



STS12NH3LL

N-channel 30 V - 0.008 Ω - 12 A - SO-8
ultra low gate charge STripFET™ Power MOSFET

Features

Type	V _{DSS}	R _{DS(on)}	I _D
STS12NH3LL	30 V	<0.0105 Ω	12 A

- Optimal R_{DS(on)} x Qg trade-off @ 4.5 V
- Switching losses reduced
- Low input capacitance
- Low threshold device

Application

- Switching applications

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.

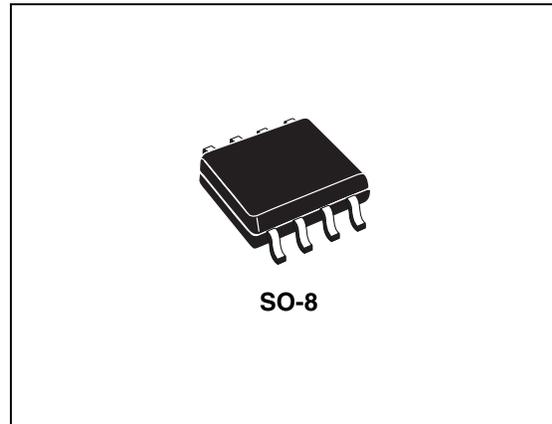


Figure 1. Internal schematic diagram

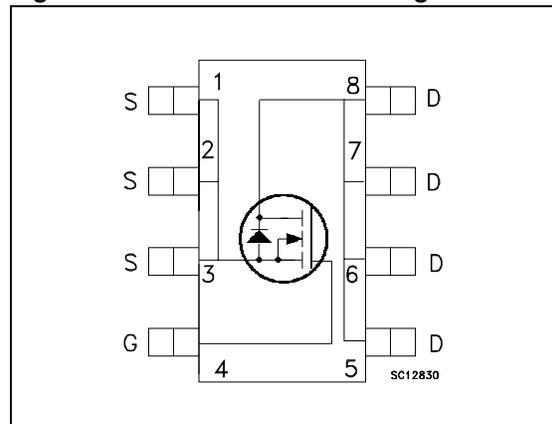


Table 1. Device summary

Order code	Marking	Packag	Packaging
STS12NH3LL	12H3LL	SO-8	Tape & reel

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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
$V_{GS}^{(1)}$	Gate-source voltage	± 16	V
$V_{GS}^{(2)}$	Gate-source voltage	± 18	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	12	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	7.5	A
$I_{DM}^{(3)}$	Drain current (pulsed)	48	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	2.7	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 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-amb}^{(1)}$	Thermal resistance junction-ambient	47	$^\circ\text{C/W}$

1. When mounted on FR-4 board of 1inch², 2oz Cu, $t < 10\text{ sec}$

2 Electrical characteristics

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

Table 4. On/off states

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

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs}	Forward transconductance	$V_{DS} = 10 V, I_D = 12 A$		38		S
C_{iss}	Input capacitance	$V_{DS} = 25 V, f = 1 \text{ MHz},$ $V_{GS} = 0$		965		pF
C_{oss}	Output capacitance			285		pF
C_{rss}	Reverse transfer capacitance			38		pF
Q_g	Total gate charge	$V_{DD} = 15 V, I_D = 12 A$ $V_{GS} = 4.5 V$ <i>(see Figure 20)</i>		9	12	nC
Q_{gs}	Gate-source charge			3.7		nC
Q_{gd}	Gate-drain charge			3		nC
Q_{gs1}	Pre V_{th} gate-to-source charge	$V_{DD} = 15 V, I_D = 12 A$ $V_{GS} = 4.5 V$ <i>(see Figure 20)</i>		2.5		nC
Q_{gs2}	Post V_{th} gate-to-source charge			1.2		nC
R_G	Gate Input Resistance	$f = 1 \text{ MHz}$ Gate DC Bias = 0 Test signal level = 20 mV open drain	0.5	1.5	2.5	Ω

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD}=15\text{ V}$, $I_D=6\text{ A}$, $R_G=4.7\ \Omega$, $V_{GS}=4.5\text{ V}$ (see Figure 14)		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 7. 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	$I_{SD}=12\text{ A}$, $V_{GS}=0$			1.3	V
t_{rr}	Reverse recovery time	$I_{SD}=12\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD}=20\text{ V}$, $T_j=150\text{ }^\circ\text{C}$ (see Figure 16)		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 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

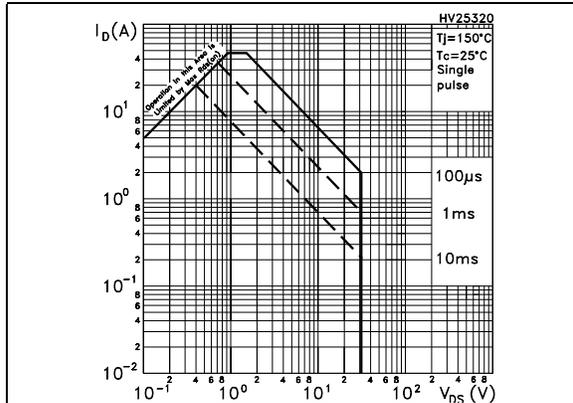


Figure 3. Thermal impedance

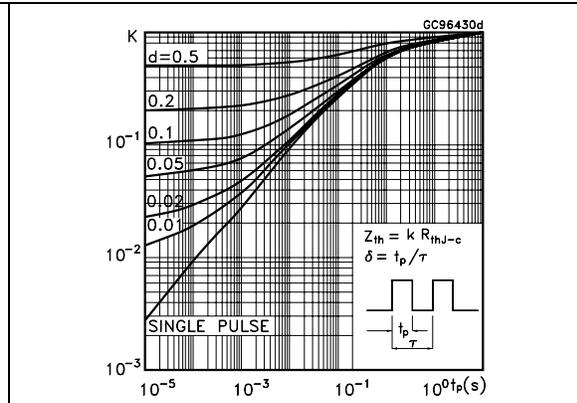


Figure 4. Output characteristics

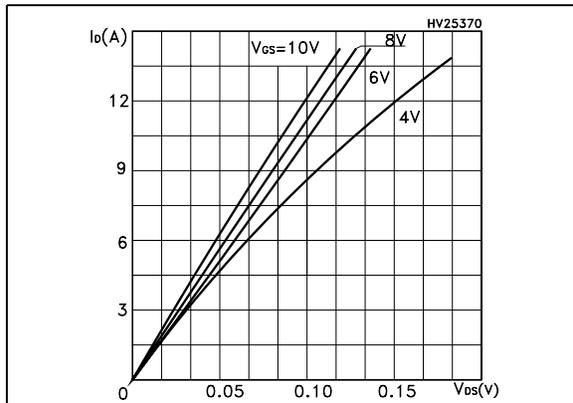


Figure 5. Transfer characteristics

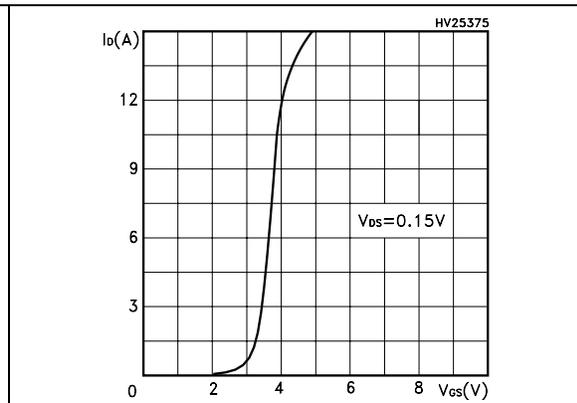


Figure 6. Transconductance

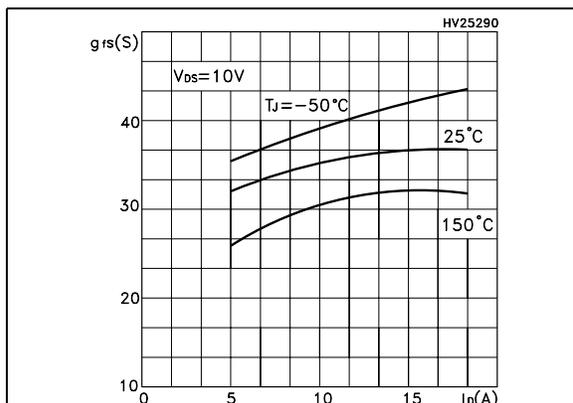


Figure 7. Static drain-source on resistance

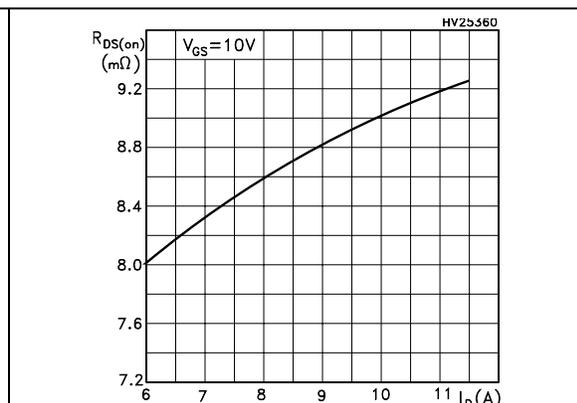


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

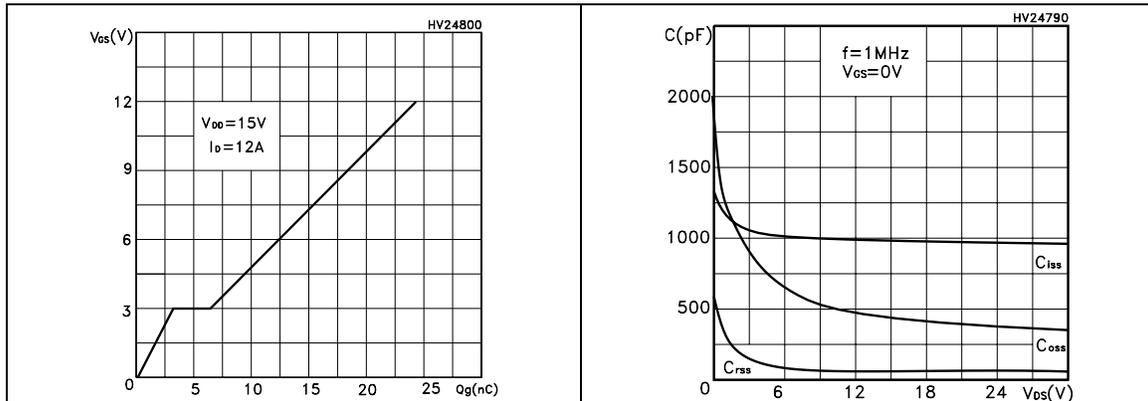


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

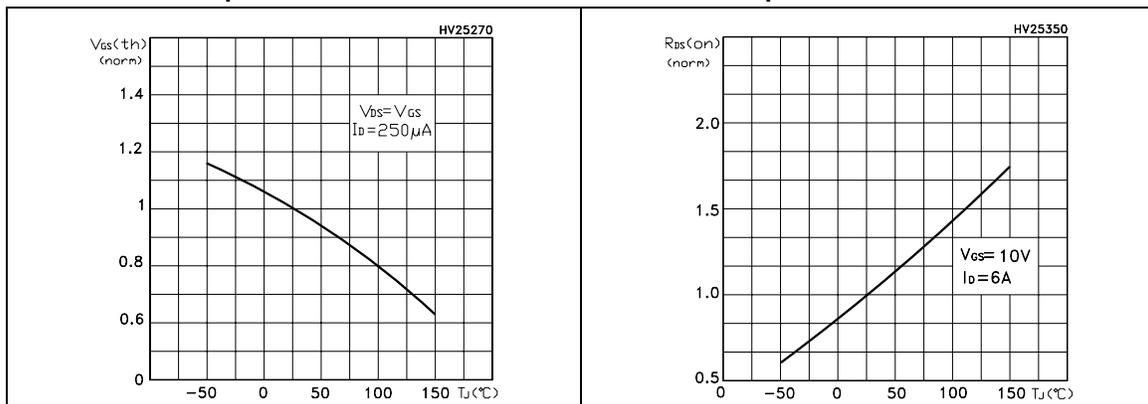
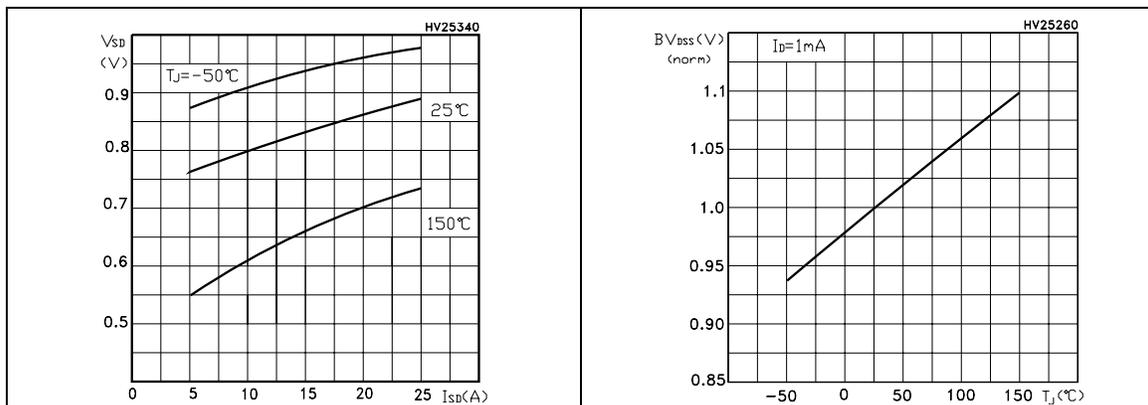


Figure 12. Source-drain diode forward characteristics Figure 13. Normalized $B_{V_{DS}}$ vs temperature



3 Test circuit

Figure 14. Switching times test circuit for resistive load

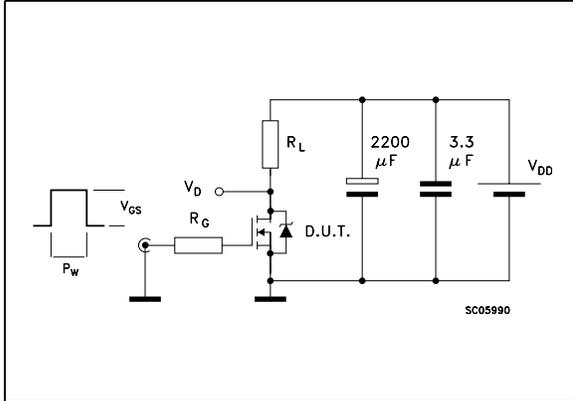


Figure 15. Gate charge test circuit

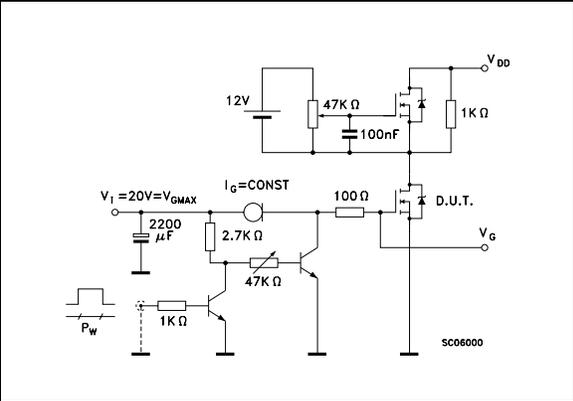


Figure 16. Test circuit for inductive load switching and diode recovery times

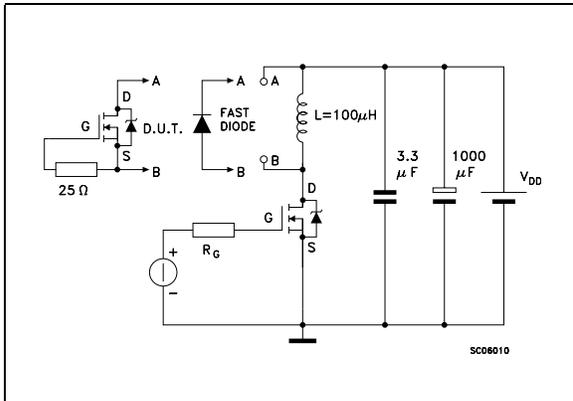


Figure 17. Unclamped inductive load test circuit

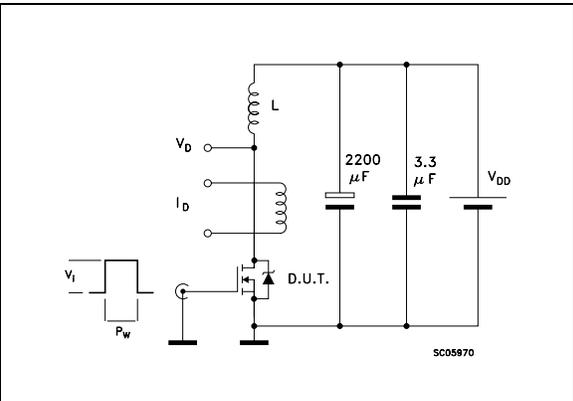


Figure 18. Unclamped inductive waveform

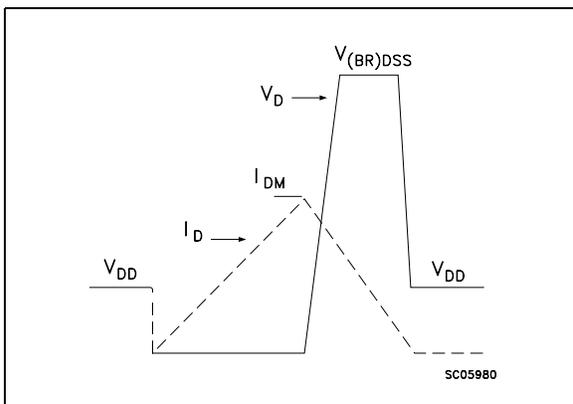


Figure 19. Switching time waveform

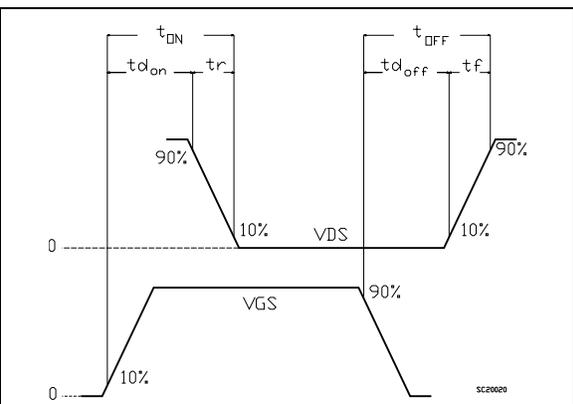
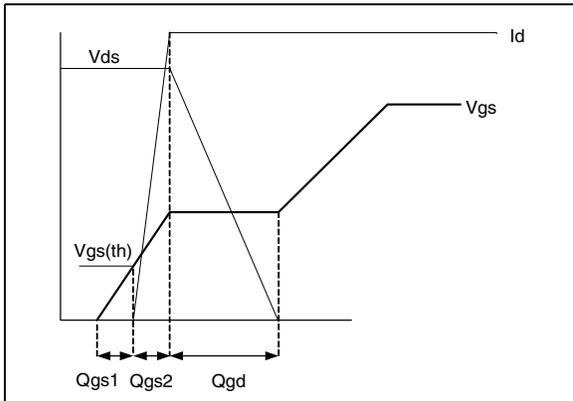


Figure 20. Gate charge waveform

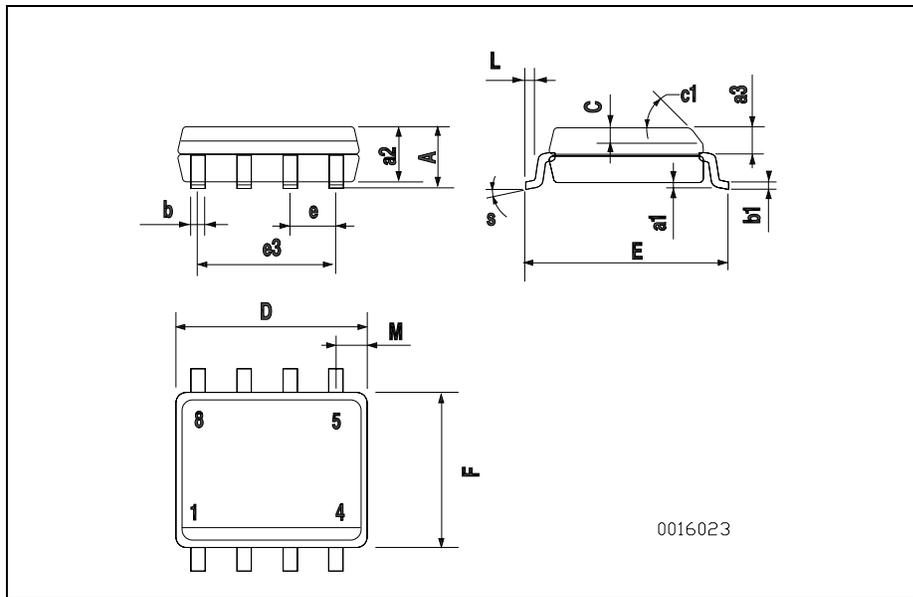


4 Package mechanical data

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

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 8. Document revision history

Date	Revision	Changes
22-Jun2004	1	First release
03-Aug-2004	2	Some value change in Table 2
08-Mar-2005	3	Complete version
17-Mar-2005	4	Ron value change (see Table 4)
23-Jun-2005	5	New Rg value on Table 5
30-Mar-2006	6	The document has been reformatted
17-Apr-2007	7	New parameters on Table 5 and new Figure 20
23-Apr-2007	8	Modified value on Table 2
26-Nov-2007	9	Modified marking on Table 1

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