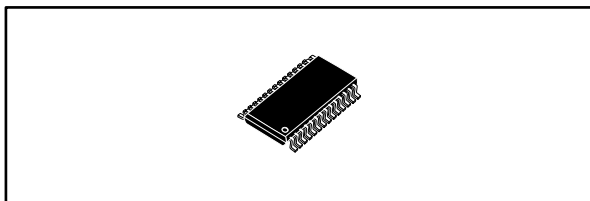


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**±15 kV ESD protected 3 to 5.5 V, 400 kbps, RS-232 transceiver  
with auto power-down**

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Datasheet - production data

**Features**

- ESD protection for RS-232 I/O pins: ±8 kV IEC 1000-4-2 contact discharge ±15 kV human body model
- 1  $\mu$ A supply current achieved when in auto power-down
- 250 kbps minimum guaranteed data rate
- Guaranteed 6 V/ $\mu$ s slew rate range
- Guaranteed mouse drive ability
- 0.1  $\mu$ F 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 the 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.

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# 1 Pin information

Figure 1: Pin connections (top view)

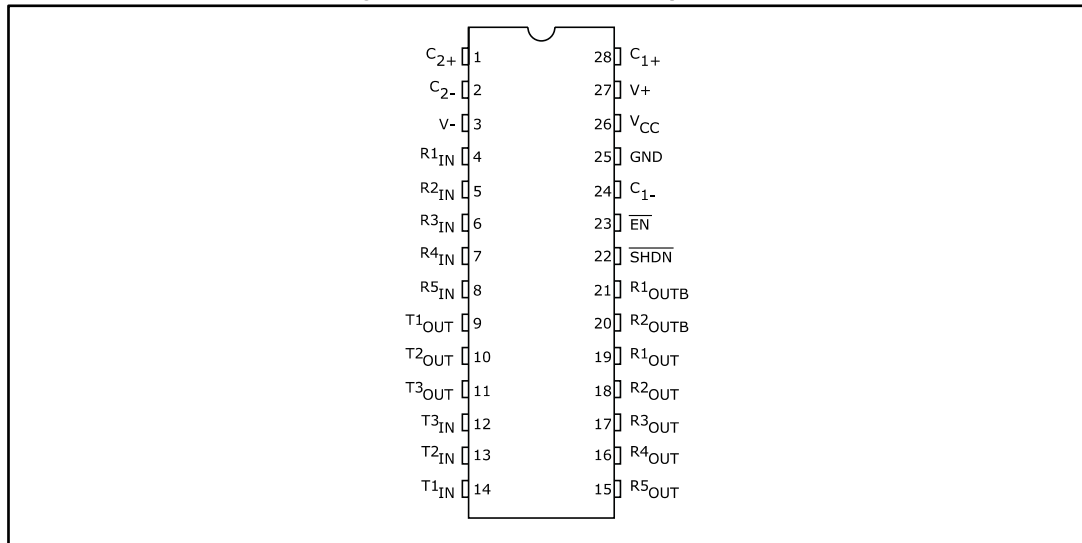


Table 1: Pin description

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-	-5.5 V generated by the charge pump
4	R <sub>1IN</sub>	First receiver input voltage
5	R <sub>2IN</sub>	Second receiver input voltage
6	R <sub>3IN</sub>	Third receiver input voltage
7	R <sub>4IN</sub>	Fourth receiver input voltage
8	R <sub>5IN</sub>	Fifth receiver input voltage
9	T <sub>1OUT</sub>	First transmitter output voltage
10	T <sub>2OUT</sub>	Second transmitter output voltage
11	T <sub>3OUT</sub>	Third transmitter output voltage
12	T <sub>3IN</sub>	Third transmitter input voltage
13	T <sub>2IN</sub>	Second transmitter input voltage
14	T <sub>1IN</sub>	First transmitter input voltage
15	R <sub>5OUT</sub>	Fifth receiver output voltage
16	R <sub>4OUT</sub>	Fourth receiver output voltage
17	R <sub>3OUT</sub>	Third receiver output voltage
18	R <sub>2OUT</sub>	Second receiver output voltage
19	R <sub>1OUT</sub>	First receiver output voltage
20	R <sub>2OUTB</sub>	Non-inverting complementary receiver output, always active for wake-up

Pin number	Symbol	Name and function
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 <sub>+</sub>	5.5 V generated by the charge pump
28	C <sub>1+</sub>	Positive terminal of voltage - charge pump capacitor

Table 2: Shutdown and enable control truth table

$\overline{\text{SHDN}}$	$\overline{\text{EN}}$	T <sub>OUT</sub>	R <sub>OUT</sub>	T <sub>OUTB</sub>
0	0	High Z	Active	Active
	1		High Z	
1	0	Active	Active	
	1		High Z	

## 2 Absolute maximum ratings and ESD performance

Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

**Table 3: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply voltage	-0.3 to 6	V
$V_{+}$	Extra positive voltage <sup>(1)</sup>	$(V_{CC} - 0.3)$ to 7	
$V_{-}$	Extra negative voltage <sup>(1)</sup>	0.3 to -7	
$V_{+} +  V_{-} $	<sup>(1)</sup>	13	
$\overline{SHDN}$ , $\overline{EN}$ , $T_{IN}$	Input voltage	-0.3 to 6	
$R_{IN}$	Receiver input voltage range	$\pm 25$	
$T_{OUT}$	Transmitter output voltage range	$\pm 13.2$	
$R_{OUT}$ , $R_{OUTB}$ , $\overline{INVALID}$	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	

**Notes:**

<sup>(1)</sup> $V_{+}$  and  $V_{-}$  can have a maximum magnitude of 7 V, but their absolute addition cannot exceed 13 V

**Table 4: ESD performance: transmitter outputs, receiver inputs**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
ESD	ESD protection voltage	Human body model	$\pm 15$	—	—	kV
		IEC 1000-4-2 (contact discharge)	$\pm 8$	—	—	

### 3 Electrical characteristics

**Table 5: Electrical characteristics, C1 - C4 = 0.1  $\mu$ F, 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**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I <sub>SUPPLY</sub>	Supply current	No load V <sub>CC</sub> = 3.3 V or 5 V, T <sub>A</sub> = 25 °C	—	0.3	1	mA
I <sub>SHDN</sub>	Shutdown supply current	$\overline{\text{SHDN}} = \text{GND}$ , T <sub>A</sub> = 25 °C		1	10	$\mu$ A

**Table 6: Logic input and receiver output electrical characteristics, C1 - C4 = 0.1  $\mu$ F, V<sub>CC</sub> = 3 V to 5.5 V, T<sub>A</sub> = -40 to 85 °C, unless otherwise specified**

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

**Table 7: Receiver output electrical characteristics, C1 - C4 = 0.1  $\mu$ F, V<sub>CC</sub> = 3 V to 5.5 V, T<sub>A</sub> = -40 to 85 °C, unless otherwise specified**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I <sub>OL</sub>	Output leakage current	R <sub>OUT</sub> , $\overline{\text{EN}}$ , receiver disabled	—	$\pm 0.05$	$\pm 10$	$\mu$ A
V <sub>OL</sub>	Output voltage low	I <sub>OUT</sub> = 1.6 mA			0.4	V
V <sub>OH</sub>	Output voltage high	I <sub>OUT</sub> = -1 mA		V <sub>CC</sub> - 0.6	V <sub>CC</sub> - 0.1	

**Table 8: Transmitter electrical characteristics, C1 - C4 = 0.1  $\mu$ F, V<sub>CC</sub> = 3 V to 5.5 V, T<sub>A</sub> = -40 to 85 °C, unless otherwise specified**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>TOUT</sub>	Output voltage swing	All transmitter outputs are loaded with 3 k $\Omega$ to GND	$\pm 5$	$\pm 5.4$		V
R <sub>OUT</sub>	Output resistance	V <sub>CC</sub> = V <sub>+</sub> = V <sub>-</sub> = 0 V, V <sub>OUT</sub> = $\pm 2$ V	300	10 M		$\Omega$
I <sub>SC</sub>	Output short circuit current			$\pm 35$	$\pm 60$	mA
I <sub>L</sub>	Output leakage current	V <sub>CC</sub> = 0 to 5.5 V, transmitter output = $\pm 12$ V, transmitter disabled			$\pm 25$	$\mu$ A
V <sub>TO</sub>	Transmitter output voltage	T <sub>1IN</sub> = T <sub>2IN</sub> = GND, T <sub>3IN</sub> = V <sub>CC</sub> , T <sub>3OUT</sub> loaded with 3 k $\Omega$ to GND, T <sub>1OUT</sub> and T <sub>2OUT</sub> loaded with 2.5 mA each	$\pm 5$			V

**Table 9: Receiver electrical characteristics, C1 - C4 = 0.1  $\mu$ F, V<sub>CC</sub> = 3 V to 5.5 V, T<sub>A</sub> = -40 to 85 °C, unless otherwise specified**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>RIN</sub>	Receiver input voltage operating range		-25		25	V
V <sub>RIL</sub>	RS-232 Input threshold low	T <sub>A</sub> = 25 °C, V <sub>CC</sub> = 3.3 V	0.6	1.2		
		T <sub>A</sub> = 25 °C, V <sub>CC</sub> = 5.0 V	0.8	1.5		
V <sub>RIH</sub>	RS-232 Input threshold high	T <sub>A</sub> = 25 °C, V <sub>CC</sub> = 3.3 V		1.5	2.4	
		T <sub>A</sub> = 25 °C, V <sub>CC</sub> = 5.0 V		1.8	2.4	
V <sub>RIHYS</sub>	Input hysteresis			0.3		
R <sub>RIN</sub>	Input resistance	T <sub>A</sub> = 25 °C	3	5	7	k $\Omega$

**Table 10: Timing characteristics, C1 - C4 = 0.1  $\mu$ F, V<sub>CC</sub> = 3 V to 5.5 V, T<sub>A</sub> = -40 to 85 °C, unless otherwise specified**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
D <sub>R</sub>	Maximum data rate	R <sub>L</sub> = 3 k $\Omega$ , C <sub>L</sub> = 1000 pF one transmitter switching	250			kbps
t <sub>PHL</sub> , t <sub>PLH</sub>	Receiver propagation delay	R <sub>IN</sub> to R <sub>OUT</sub> , C <sub>L</sub> = 150 pF		0.15		$\mu$ s
t <sub>T_SKEW</sub>	Transmitter skew			100		ns
t <sub>R_SKEW</sub>	Receiver skew			300		
S <sub>RT</sub>	Transition slew rate	T <sub>A</sub> = 25 °C, R <sub>L</sub> = 3 k to 7 k $\Omega$ , V <sub>CC</sub> = 3.3 V measured from 3 V to -3 V or -3 V to 3 V, C <sub>L</sub> = 150 pF to 1000 pF	6		30	V/ $\mu$ s
		T <sub>A</sub> = 25 °C, R <sub>L</sub> = 3 k to 7 k $\Omega$ , V <sub>CC</sub> = 3.3 V measured from 3 V to -3 V or -3 V to 3 V, C <sub>L</sub> = 150 pF to 2500 pF	4		30	

# 4 Application

Figure 2: Application circuits

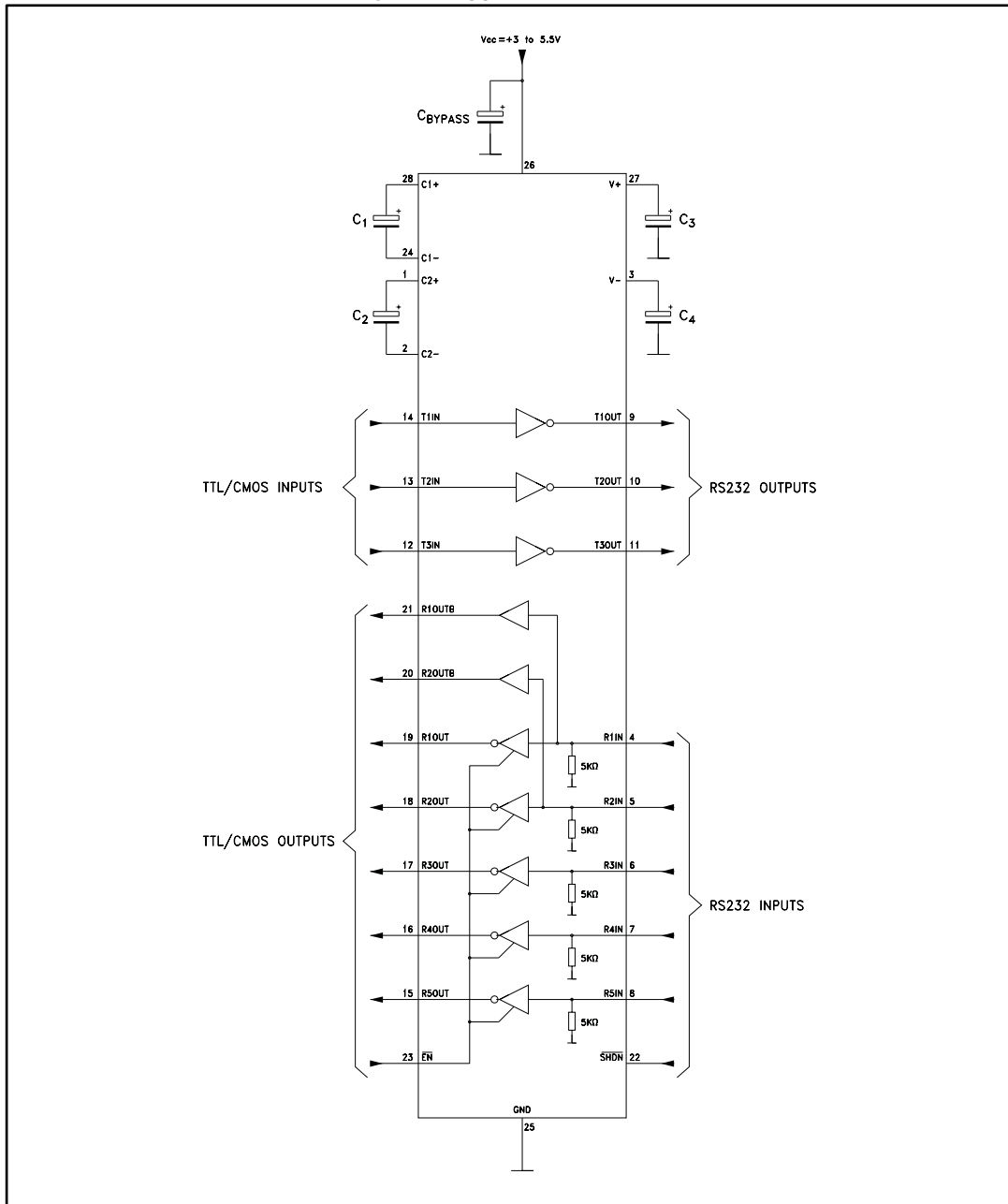


Table 11: Required minimum capacitance value (µF)

V <sub>cc</sub>	C1	C2	C3	C4	C <sub>bypass</sub>
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 information

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](http://www.st.com). ECOPACK® is an ST trademark.

### 5.1 SSOP 28 package information

Figure 3: SSOP 28 package outline

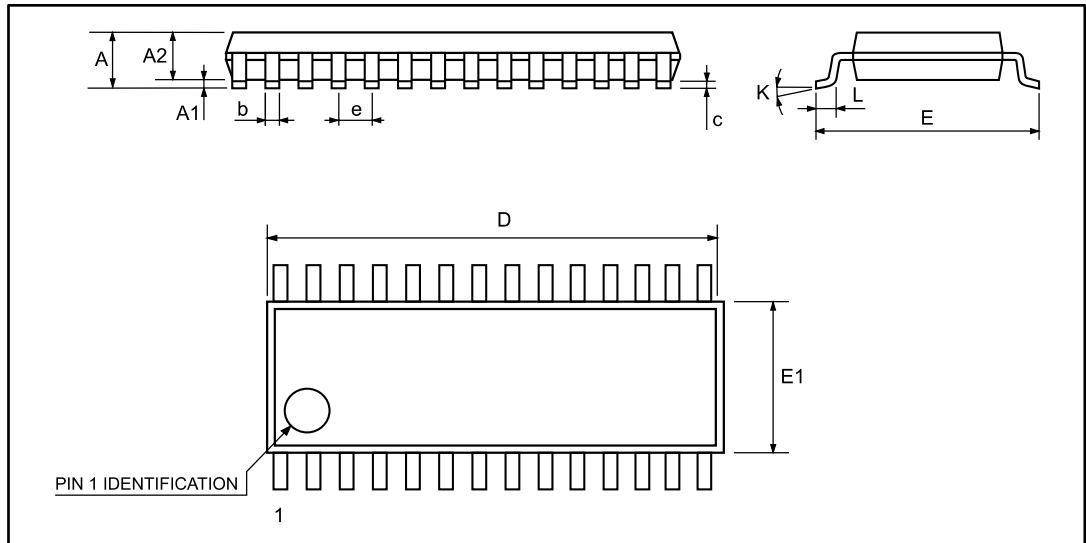
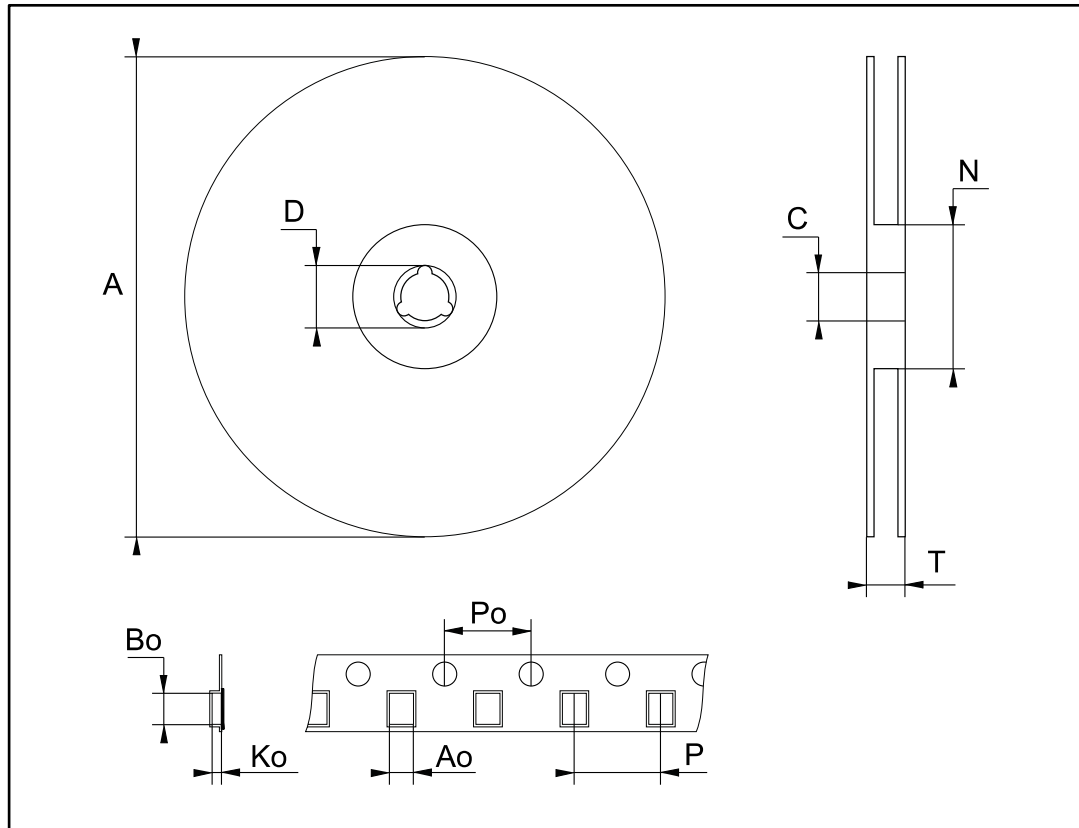


Table 12: SSOP 28 mechanical data

Ref.	Dimensions					
	Millimeters			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			0.0256	
K	0 °		10 °	0 °		10 °
L	0.55	0.75	0.95	0.022	0.030	0.037

## 5.2 SSOP 28 tape and reel package information

Figure 4: SSOP 28 tape and reel package outline



1. Drawing is not to scale

Table 13: SSOP 28 tape and reel mechanical data

Ref.	Dimensions					
	Millimeters			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

## 6 Ordering information

Table 14: Order codes

Order code	Temperature range	Package	Packaging	Marking
ST3241EBPR	-40 to 85 °C	SSOP 28 (tape and reel)	1350 parts per reel	ST3241EB
ST3241ECPR	0 to 70 °C			ST3241EC

## 7 Revision history

**Table 15: Document revision history**

Date	Revision	Changes
21-Jun-2004	2	The I <sub>L</sub> (Output Leakage Current) mA ==> μA in table 8
03-Apr-2006	3	Order code updated.
13-Nov-2007	4	Added Table 1
28-Sep-2010	5	Removed TSSOP28 package and all references from datasheet; updated ECOPACK® text in Section 5; reformatted document; minor textual updates.
08-Mar-2017	6	<i>Features</i> : updated units of slew rate change (from 6 V/ms to 6 V/μs) Moved "Device summary" table to <i>Section 6: "Ordering information"</i> and added "Marking". <i>Table 12</i> : removed "BSC" from "e" dimension

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