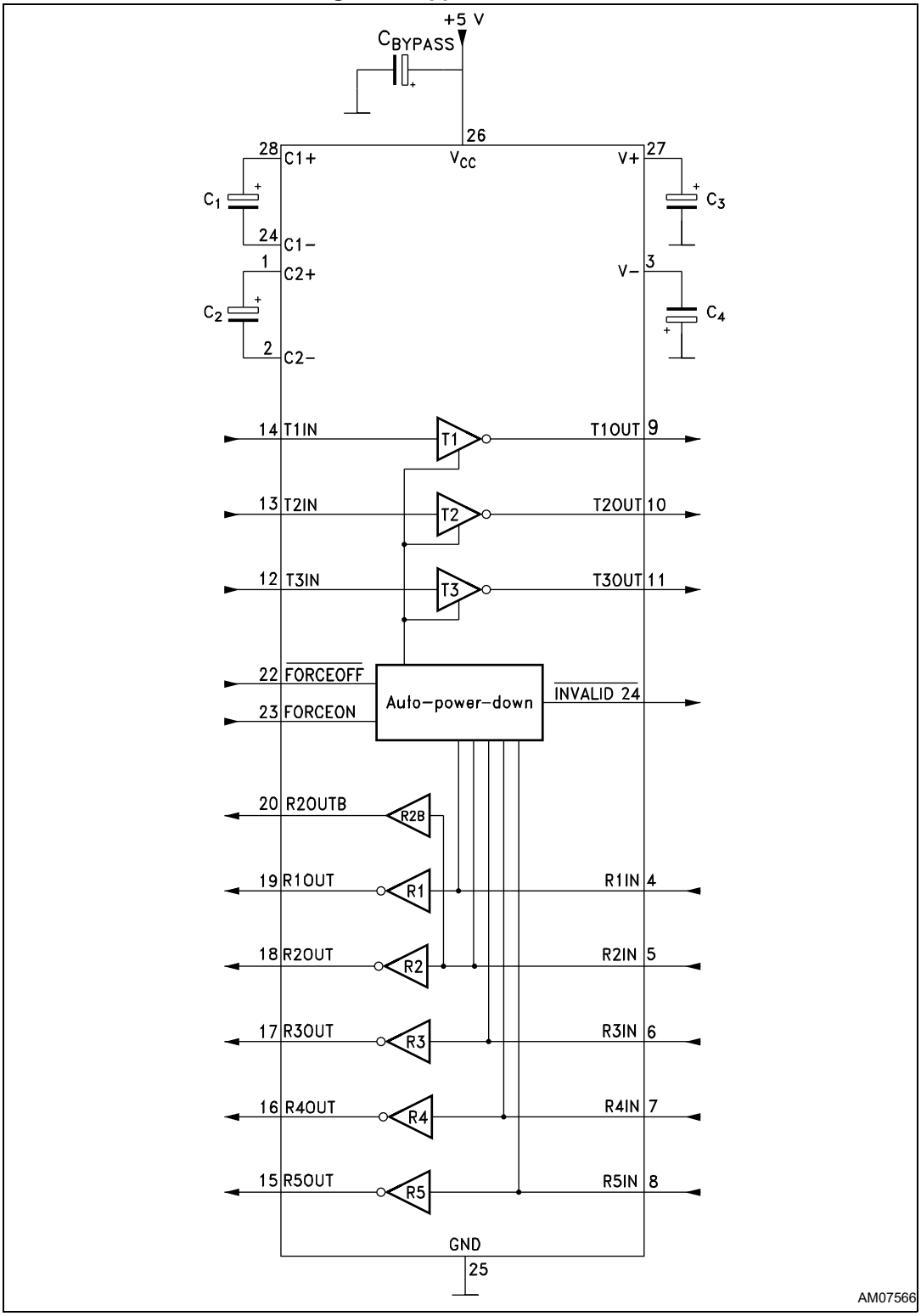


Table 12. Capacitance value (µF)

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 °C.

Figure 3. $\overline{\text{INVALID}}$ HIGH threshold time

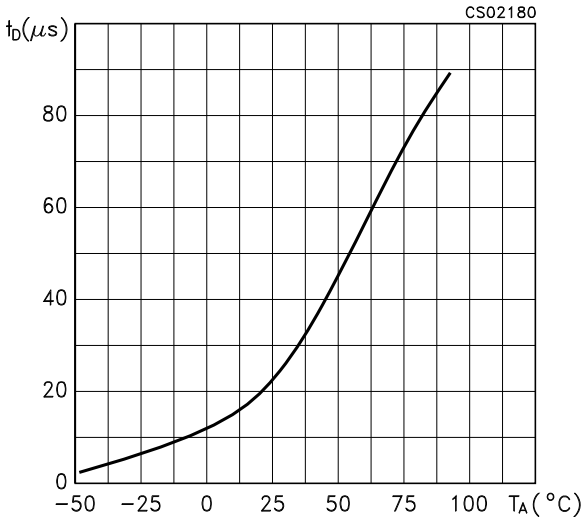


Figure 4. $\overline{\text{INVALID}}$ LOW threshold time

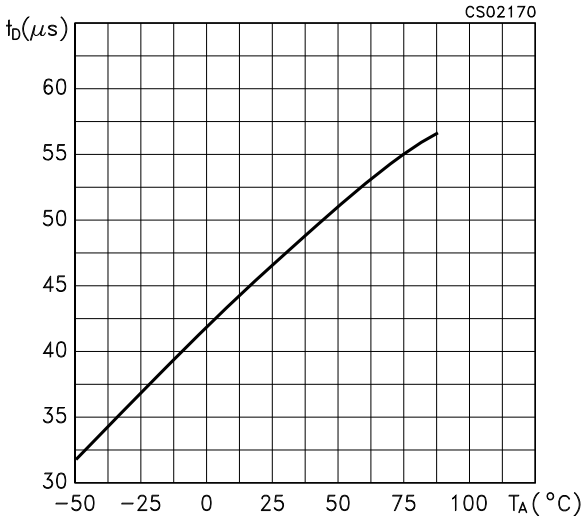


Figure 5. Receiver propagation delay

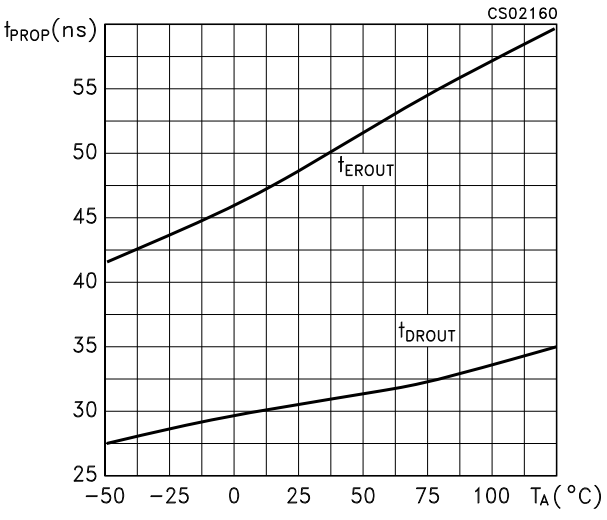


Figure 6. Receiver output enable and disable time

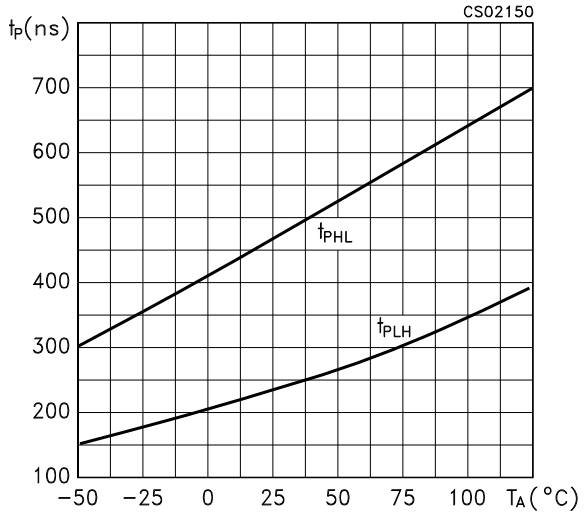


Figure 7. Output current vs. output high voltage

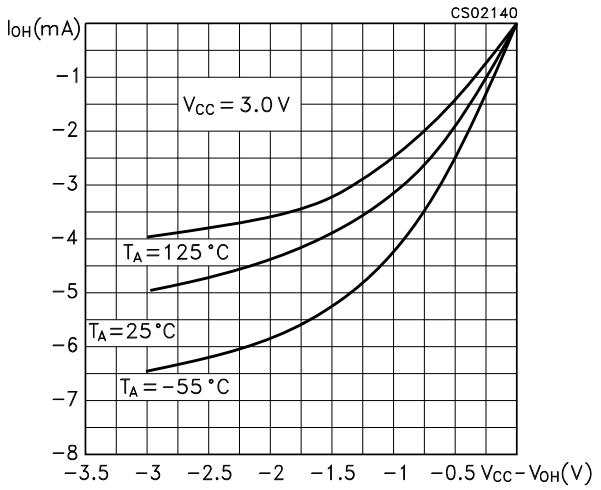
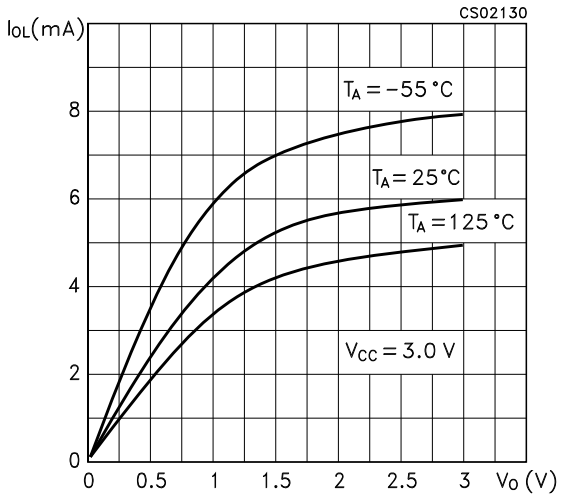


Figure 8. Output current vs. output low voltage



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

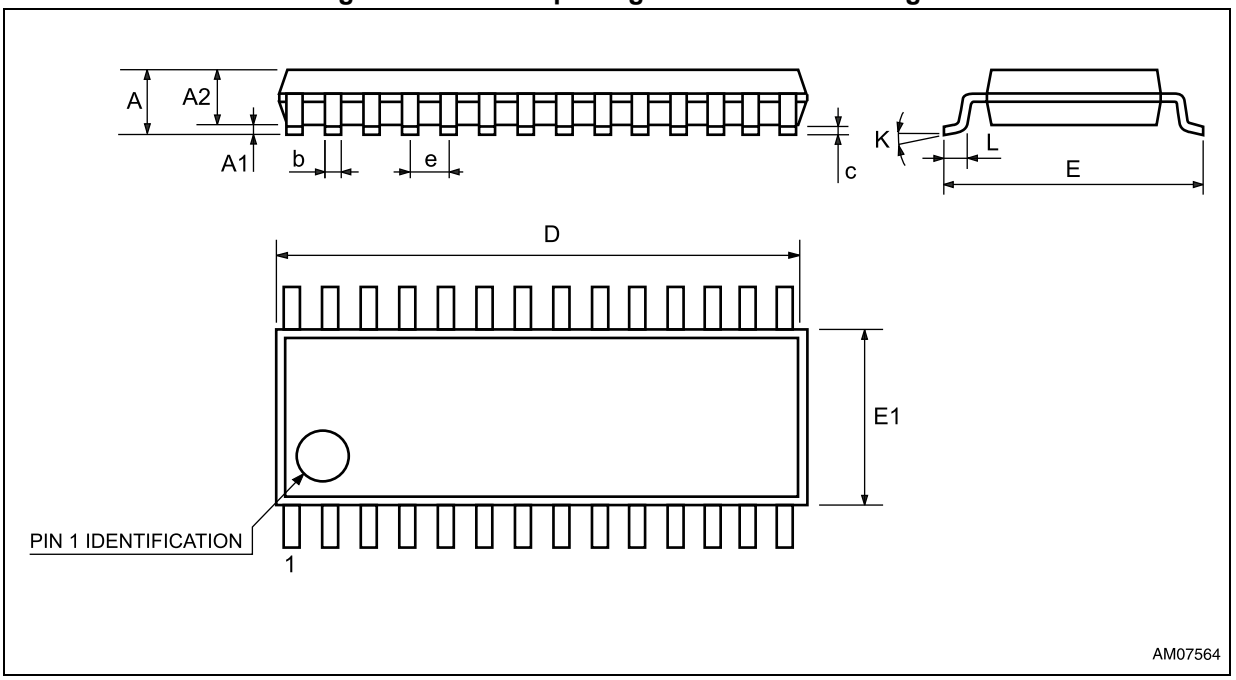
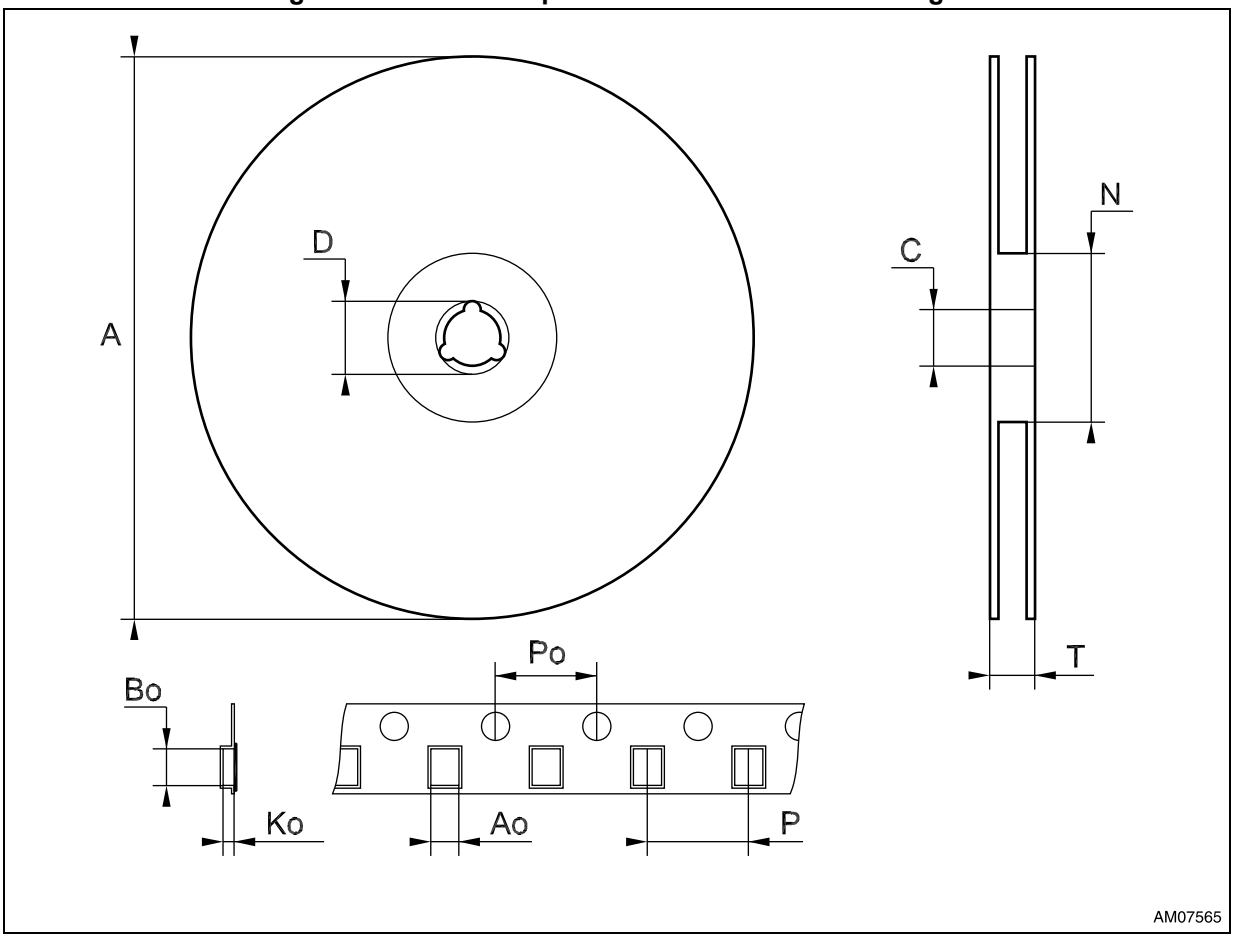


Table 13. SSOP-28 package mechanical data

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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