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## ST3241EB ST3241EC

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

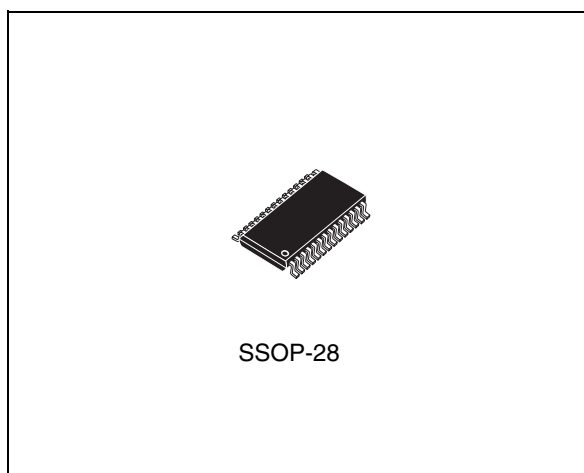
### Features

- 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
- Meets EIA/TIA-232 specifications down to 3 V
- Available in SSOP-28 package

### Description

The ST3241E 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 inputs 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 ST3241E 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.



It is a complete serial port (3 drivers, 5 receivers) intended for notebook or sub-notebook computers. Receivers R1 and R2 have extra outputs in addition to their standard outputs. These extra outputs are always active.

Typical applications are in notebooks, sub-notebooks, palmtop computers, battery-powered equipment, hand-held equipment, peripherals and printers.

**Table 1. Device summary**

Order code	Temperature range	Package	Packaging
ST3241ECPR	0 to 70°C	SSOP-28 (tape and reel)	1350 parts per reel
ST3241EBPR	−40 to 85°C	SSOP-28 (tape and reel)	1350 parts per reel

## Contents

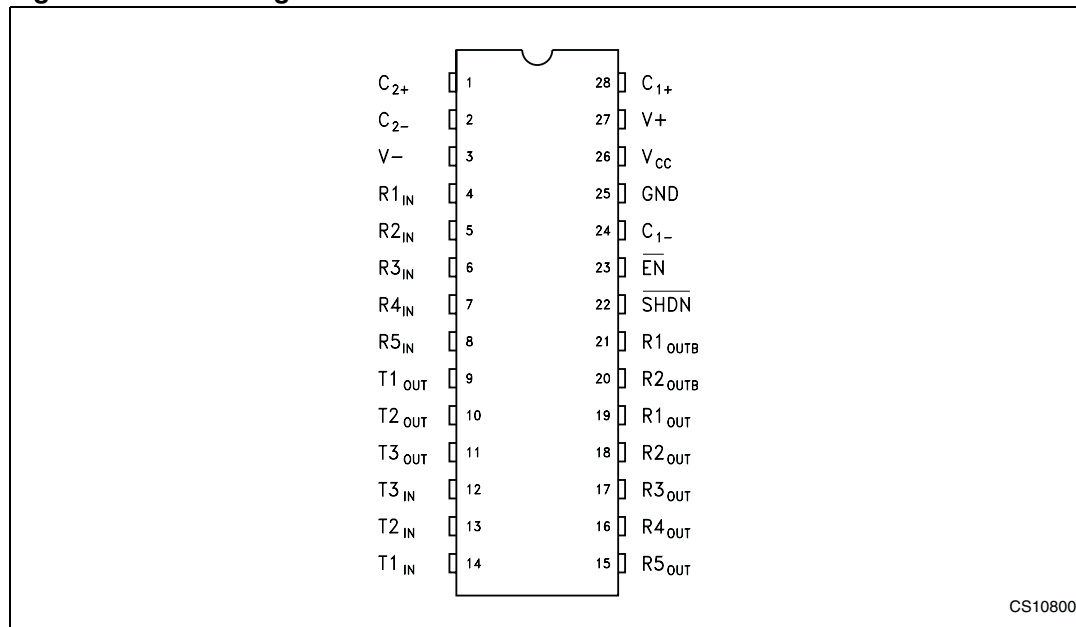
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**ST3241EB - ST3241EC**

**Pin configuration**

# 1 Pin configuration

**Figure 1. Pin configuration**



**Table 2. Pin description**

Pin number	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 <sub>-</sub>	-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

## Pin configuration

## ST3241EB - ST3241EC

**Table 2. Pin description (continued)**

Pin number	Symbol	Name and function
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	R1 <sub>OUTB</sub>	Non-inverting complementary receiver output, always active for wake-up
22	SHDN	Shutdown control. Active low.
23	EN	Receiver enable. Active low
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. Shutdown and enable control truth table**

SHDN	EN	T <sub>OUT</sub>	R <sub>OUT</sub>	R <sub>OUTB</sub>
0	0	HIGH Z	ACTIVE	ACTIVE
0	1	HIGH Z	HIGH Z	ACTIVE
1	0	ACTIVE	ACTIVE	ACTIVE
1	1	ACTIVE	HIGH Z	ACTIVE

## ST3241EB - ST3241EC

## Maximum ratings

# 2 Maximum ratings

**Table 4. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply voltage	-0.3 to 6	V
$V+$	Extra positive voltage ( <i>Note: 1</i> )	$(V_{CC} - 0.3)$ to 7	V
$V-$	Extra negative voltage ( <i>Note: 1</i> )	0.3 to -7	V
$V+ +  V- $	( <i>Note: 1</i> )	13	V
$\overline{SHDN}$ , $\overline{EN}$ , $T_{IN}$	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
$R_{OUT}$ $R_{OUTB}$ $\overline{INVALID}$	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 conditions is not implied.

*Note: 1*  $V+$  and  $V-$  can have a maximum magnitude of +7 V, but their absolute addition cannot exceed 13 V.

**Table 5. 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

## Electrical characteristics

## ST3241EB - ST3241EC

### 3 Electrical characteristics

**Table 6. 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)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SUPPLY}$	Supply current	No load $V_{CC}$ = 3.3V or 5V, $T_A$ = 25 $^{\circ}$ C	-	0.3	1	mA
$I_{SHDN}$	Shutdown supply current	$\overline{SHDN}$ = GND, $T_A$ = 25 $^{\circ}$ C	-	1	10	$\mu$ A

**Table 7. Logic input and receiver output 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.)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{TIL}$	Input logic threshold low	$T_{IN}$ , $\overline{EN}$ , $\overline{SHDN}$			0.8	V
$V_{TIH}$	Input logic threshold high	$V_{CC}$ = 3.3V $V_{CC}$ = 5V	2 2.4			V V
$I_{IL}$	Input leakage current	$T_{IN}$ , $\overline{EN}$ , $\overline{SHDN}$		$\pm 0.01$	$\pm 1.0$	$\mu$ A

**Table 8. Receiver output 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.)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{OL}$	Output leakage current	$R_{OUT}$ , $\overline{EN}$ , receiver disabled	-	$\pm 0.05$	$\pm 10$	$\mu$ A
$V_{OL}$	Output voltage low	$I_{OUT}$ = 1.6mA	-		0.4	V
$V_{OH}$	Output voltage high	$I_{OUT}$ = -1mA	-	$V_{CC}-0.6$	$V_{CC}-0.1$	V

**Table 9. Transmitter 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.)

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 V, $V_{OUT}$ = $\pm 2$ V	300	10M		$\Omega$
$I_{SC}$	Output short circuit current			$\pm 35$	$\pm 60$	mA
$I_L$	Output leakage current	$V_{CC}$ = 0 to 5.5V, transmitter output = $\pm 12$ V, transmitter disabled			$\pm 25$	$\mu$ A
$V_{TO}$	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

## ST3241EB - ST3241EC

## Electrical characteristics

**Table 10. Receiver electrical characteristics**

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

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 1.5		V
$V_{RIH}$	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
$V_{RIHYS}$	Input hysteresis			0.3		V
$R_{RIN}$	Input resistance	$T_A = 25 \text{ }^\circ\text{C}$	3	5	7	k $\Omega$

**Table 11. Timing characteristics**

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

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			kbps
$t_{PHL}$ $t_{PLH}$	Receiver propagation delay	$R_{IN}$ to $R_{OUT}$ , $C_L = 150 \text{ pF}$		0.15		$\mu\text{s}$
$t_{T\_SKEW}$	Transmitter skew			100		ns
$t_{R\_SKEW}$	Receiver skew			300		ns
$S_{RT}$	Transition slew rate	$T_A = 25 \text{ }^\circ\text{C}$ , $R_L = 3 \text{ k}$ to $7 \text{ k}\Omega$ , $V_{CC} = 3.3 \text{ V}$ 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/ $\mu\text{s}$ V/ $\mu\text{s}$

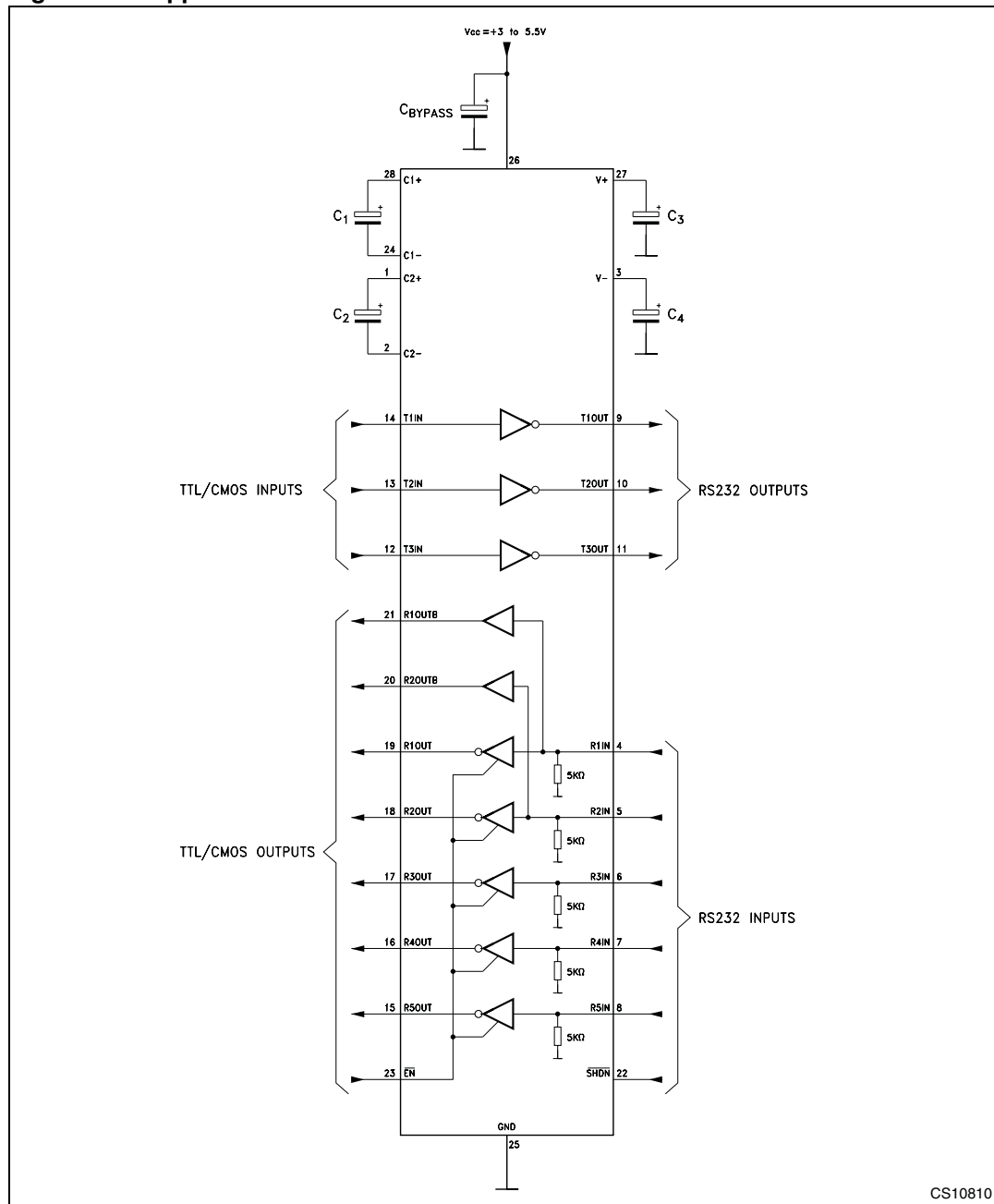


## Application

## ST3241EB - ST3241EC

# 4 Application

**Figure 2. Application circuits**



**Table 12. Required minimum capacitance value (μF)**

V <sub>CC</sub>	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	0.1
3.0 to 5.5	0.1	0.47	0.47	0.47	0.1

## **5 Package mechanical data**

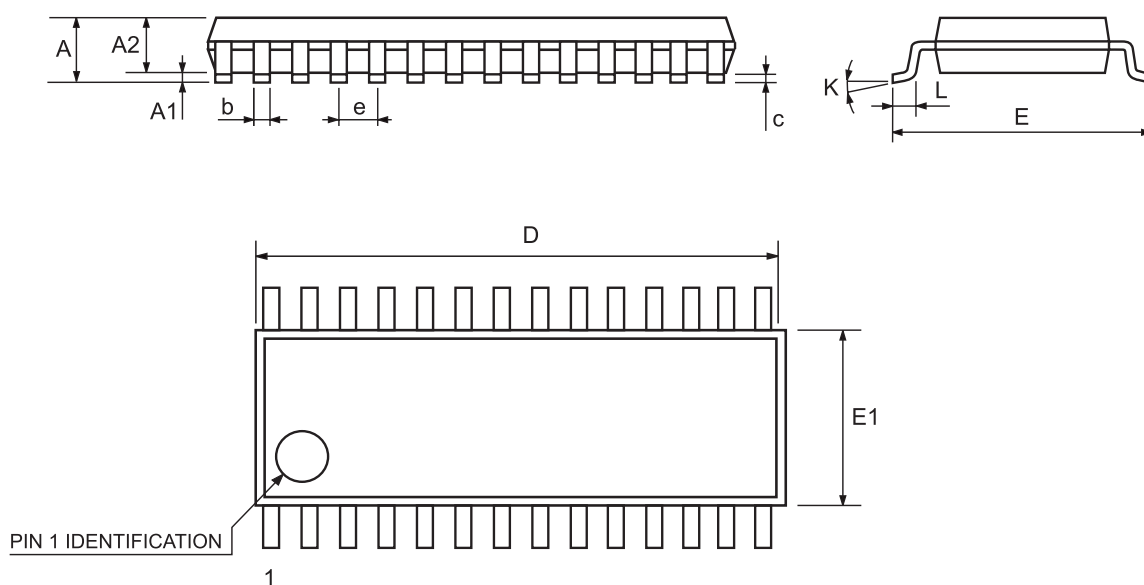
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**Package mechanical data**

**ST3241EB - ST3241EC**

**SSOP28 mechanical data**

Dim.	mm.			inch.		
	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

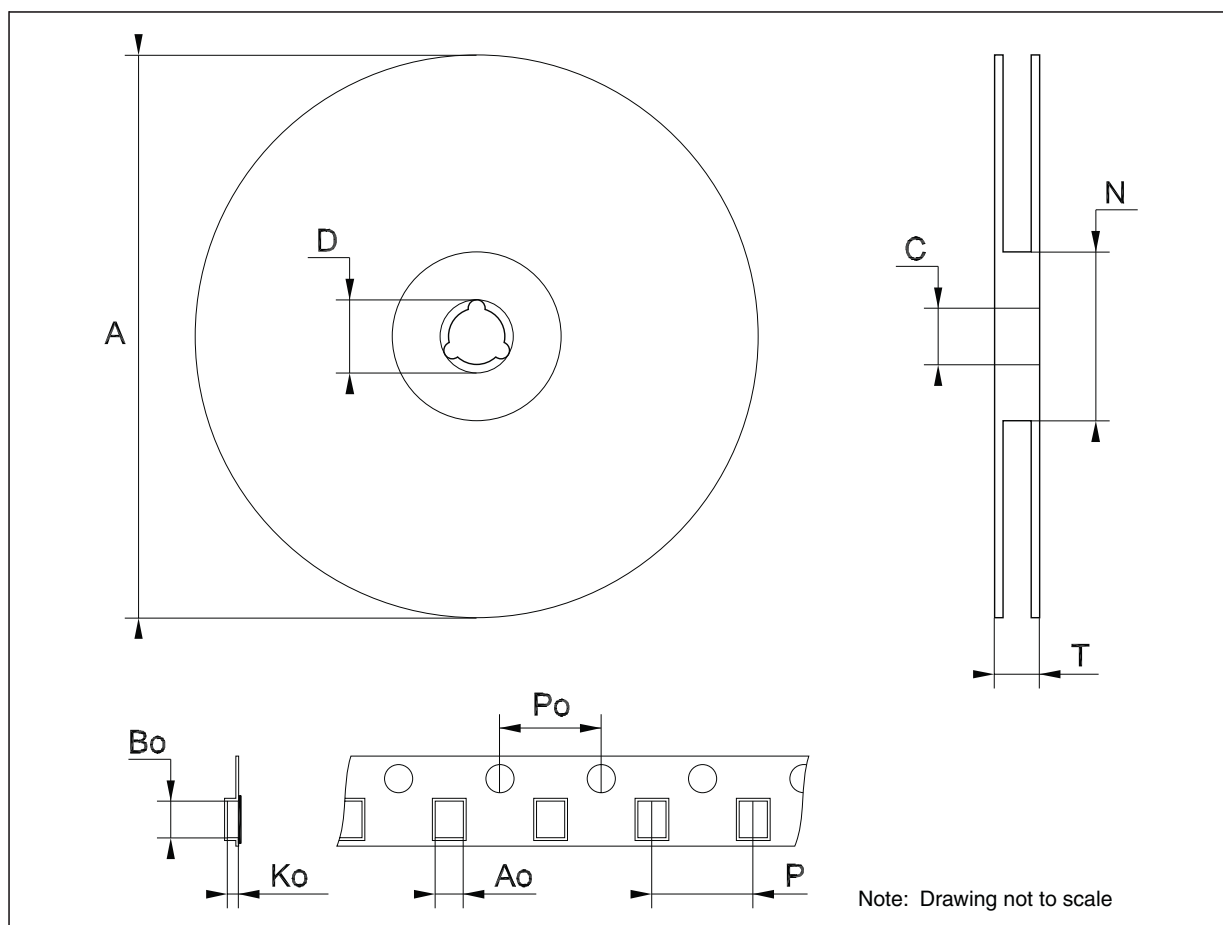


**ST3241EB - ST3241EC**

**Package mechanical data**

**Tape & reel SSOP28 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	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



## Revision history

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# 6 Revision history

Table 13. Document revision history

Date	Revision	Changes
21-Jun-2004	2	The $I_L$ (Output Leakage Current) mA ==> $\mu A$ in table 8.
03-Apr-2006	3	Order code updated.
13-Nov-2007	4	Added <a href="#">Table 1</a>
28-Sep-2010	5	Removed TSSOP28 package and all references from datasheet; updated ECOPACK® text in <a href="#">Section 5</a> ; reformatted document; minor textual updates.

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