



# STS13N3LLH5

N-channel 30 V, 0.006  $\Omega$ , 13 A, SO-8  
STripFET™ V Power MOSFET

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STS13N3LLH5	30 V	<0.0066 $\Omega$	13 A <sup>(1)</sup>

1. The value is rated according to R<sub>thj-pcb</sub>.

- R<sub>DS(on)</sub> \* Q<sub>g</sub> industry benchmark
- Extremely low on-resistance R<sub>DS(on)</sub>
- Very low switching gate charge
- High avalanche ruggedness
- Low gate drive power losses

## Applications

- Switching applications

## Description

This product is an N-channel Power MOSFET that utilizes the 5<sup>th</sup> generation of design rules for ST's proprietary STripFET™ technology. The lowest available R<sub>DS(on)</sub> \* Q<sub>g</sub>, in SO-8 package, makes this device suitable for the most demanding DC-DC converter applications, where high power density is to be achieved.

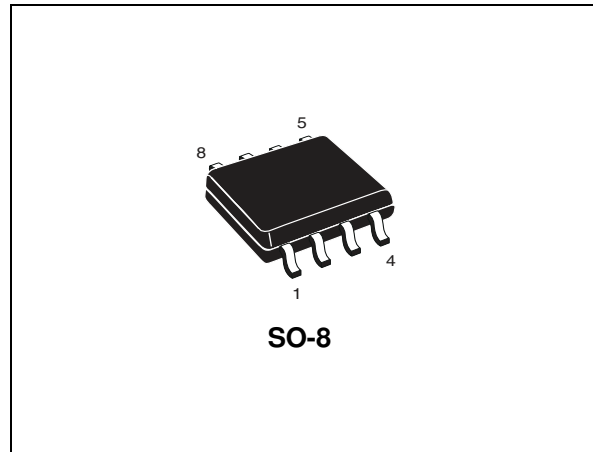


Figure 1. Internal schematic diagram

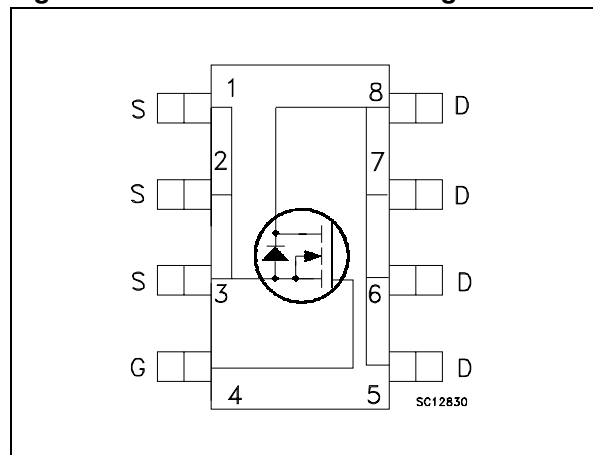


Table 1. Device summary

Order code	Marking	Package	Packaging
STS13N3LLH5	13D3L	SO-8	Tape and reel

## Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	30	V
$V_{GS}$	Gate-source voltage	+ 22 / - 20	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25\text{ °C}$	13	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100\text{ °C}$	8.1	A
$I_{DM}^{(2)}$	Drain current (pulsed)	52	A
$P_{TOT}^{(2)}$	Total dissipation at $T_C = 25\text{ °C}$	2.7	W
	Derating factor	0.02	W/°C
$T_J$	Operating junction temperature	-55 to 150	°C
$T_{stg}$	Storage temperature		

1. The value is rated according to  $R_{thj-pcb}$ .
2. Pulse width limited by safe operating area.

**Table 3. Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-pcb	46	°C/W

1. When mounted on FR-4 board of 1 inch<sup>2</sup>, 2 oz Cu,  $t < 10$  sec.

**Table 4. Avalanche data**

Symbol	Parameter	Value	Unit
$I_{AV}$	Not-repetitive avalanche current, (pulse width limited by $T_J$ Max)	8.5	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25\text{ °C}$ , $I_D = I_{AV}$ , $V_{DD} = 24\text{ V}$ )	180	mJ

## 2 Electrical characteristics

( $T_{CASE}=25\text{ }^{\circ}\text{C}$  unless otherwise specified).

**Table 5. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ( $V_{GS} = 0$ )	$I_D = 250\text{ }\mu\text{A}$	30			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{max rating}$ , $V_{DS} = \text{max rating}$ $T_C = 125\text{ }^{\circ}\text{C}$			1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = +22 / -20\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	1			V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$ , $I_D = 6.5\text{ A}$ $V_{GS} = 4.5\text{ V}$ , $I_D = 6.5\text{ A}$		0.006 0.0052	0.0066 0.0091	$\Omega$ $\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$C_{iss}$	Input capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$	-	1500	-	pF
$C_{oss}$	Output capacitance			295		pF
$C_{rss}$	Reverse transfer capacitance			39		pF
$Q_g$	Total gate charge	$V_{DD} = 15\text{ V}$ , $I_D = 13\text{ A}$	-	12	-	nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 4.5\text{ V}$		4		nC
$Q_{gd}$	Gate-drain charge	(see Figure 14)		4.7		nC

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 15\text{ V}$ , $I_D = 6.5\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ (see Figure 13)	-	9.3	-	ns
$t_r$	Rise time			14.5		ns
$t_{d(off)}$	Turn-off delay time			22.7		ns
$t_f$	Fall time			4.5		ns

**Table 8. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		13	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		52	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 13 \text{ A}, V_{GS}=0$	-		1.1	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 13 \text{ A},$ $di/dt = 100 \text{ A}/\mu\text{s},$ $V_{DD} = 25 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$	-	25		ns
$Q_{rr}$	Reverse recovery charge			17.5		nC
$I_{RRM}$	Reverse recovery current			1.4		A

1. Pulse width limited by safe operating area.
2. Pulsed: pulse duration=300 $\mu\text{s}$ , duty cycle 1.5 %.

### Electrical characteristics (curves)

Figure 2. Safe operating area

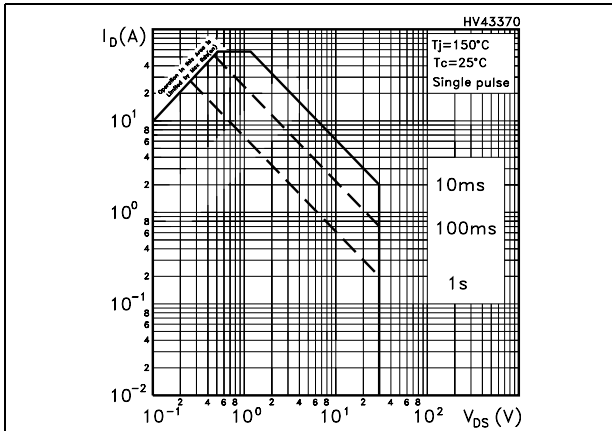


Figure 3. Thermal impedance

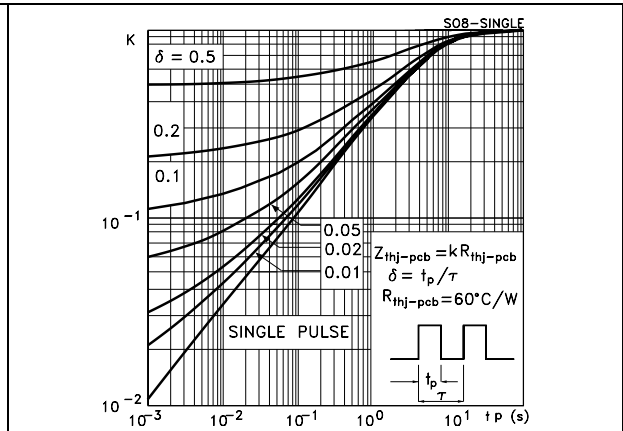


Figure 4. Output characteristics

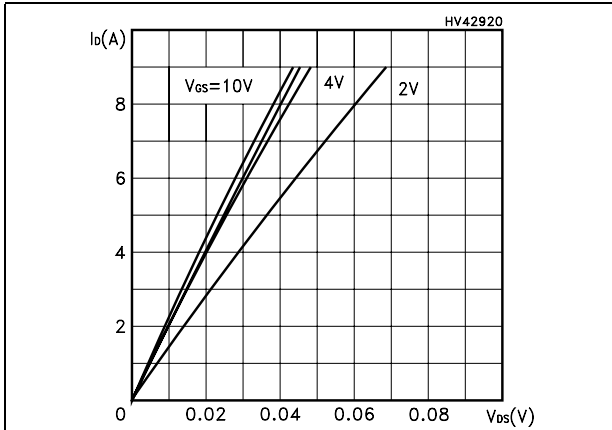


Figure 5. Transfer characteristics

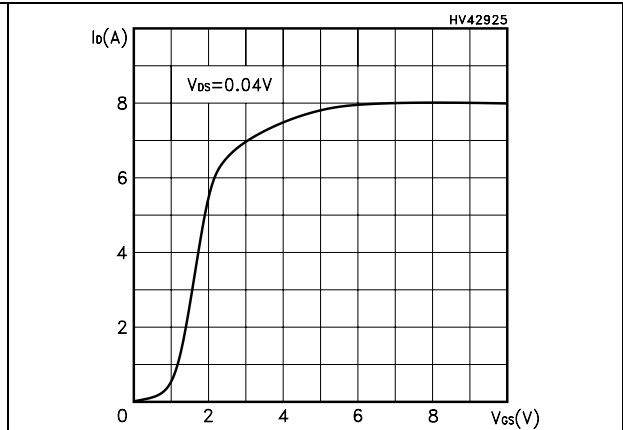


Figure 6. Normalized  $B_{V_{DSS}}$  vs temperature

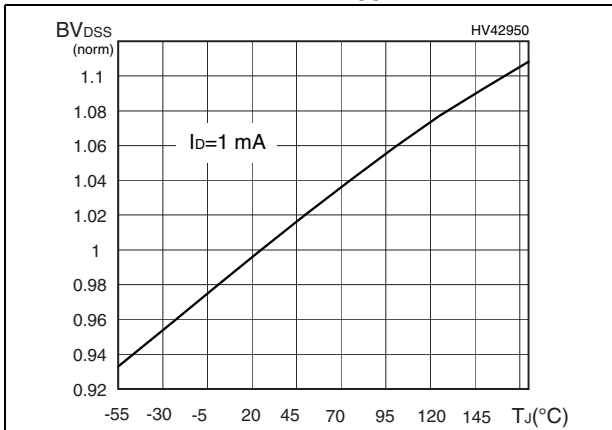


Figure 7. Static drain-source on resistance

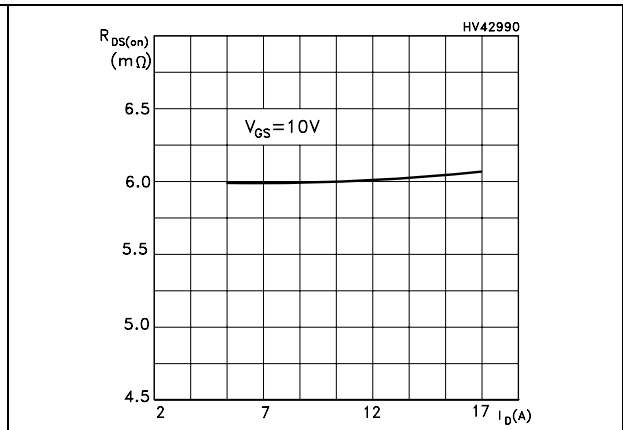


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

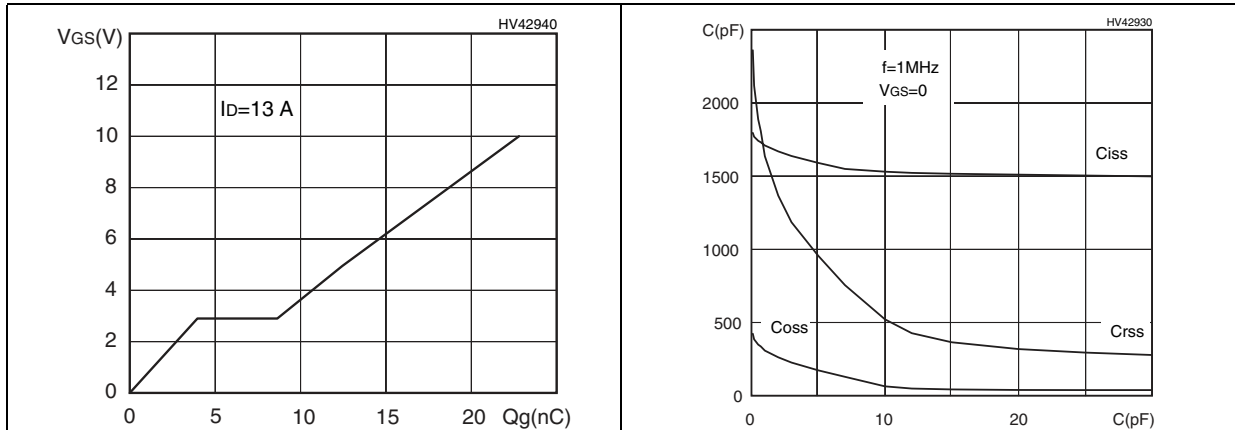


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

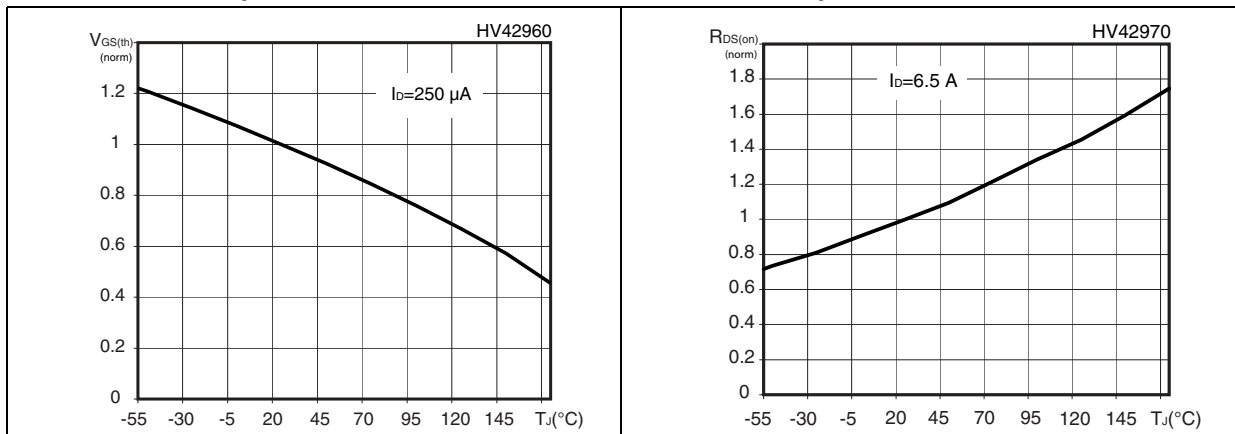
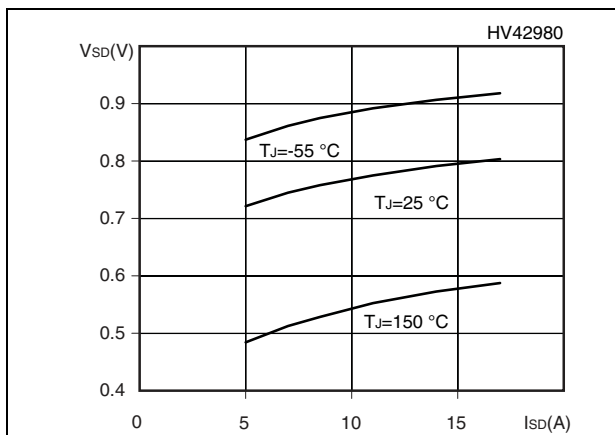
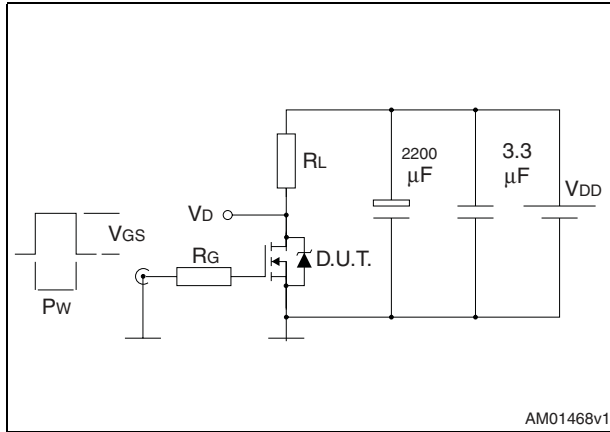


Figure 12. Source-drain diode forward characteristics

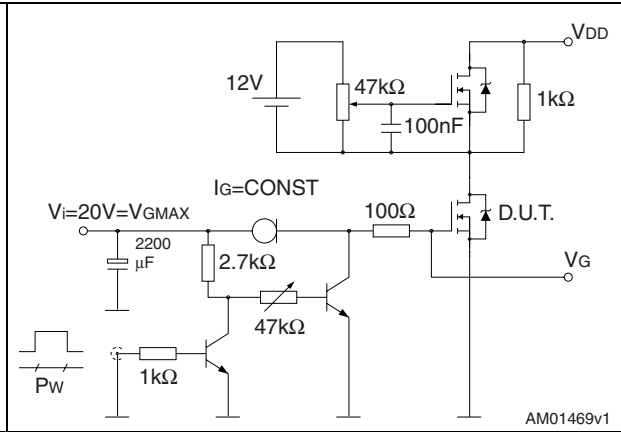


### 3 Test circuits

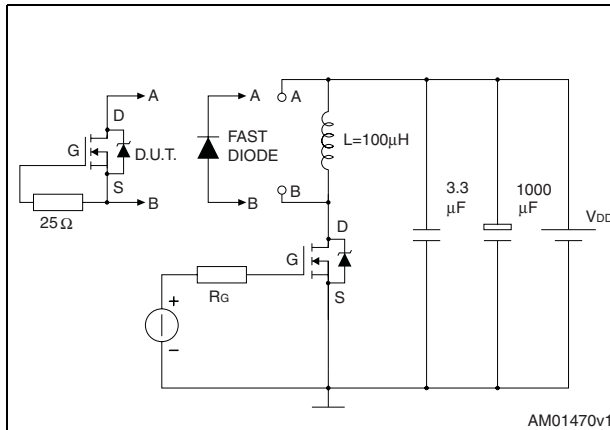
**Figure 13. Switching times test circuit for resistive load**



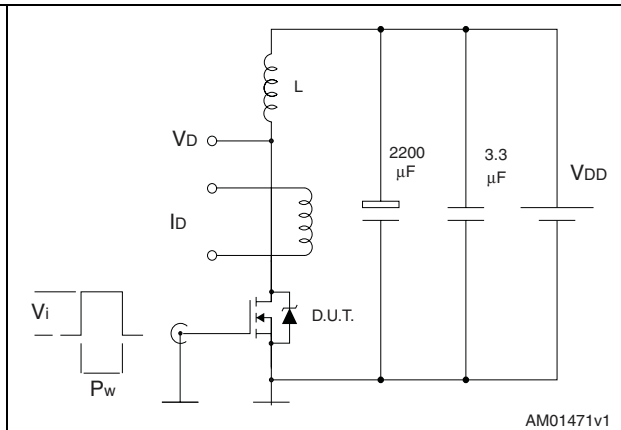
**Figure 14. Gate charge test circuit**



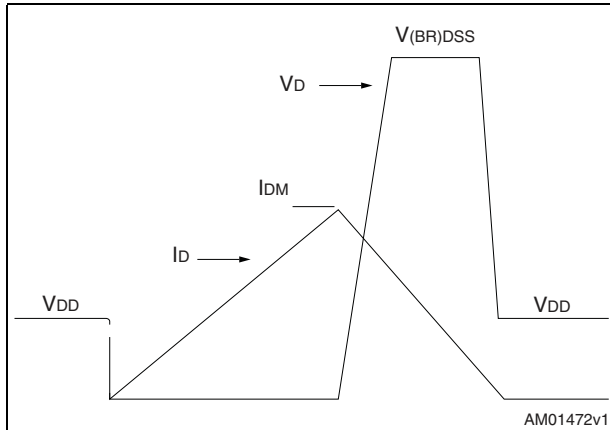
**Figure 15. Test circuit for inductive load switching and diode recovery times**



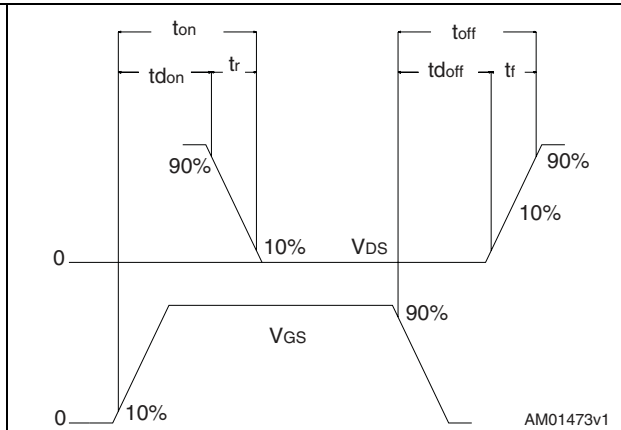
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**





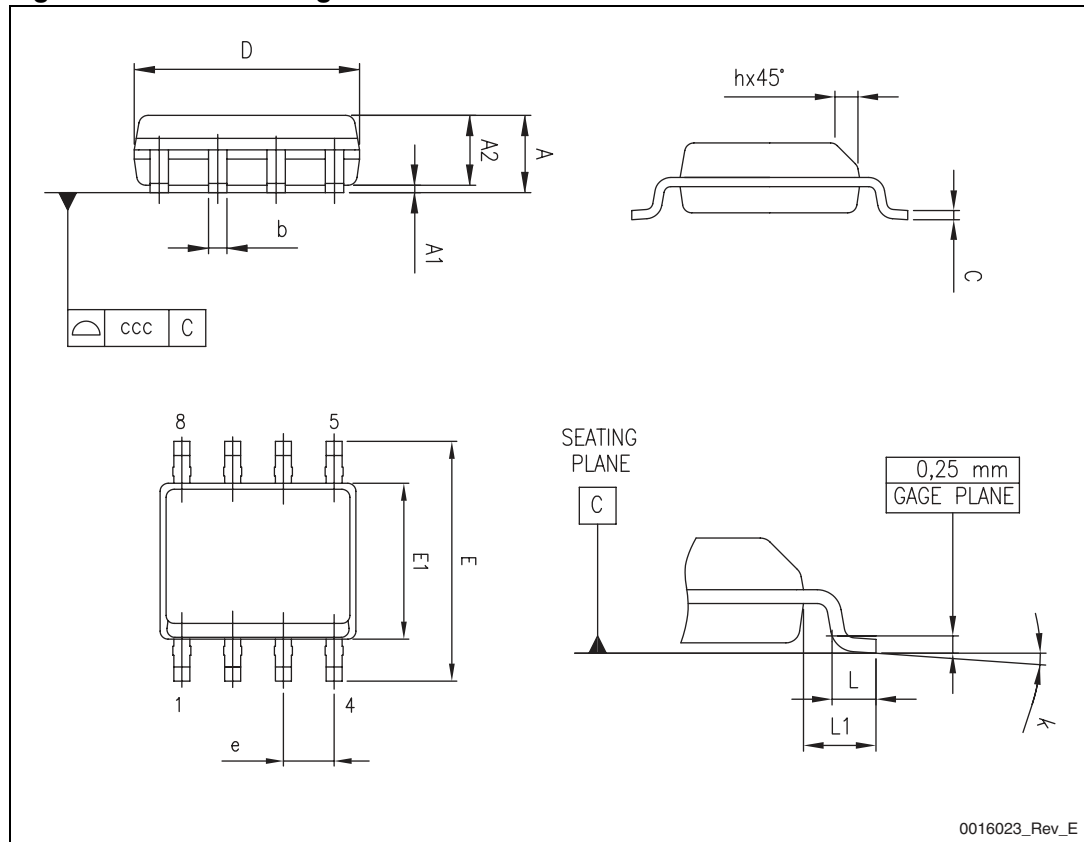
## 4 Package mechanical data

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

Table 9. SO-8 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			1.75
A1	0.10		0.25
A2	1.25		
b	0.28		0.48
c	0.17		0.23
D	4.80	4.90	5.00
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
L1		1.04	
k	0°		8°
ccc			0.10

Figure 19. SO-8 drawing



## 5 Revision history

Table 10. Document revision history

Date	Revision	Changes
30-Jun-2011	1	First release.

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