



## STS12NH3LL

N-channel 30V - 0.008 $\Omega$  - 12A - SO-8  
Ultra low gate charge STripFET™ Power MOSFET

### General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STS12NH3LL	30V	<0.0105 $\Omega$	12A

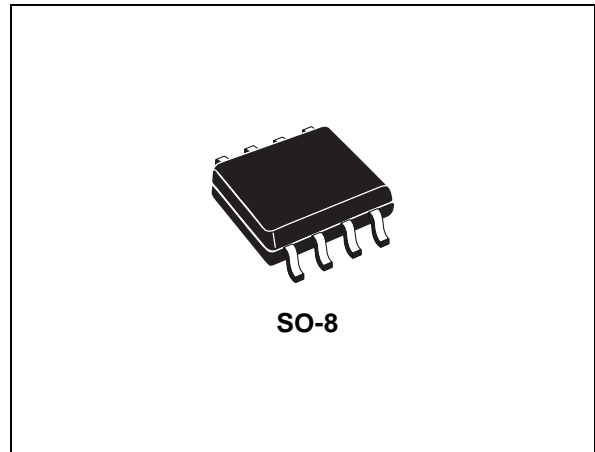
- Optimal R<sub>DS(on)</sub> x Q<sub>g</sub> trade-off @ 4.5V
- Switching losses reduced
- Low input capacitance
- Low threshold device

### Description

This series is based on the latest generation of ST's proprietary "STripFET™" technology. An innovative layout enables the device to also exhibit extremely low gate charge for the most demanding requirements as high-side switch in high-frequency DC-DC converters. It's therefore ideal for high-density converters in Telecom and Computer applications.

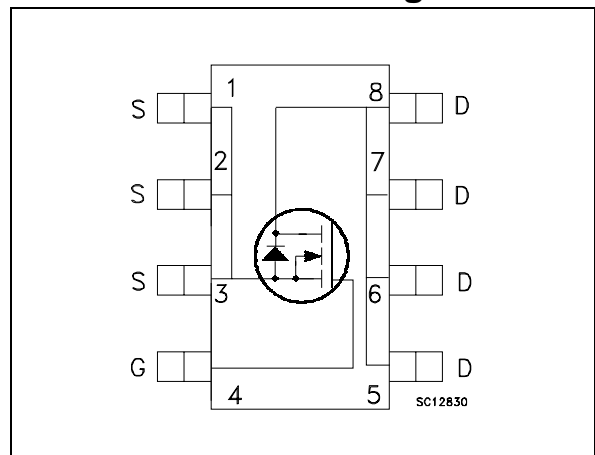
### Applications

- Switching application



SO-8

### Internal schematic diagram



### Order codes

Part number	Marking	Package	Packaging
STS12NH3LL	S12NH3LL	SO-8	Tape & reel

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	30	V
$V_{GS}^{(1)}$	Gate-source voltage	$\pm 16$	V
$V_{GS}^{(2)}$	Gate-source voltage	$\pm 18$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	12	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	7.5	A
$I_{DM}^{(3)}$	Drain current (pulsed)	48	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	2.5	W
$T_J$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 150	$^\circ\text{C}$

1. Continuous mode
2. Guaranteed for test time  $\leq 15\text{ms}$
3. Pulse width limited by safe operating area

**Table 2. Thermal resistance**

Symbol	Parameter	Value	Unit
$R_{thj-amb}^{(1)}$	Thermal resistance junction-ambient	50	$^\circ\text{C/W}$

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

## 2 Electrical characteristics

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

**Table 3. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\mu\text{A}$ , $V_{GS} = 0$	30			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating}$ , $V_{DS} = \text{Max rating @ } 125^{\circ}\text{C}$			1 10	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 16\text{V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$	1			V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{V}$ , $I_D = 6\text{A}$ $V_{GS} = 4.5\text{V}$ , $I_D = 6\text{A}$		0.008 0.010	0.0105 0.013	$\Omega$ $\Omega$

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward transconductance	$V_{DS} = 10\text{V}$ , $I_D = 12\text{A}$		38		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25\text{V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$		965 285 38		pF pF pF
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 15\text{V}$ , $I_D = 12\text{A}$ $V_{GS} = 4.5\text{V}$ (see Figure 7)		9 3.7 3	12	nC nC nC
$R_G$	Gate Input Resistance	$f = 1\text{ MHz}$ Gate DC Bias = 0 Test signal level = 20mV open drain	0.5	1.5	2.5	$\Omega$

**Table 5. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD}=15V$ , $I_D=6A$ , $R_G=4.7\Omega$ , $V_{GS}=4.5V$ (see Figure 13)		15		ns
$t_r$	Rise time			32		ns
$t_{d(off)}$	Turn-off delay time			18		ns
$t_f$	Fall time			8.5		ns

**Table 6. Source drain diode**

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
$I_{SD}$	Source-drain current				12	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				48	A
$V_{SD}^{(2)}$	Forward on Voltage	$I_{SD}=12A$ , $V_{GS}=0$			1.3	V
$t_{rr}$	Reverse recovery time	$I_{SD}=12A$ , $di/dt = 100A/\mu s$ , $V_{DD}=20V$ , $T_j=150^\circ C$ (see Figure 15)		24		ns
$Q_{rr}$	Reverse recovery charge			17.4		nC
$I_{RRM}$	Reverse recovery current			1.45		A

1. Pulse width limited by safe operating area

2. Pulsed: pulse duration=300 $\mu s$ , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

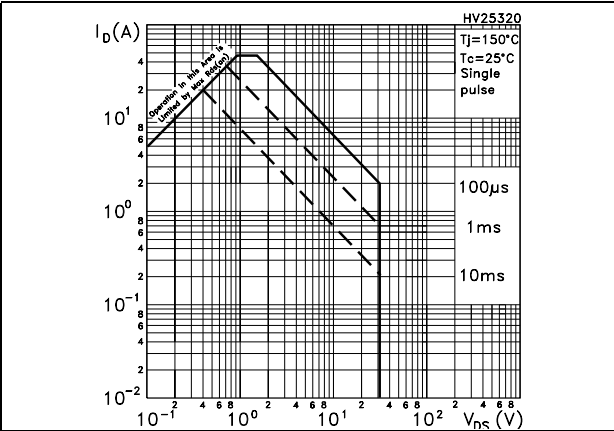


Figure 2. Thermal impedance

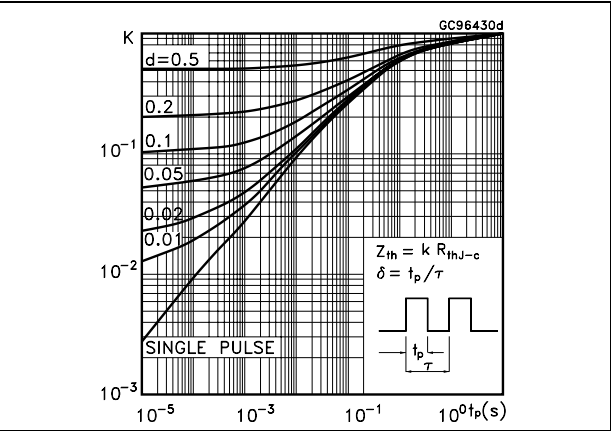


Figure 3. Output characteristics

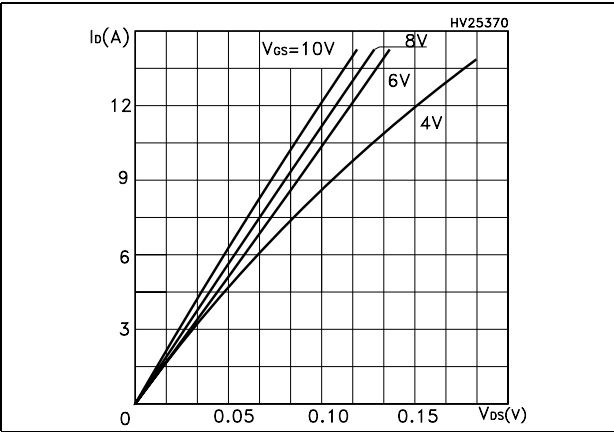


Figure 4. Transfer characteristics

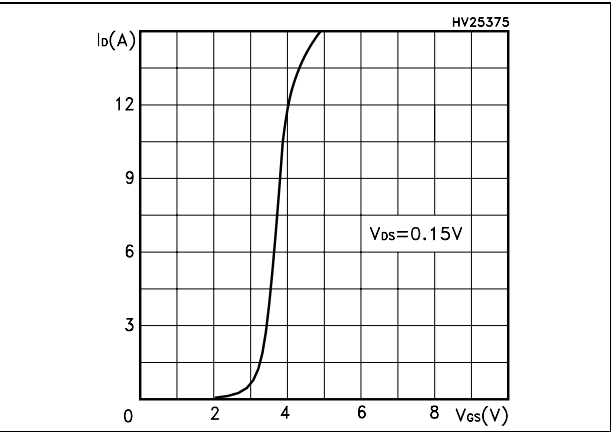


Figure 5. Transconductance

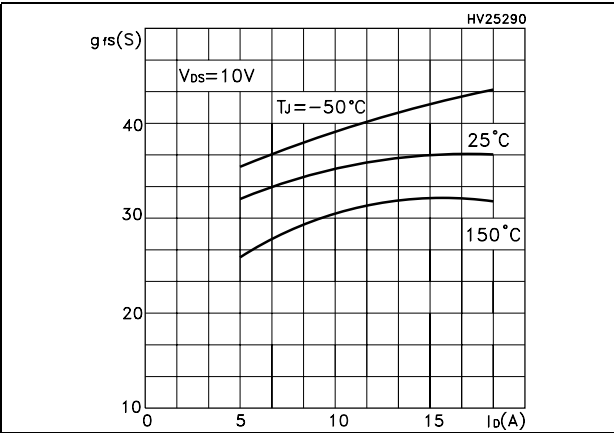


Figure 6. Static drain-source on resistance

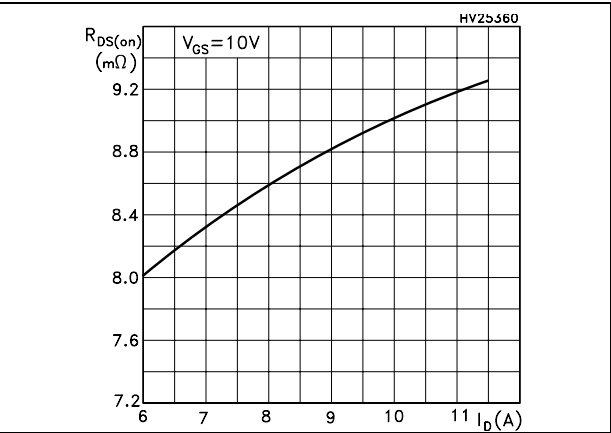


Figure 7. Gate charge vs gate-source voltage    Figure 8. Capacitance variations

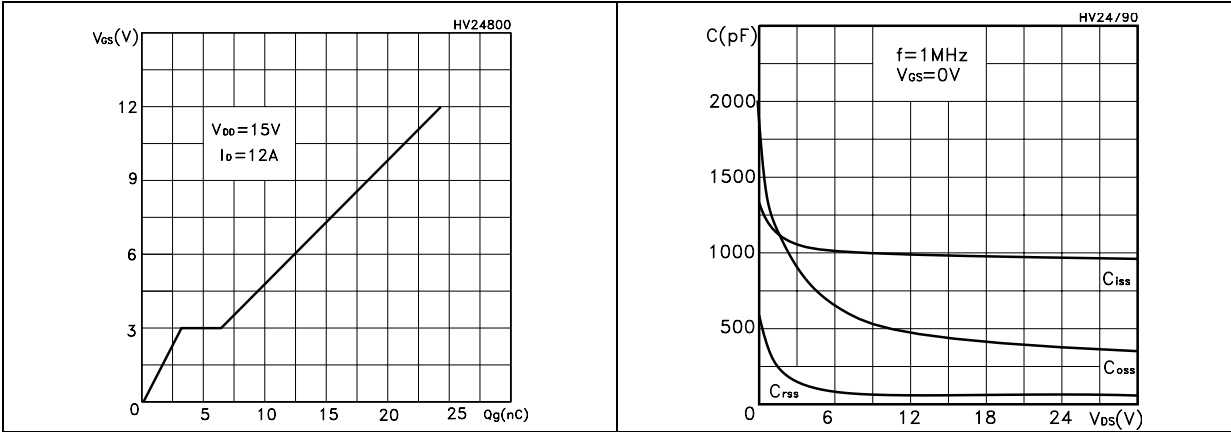


Figure 9. Normalized gate threshold voltage vs temperature    Figure 10. Normalized on resistance vs temperature

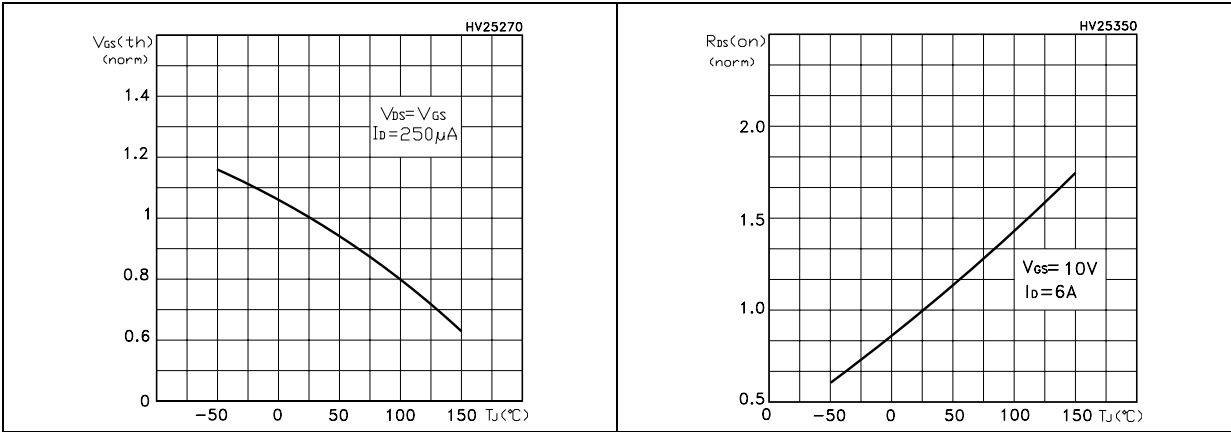
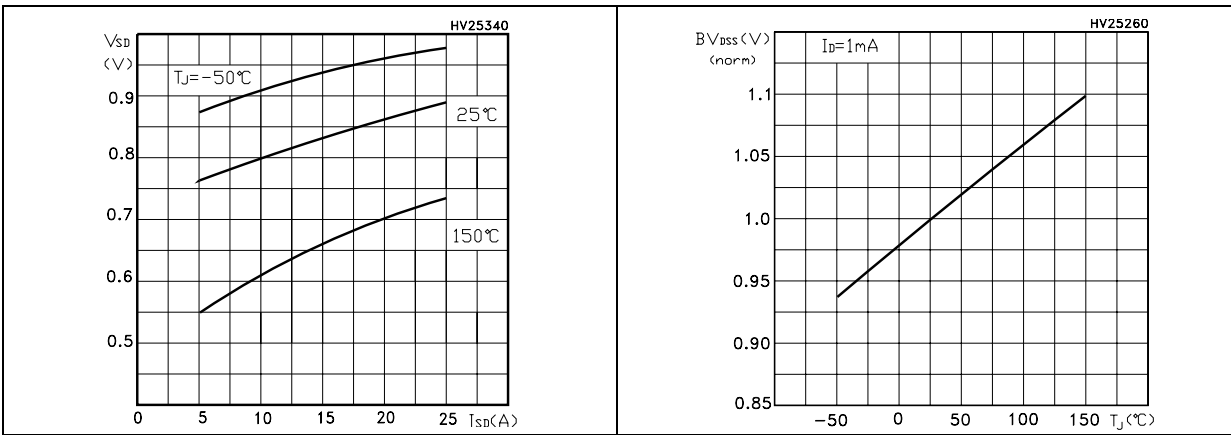
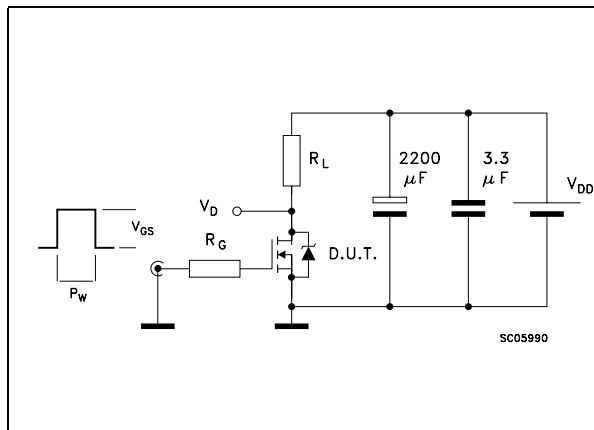


Figure 11. Source-drain diode forward characteristics    Figure 12. Normalized  $B_{V_{DS}}$  vs temperature

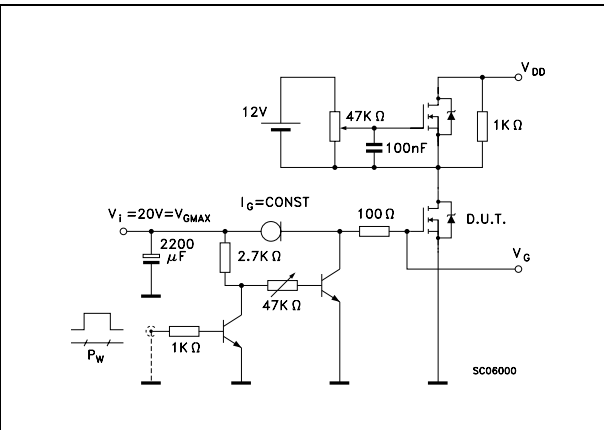


### 3 Test circuit

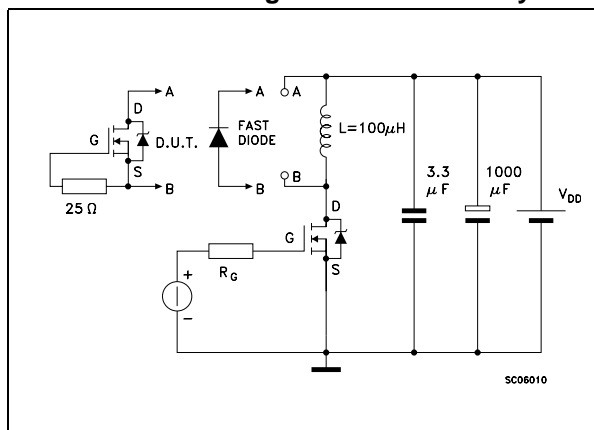
**Figure 13. Switching times test circuit for resistive load**



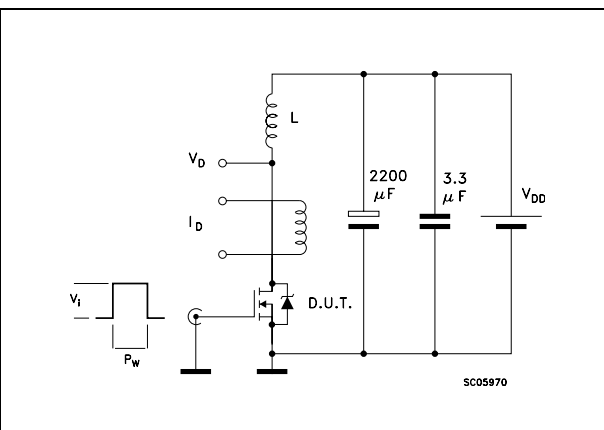
**Figure 14. Gate charge test circuit**



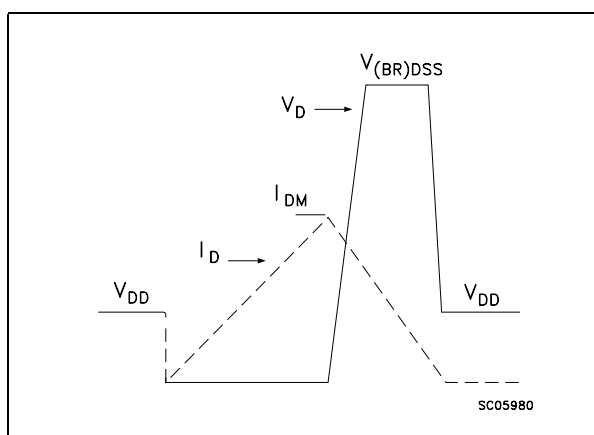
**Figure 15. Test circuit for inductive load switching and diode recovery times**



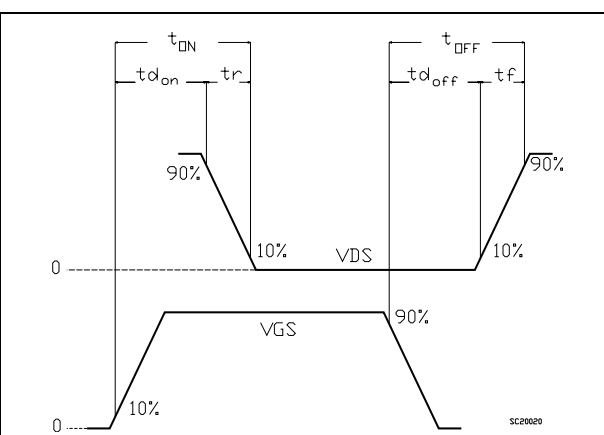
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**

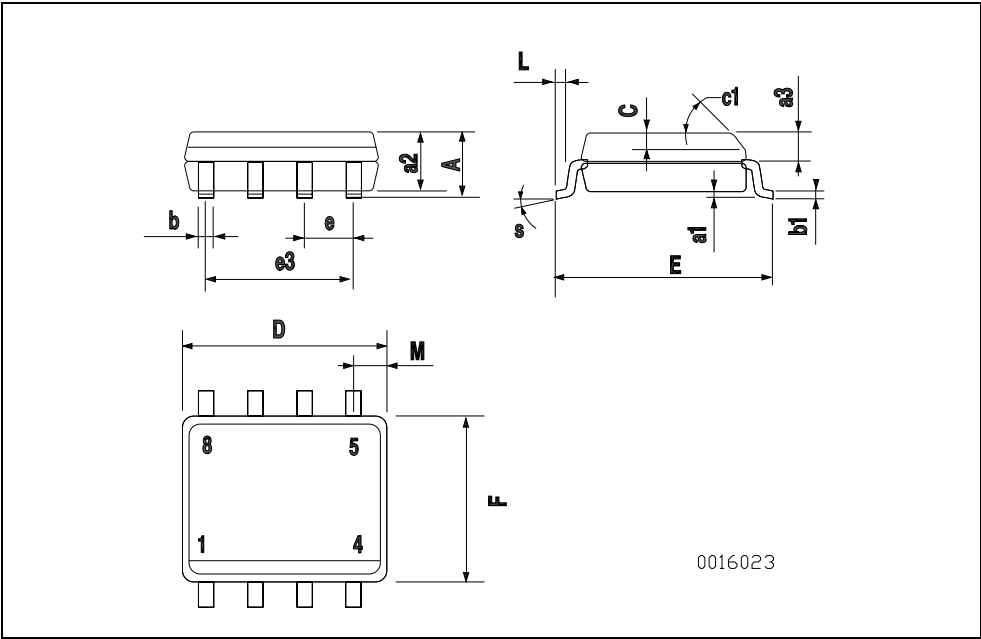




## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

SO-8 MECHANICAL DATA						
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.75			0.068
a1	0.1		0.25	0.003		0.009
a2			1.65			0.064
a3	0.65		0.85	0.025		0.033
b	0.35		0.48	0.013		0.018
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.019
c1	45 (typ.)					
D	4.8		5.0	0.188		0.196
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.14		0.157
L	0.4		1.27	0.015		0.050
M			0.6			0.023
S	8 (max.)					



## 5 Revision history

**Table 7. Revision history**

Date	Revision	Changes
22-Jun2004	1	First Release
03-Aug-2004	2	Some value change in <a href="#">Table 1</a>
08-Mar-2005	3	Complete version
17-Mar-2005	4	Ron value change (see <a href="#">Table 3</a> )
23-Jun-2005	5	New Rg value on <a href="#">Table 4</a>
30-Mar-2006	6	New template.

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