



## STS4DNF60

N-channel 60V - 0.070Ω - 4A - SO-8  
STripFET™ Power MOSFET

### Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STS4DNF60	60V	<0.090Ω	4A

- Standard outline for easy automated surface mount assembly
- Low threshold drive

### Description

This Power MOSFET is the latest development of STMicroelectronics unique “single feature size” strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

### Application

- Switching applications

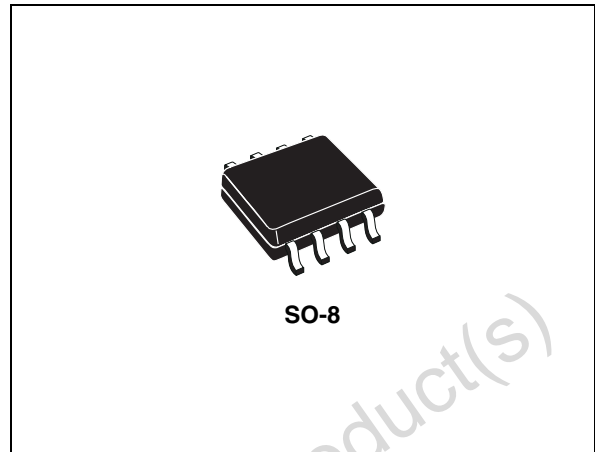


Figure 1. Internal schematic diagram

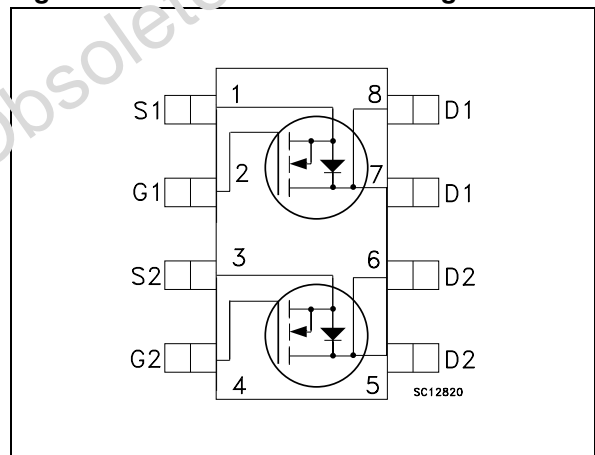


Table 1. Device summary

Order code	Marking	Package	Packaging
STS4DNF60	4DF60	SO-8	Tape & reel

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Obsolete Product(s) - Obsolete Product(s)

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	60	V
$V_{GS}$	Gate- source voltage	$\pm 20$	V
$I_D$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	4	A
$I_D$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	2.5	A
$I_{DM}^{(1)}$	Drain current (pulsed)	16	A
$P_{TOT}^{(2)}$	Total dissipation at $T_C = 25^\circ\text{C}$	2	W
$T_j$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 150	$^\circ\text{C}$

1. Pulse width limited by safe operating area

2.  $P_{TOT}=1.6\text{W}$  for single operation

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-pcb}$	Thermal resistance junction-pcb D.O. <sup>(1)</sup>	62.5	$^\circ\text{C/W}$

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

## 2 Electrical characteristics

(T<sub>case</sub> = 25°C unless otherwise specified)

**Table 4. On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\mu A$ , $V_{GS} = 0$	60			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}$ , $T_C = 125^\circ C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 250\mu A$	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V$ , $I_D = 2A$		0.070	0.090	$\Omega$

**Table 5. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward transconductance	$V_{DS} = 25V$ , $I_D = 2A$		25		S
$C_{iss}$	Input capacitance	$V_{DS} = 25V$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$		315		pF
$C_{oss}$	Output capacitance			70		pF
$C_{rss}$	Reverse transfer capacitance			30		pF
$Q_g$	Total gate charge	$V_{DD} = 48V$ , $I_D = 4A$ ,		10		nC
$Q_{gs}$	Gate-source charge	$V_{GS} = 10V$		3.5		nC
$Q_{gd}$	Gate-drain charge	(see <a href="#">Figure 13</a> )		3.5		nC

**Table 6. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$ $t_r$	Turn-on delay time Rise time	$V_{DD} = 30V$ , $I_D = 2A$ , $R_G = 4.7\Omega$ , $V_{GS} = 10V$ (see <a href="#">Figure 12</a> )		7 18		ns ns
$t_{d(off)}$ $t_f$	Turn-off delay time Fall time	$V_{DD} = 30V$ , $I_D = 2A$ , $R_G = 4.7\Omega$ , $V_{GS} = 10V$ (see <a href="#">Figure 12</a> )		17 6		ns ns

**Table 7. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current				4	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				16	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 4A$ , $V_{GS} = 0$			1.2	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 4A$ , $di/dt = 100A/\mu s$		45		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 20V$ , $T_J = 25^\circ C$		68		nC
$I_{RRM}$	Reverse recovery current	(see <a href="#">Figure 17</a> )		3		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 4A$ , $di/dt = 100A/\mu s$		50		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 20V$ , $T_J = 150^\circ C$		88		nC
$I_{RRM}$	Reverse recovery current	(see <a href="#">Figure 17</a> )		3.5		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 2. Safe operating area

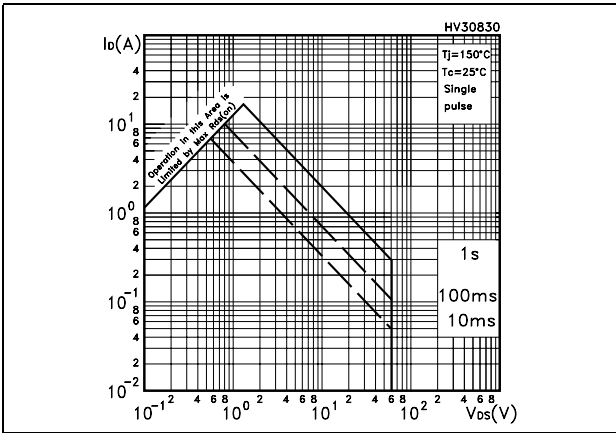


Figure 3. Thermal impedance

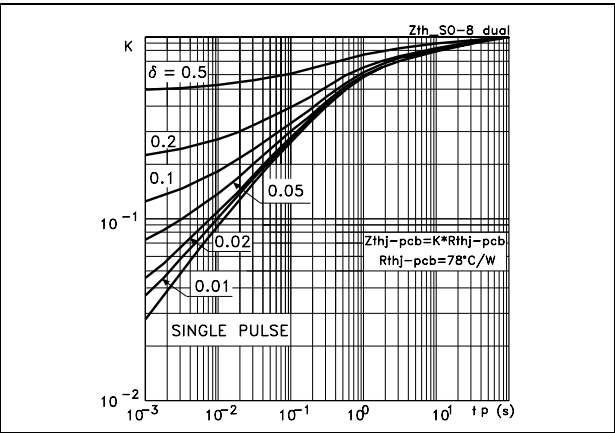


Figure 4. Output characteristics

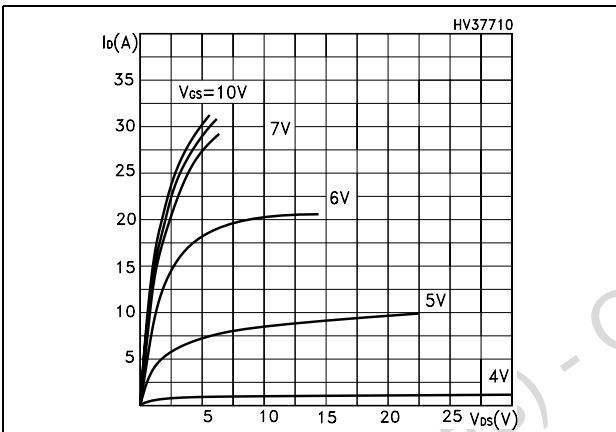


Figure 5. Transfer characteristics

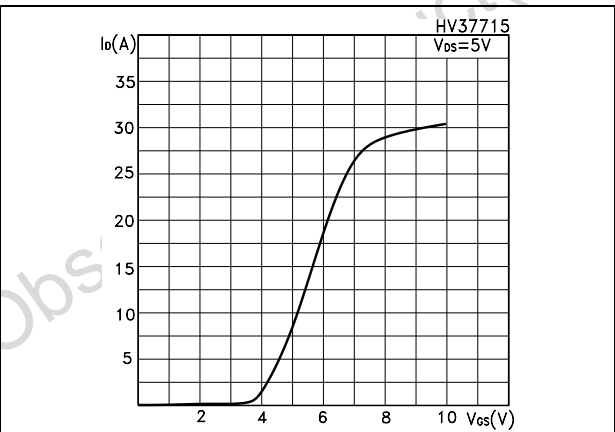


Figure 6. Source-drain diode forward characteristics

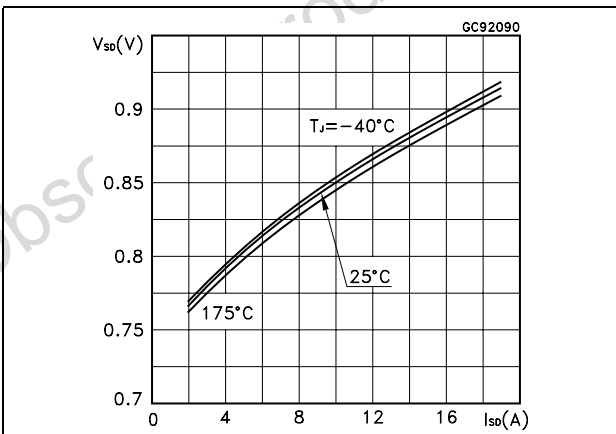


Figure 7. Static drain-source on resistance

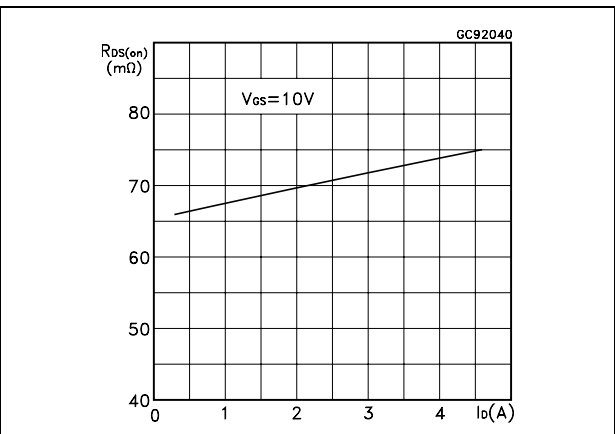


Figure 8. Gate charge vs gate-source voltage    Figure 9. Capacitance variations

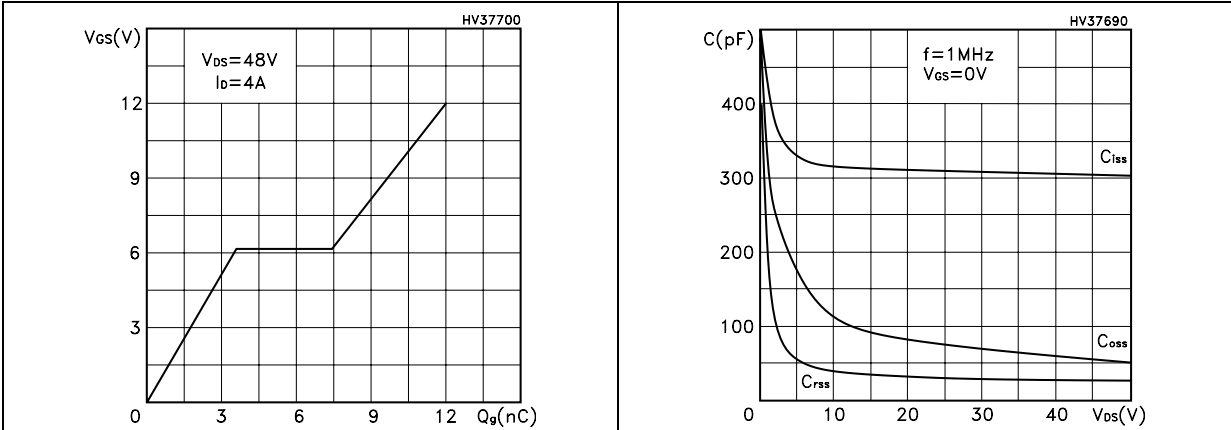
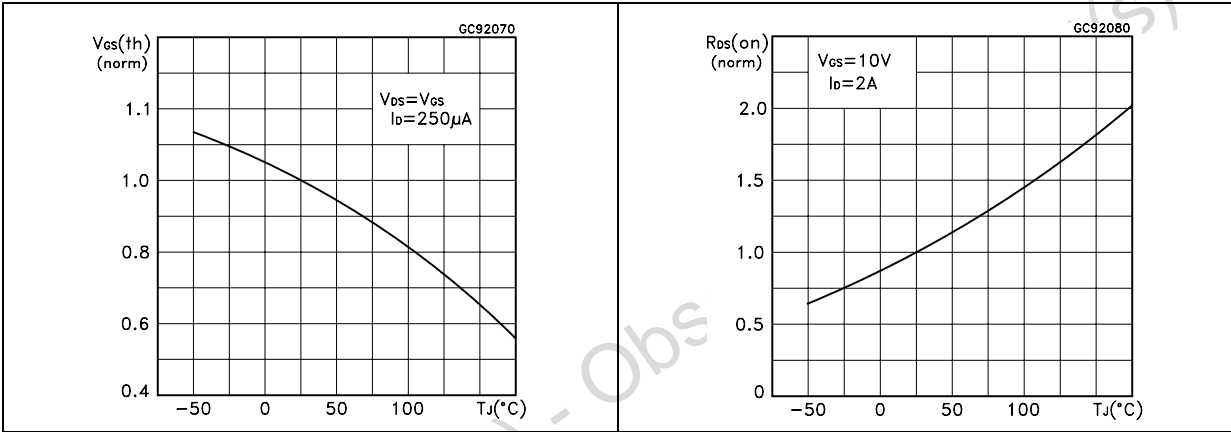
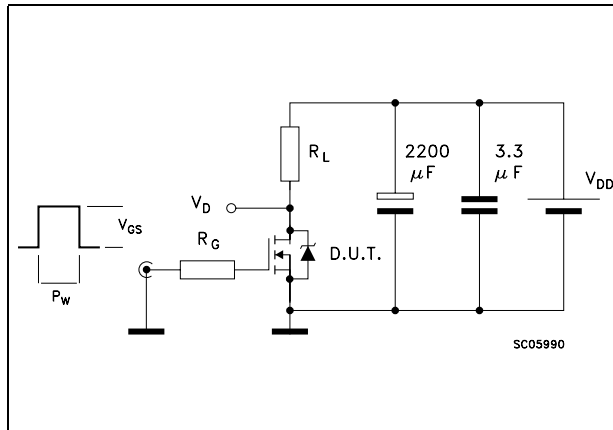


Figure 10. Normalized gate threshold voltage vs temperature    Figure 11. Normalized on resistance vs temperature

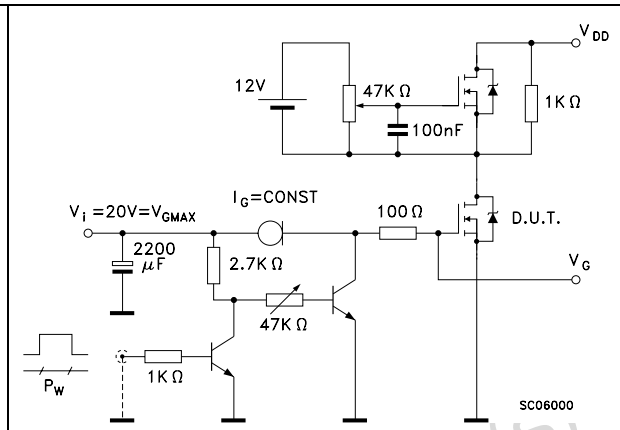


### 3 Test circuits

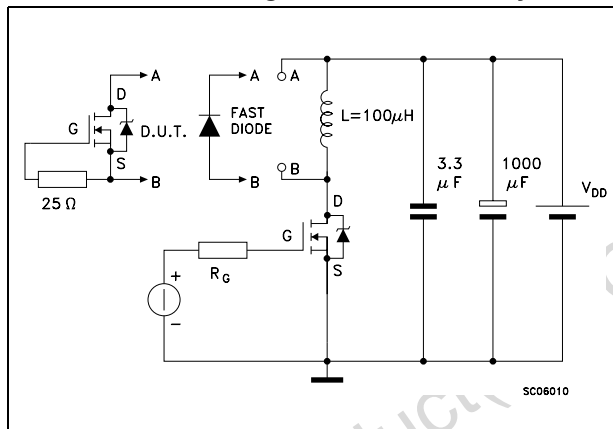
**Figure 12. Switching times test circuit for resistive load**



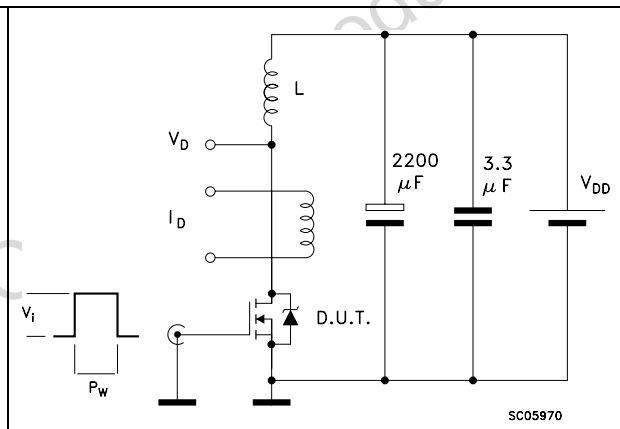
**Figure 13. Gate charge test circuit**



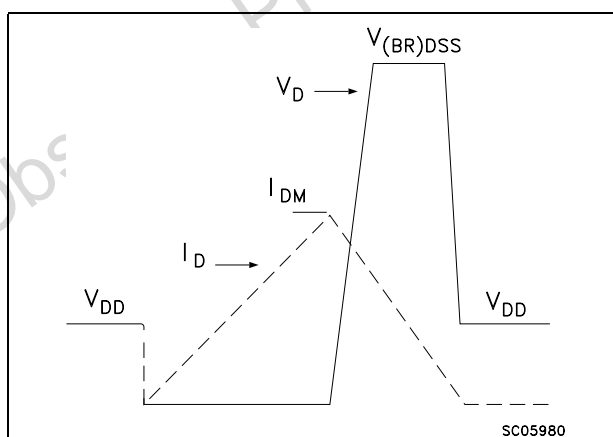
**Figure 14. Test circuit for inductive load switching and diode recovery times**



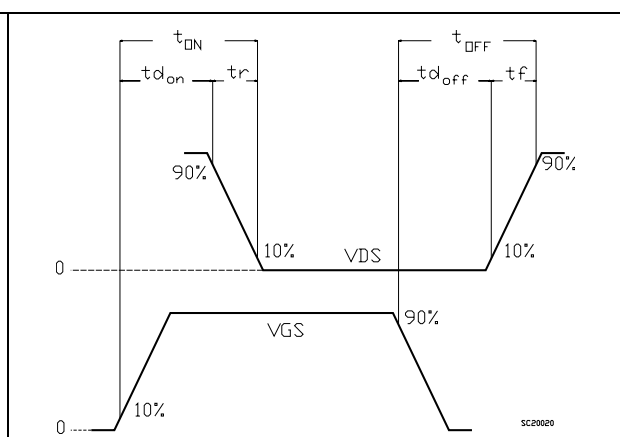
**Figure 15. Unclamped Inductive load test circuit**



**Figure 16. Unclamped inductive waveform**



**Figure 17. Switching time waveform**



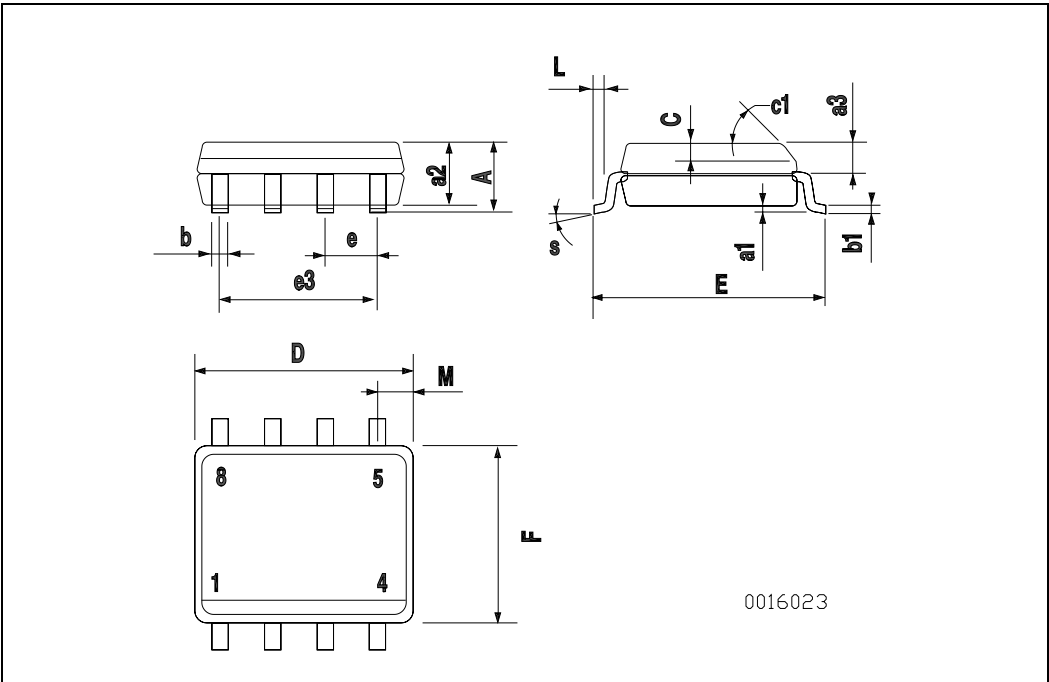


## 4 Package mechanical data

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)

Obsolete Product(s) - Obsolete Product(s)

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. Revision history**

Date	Revision	Changes
17-May-2007	1	First release
02-Aug-2007	2	Marking has been updated

Obsolete Product(s) - Obsolete Product(s)

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