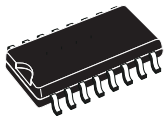
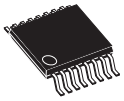
ST3232EB
ST3232EC

±15 kV ESD protection 3 to 5.5 V low power, up to 250 kbps, RS-232 drivers and receivers

Datasheet - production data



SO-16



TSSOP16

Features

- ESD protection for RS-232 I/O pins
- ±15 kV human body model
- ±8 kV IEC 1000-4-2 contact discharge
- 300 µA supply current
- 250 kbps minimum guaranteed data rate
- 6 V/µs minimum guaranteed slew rate
- Meet EIA/TIA-232 specifications down to 3 V
- Available in SO-16 and TSSOP16

Applications

- Notebook, subnotebook and palmtop computers
- Battery-powered equipment
- Hand-held equipment
- Peripherals and printers

Description

The ST3232E is a 3 V powered EIA/TIA-232 and V.28/V.24 communication interfaces with low power requirements, high data-rate capabilities and enhanced electrostatic discharge (ESD) protection to ± 8 kV using IEC1000-4-2 contact discharge and ± 15 kV using the human body model. The ST3232E has a proprietary low-dropout transmitter output stage providing true RS-232 performance from 3 to 5 V supplies with a dual charge pump. The charge pump requires only four small 0.1 µF standard external capacitors for operations from 3 V supply.

The ST3232E has two receivers and two drivers.

The device is guaranteed to run at data rates of 250 kbps while maintaining RS-232 output levels.

Table 1. Device summary

Order code	Temperature range	Package
ST3232ECDR	0 to 70 °C	SO-16 (tape and reel)
ST3232EBDR	-40 to 85 °C	SO-16 (tape and reel)
ST3232ECTR	0 to 70 °C	TSSOP16 (tape and reel)
ST3232EBTR	-40 to 85 °C	TSSOP16 (tape and reel)

This is information on a product in full production. www.st.com

Contents

1 Pin configuration

Figure 1. Pin connection

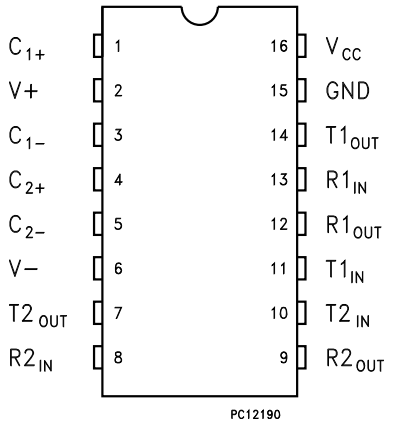


Table 2. Pin description

Pin n°	Symbol	Name and function
1	C_1+	Positive terminal for the first charge pump capacitor
2	V+	Doubled voltage terminal
3	C_1-	Negative Terminal for the first charge pump capacitor
4	C_2+	Positive terminal for the second charge pump capacitor
5	C_2-	Negative terminal for the second charge pump capacitor
6	V-	Inverted voltage terminal
7	$T2_{OUT}$	Second transmitter output voltage
8	$R2_{IN}$	Second receiver input voltage
9	$R2_{OUT}$	Second receiver output voltage
10	$T2_{IN}$	Second transmitter input voltage
11	$T1_{IN}$	First transmitter input voltage
12	$R1_{OUT}$	First receiver output voltage
13	$R1_{IN}$	First receiver input voltage
14	$T1_{OUT}$	First transmitter output voltage
15	GND	Ground
16	V_{CC}	Supply voltage

2 Absolute maximum ratings

Table 3. 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
V-	Inverted voltage terminal	0.3 to -7	V
V+ +|V-|		13	V
T_{IN}	Transmitter input voltage range	-0.3 to 6	V
R_{IN}	Receiver input voltage range	± 25	V
T_{OUT}	Transmitter output voltage range	± 13.2	V
R_{OUT}	Receiver output voltage range	-0.3 to (V_{CC} + 0.3)	V
t_{SHORT}	Transmitter output short-to-ground time	Continuous	
T_j	Maximum junction temperature	150	°C
$R_{th\text{-}jc}$	Thermal resistance junction-to-case(1) (2)		°C/W
	SO-16	30	
	TSSOP16	25	
$R_{th\text{-}ja}$	Thermal resistance junction-to-ambient (1) (2)		
	SO-16	95	
	TSSOP16	95	

1. Short-circuits can cause excessive heating and destructive dissipation.
2. R_{th} are typical values.

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

Externally applied V+ and V- can have a maximum magnitude of +7 V, but their absolute addition can not exceed 13 V.

Running on internal charge pump, intrinsic self limitation allows exceeding those values without any damage.

Start-up voltage sequence (V_{CC}, then V+, then V-) is critical, therefore it is not recommended to use this device using externally applied voltage to V+ and V-.

Figure 2. ESD performance: transmitter outputs, receiver inputs

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
ESD	ESD protection voltage	Human body model	±15			kV
ESD	ESD protection voltage	IEC-1000-4-2	±8			kV

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 4. Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SUPPLY}	V_{CC} Power supply current	No Load, V_{CC} = 3 V or 5 V, T_A = 25 °C		0.3	1	mA

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 5. Logic input

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{TIL}	Input logic threshold low	T-IN			0.8	V
V_{HYS}	Transmitter input hysteresis			0.25		V
V_{TIH}	Input logic threshold high	V_{CC} = 3.3 V	2			V
		V_{CC} = 5 V	2.4			
I_{IL}	Input leakage current	T-IN		± 0.01	± 1	µA

C_1 - C_4 = 0.1 µF tested at 3.3 V ± 10 %, 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. Transmitter

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_{TOUT}	Transmitter output resistance	V_{CC} = 0 V, V_{OUT} = ± 2 V	300	10M		W
I_{SC}	Output short-circuit current			± 60		mA
I_{TOL}	Output leakage current	V_{CC} = 0 V or 3.3 V to 5.5 V V_{OUT} = ± 12 V Transmitters disable			± 25	µA

C_1 - C_4 = 0.1 µF tested at 3.3 V ± 10%, 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. Receiver

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	0.6	1.1		V
		T_A = 25 °C, V_{CC} = 5 V	0.8	1.5		
V_{RIH}	RS-232 input threshold high	T_A = 25 °C, V_{CC} = 3.3 V		1.4	2.4	V
		T_A = 25 °C, V_{CC} = 5 V		1.8	2.4	
V_{RIHYS}	Input hysteresis			0.5		V
R_{RIN}	Input resistance	T_A = 25 °C	3	5	7	kΩ
V_{ROL}	TTL/CMOS Output voltage low	I_{OUT} = 1.6 mA			0.4	V
V_{ROH}	TTL/CMOS Output voltage high	I_{OUT} = -1 mA	V_{CC}-0.6	V_{CC}-0.1		V

C_1 - C_4 = 0.1 µF tested at 3.3 V ± 10%, 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. Timing characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
D_R	Data transfer rate	R_L = 3 kΩ, C_{L2}= 1000 pF one transmitter switching	250			kbps
t_{PHLR} t_{PLHR}	Propagation delay input to output	R_{XIN} = R_{XOUT}, C_L = 150 pF		0.15		µs
t_{OER}	Receiver output enable time	Normal operation		50		ns
t_{ODR}	Receiver output disable time	Normal operation		50		ns
$\lvert t_{PHLT} - t_{THL} \rvert$	Transmitter propagation delay difference	(1)		200		ns
$\lvert t_{PHLR} - t_{THR} \rvert$	Receiver propagation delay difference			50		ns
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 V/µs

1. Transmitter skew is measured at the transmitter zero-cross points.

4 Application

Figure 3. Application circuits

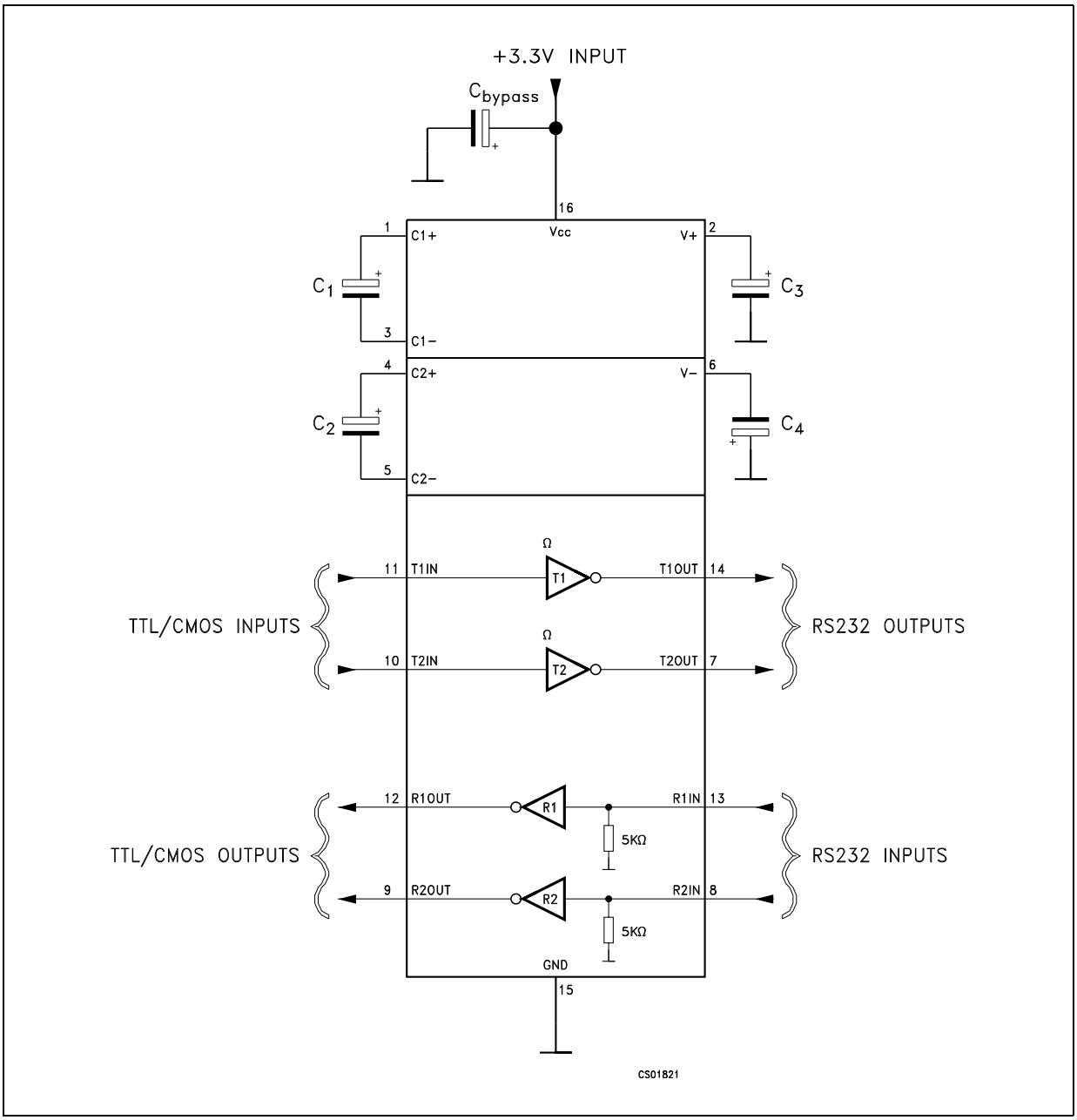


Table 9. Capacitance value (µF)

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	0.1
3.0 to 5.5	0.1	0.47	0.47	0.47	0.1

5 Typical performance characteristics

Unless otherwise specified T_J = 25 °C.

Figure 4. Output current vs. output high voltage

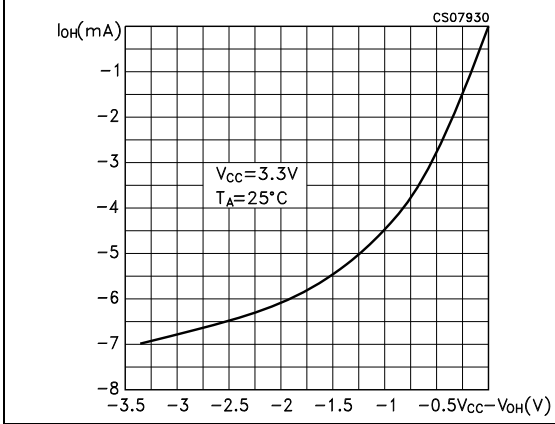


Figure 5. Output current vs. output high voltage

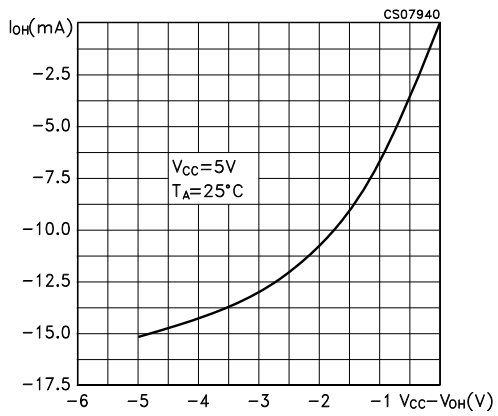


Figure 6. Output current vs. output low voltage

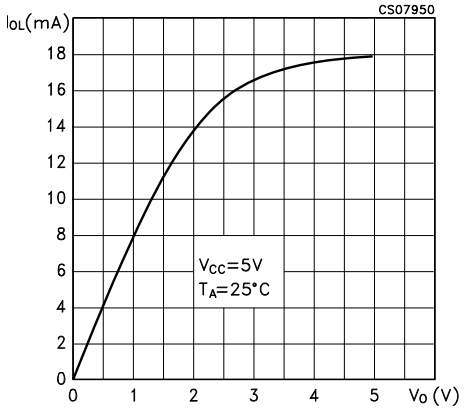


Figure 7. Output current vs. output low voltage

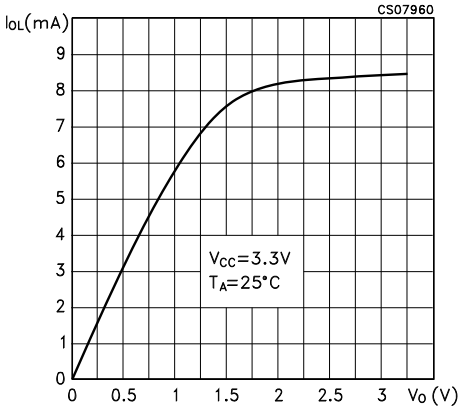


Figure 8. Voltage transfer characteristics for transmitter inputs

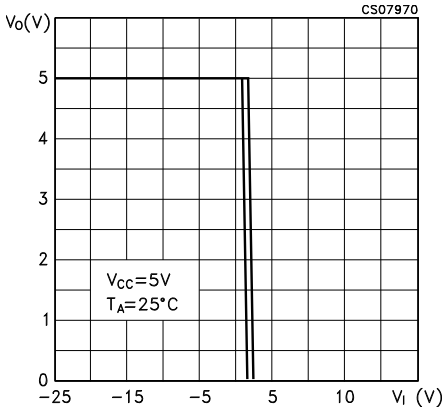
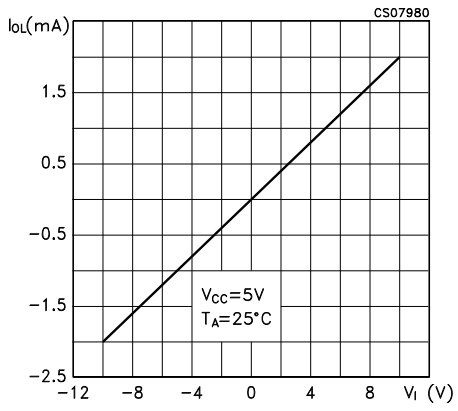


Figure 9. Receiver input resistance



6 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*. ECOPACK® is an ST trademark.

6.1 SO-16 package information

Figure 10. SO-16 package outline

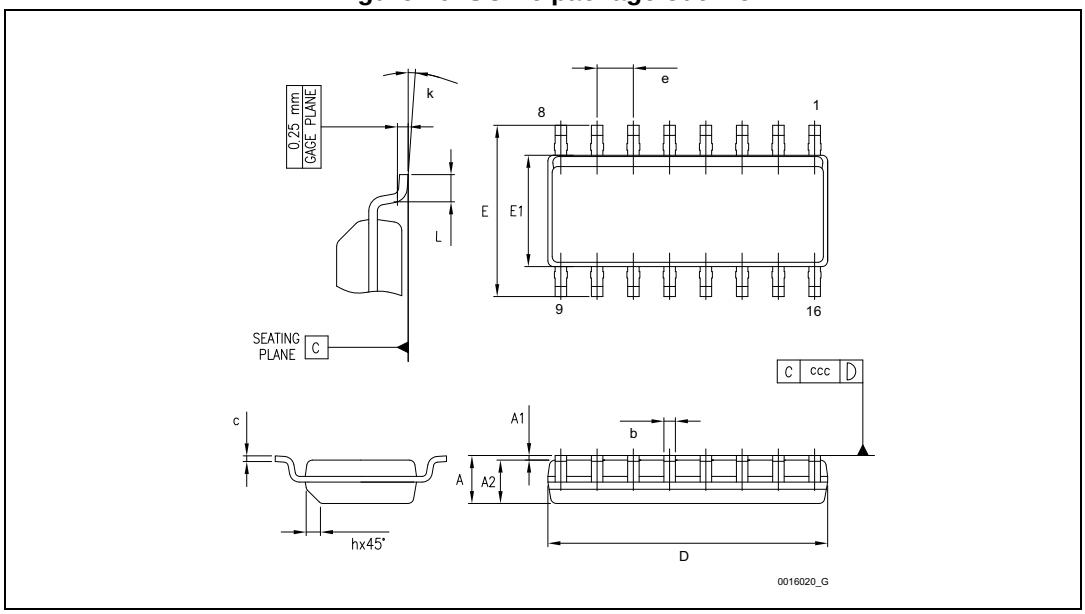


Table 10. SO-16 package mechanical data

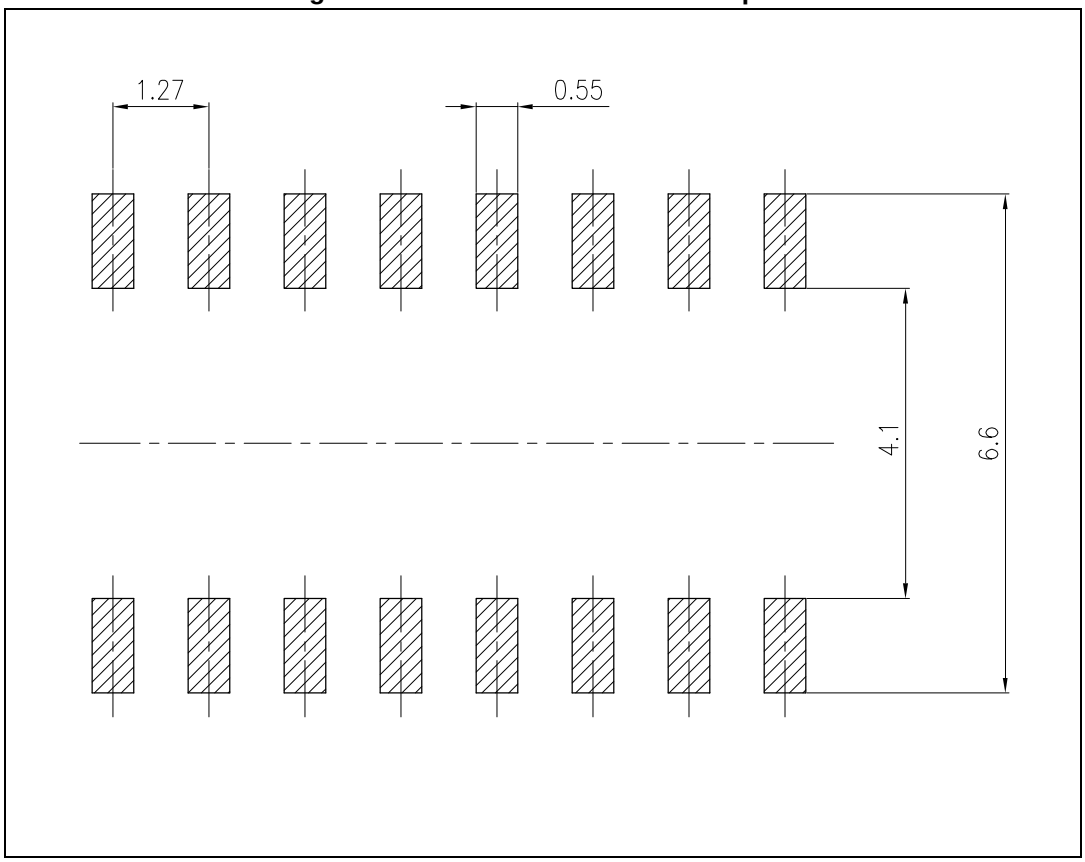
Ref.	Dimensions (mm)		
	Min.	Typ.	Max.
A			1.75
A1	0.10		0.25
A2	1.25		
b	0.31		0.51
c	0.17		0.25
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e		1.27	
h	0.25		0.50
L	0.40		1.27
k	0		8
ccc			0.10

Dimension D does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.15 mm in total (both side).

Dimension “E1” does not include interlead flash or protrusions.Interlead flash or protrusions shall not exceed 0.25mm per side.

Dimensions referred to the bottom side of the package.

Figure 11. SO-16 recommended footprint



6.2 TSSOP-16 package information

Figure 12. TSSOP-16 package outline

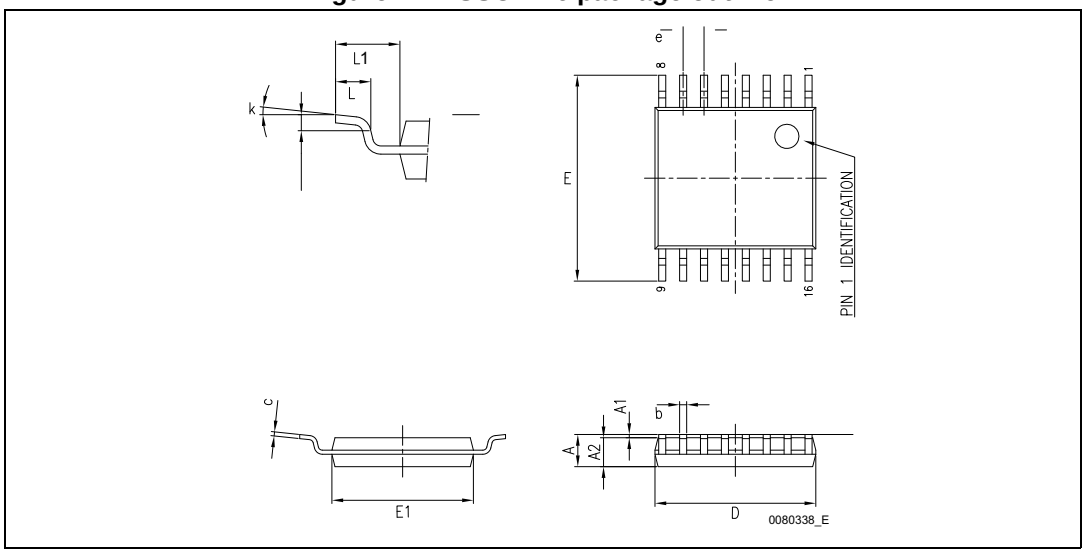


Table 11. TSSOP-16 package mechanical data

Ref.	Dimensions		
	mm		
	Min.	Typ.	Max.
A			1.20
A1	0.05		0.15
A2	0.80	1.00	1.05
b	0.19		0.30
c	0.09		0.20
D	4.90	5.00	5.10
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e		0.65	
L	0.45	0.60	0.75
L1		1.00	
k	0		8
aaa			0.10

TSSOP stands for thin shrink small outline package. Dimension “D” does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.15 mm per side. Dimension “E1” does not include interlead flash or protrusions. Interlead flash or protrusions shall not exceed 0.25 mm per side.

7 Revision history

Table 12. Document revision history

Date	Revision	Changes
06-Sep-2006	3	Order codes updated.
21-Jan-2008	4	Added: *Table 1* and note on *Table 3*.
08-Feb-2008	5	Modified: *Table 1 on page 1*.
05-Jan-2010	6	Modified: *Table 1 on page 1*.
04-Jul-2018	7	Updated *Table 3: Absolute maximum ratings* and *Section 6: Package information*.

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