



STN3NF06

N-channel 60V - 0.07Ω - 4A - SOT-223
STripFET™ II Power MOSFET

General features

Type	V _{DSS} (@T _{jmax})	R _{DS(on)}	I _D
STN3NF06	60V	<0.1Ω	4A

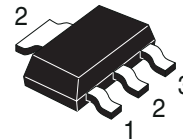
- Exceptional dv/dt capability
- 100% avalanche tested
- Avalanche rugged technology

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.

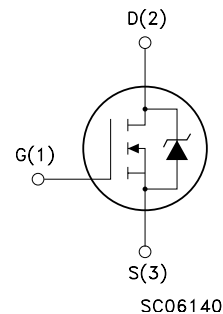
Applications

- Switching application



SOT-223

Internal schematic diagram



Order codes

Part number	Marking	Package	Packaging
STN3NF06	N3NF06	SOT-223	Tape & reel

Contents

1 **Electrical ratings** 3

2 **Electrical characteristics** 4

 2.1 Electrical characteristics (curves) 6

3 **Test circuit** 8

4 **Package mechanical data** 9

5 **Revision history** 11

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	60	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current (continuous) at $T_C = 25^\circ\text{C}$	4	A
I_D	Drain current (continuous) at $T_C = 100^\circ\text{C}$	2.9	A
$I_{DM}^{(1)}$	Drain current (pulsed)	16	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	3.3	W
	Derating factor	0.026	W/ $^\circ\text{C}$
$dv/dt^{(2)}$	Peak diode recovery voltage slope	10	V/ns
$E_{AS}^{(3)}$	Single pulse avalanche energy	200	mJ
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 150	$^\circ\text{C}$

1. Pulse width limited by safe operating area
2. $I_{SD} \leq 4\text{ A}$, $di/dt \leq 150\text{ A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq T_{JMAX}$
3. Starting $T_J = 25^\circ\text{C}$, $I_D = 4\text{ A}$, $V_{DD} = 30\text{ V}$

Table 2. Thermal data

$R_{thj-pcb}$	Thermal resistance junction-PCB ⁽¹⁾ max	38	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}$	Thermal resistance junction-PCB ⁽²⁾ max	100	$^\circ\text{C}/\text{W}$
$T_l^{(3)}$	Maximum lead temperature for soldering purpose typ	260	$^\circ\text{C}$

1. When Mounted on FR-4 board with 1 inch² pad, 2 oz. of Cu. and $t < 10\text{ sec.}$
2. When Mounted on minimum recommended footprint
3. for 10 sec. 1.6 mm from case

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	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0$	60			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	μA μA
I_{GSS}	Gate body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{V}$			± 100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{V}$, $I_D = 1.5\text{A}$		0.07	0.10	Ω

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15\text{V}$, $I_D = 1.5\text{A}$		3		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25\text{V}$, $f = 1\ \text{MHz}$, $V_{GS} = 0$		315 70 30		pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 48\text{V}$, $I_D = 3\text{A}$ $V_{GS} = 10\text{V}$ (see Figure 14)		10 3.5 3.5	13	nC nC nC

1. Pulsed: pulse duration=300 μs , duty cycle 1.5%

Table 5. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on delay time rise time	$V_{DD} = 30\ \text{V}$, $I_D = 1.5\text{A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{V}$ (see Figure 13)		7 18		ns ns
$t_{d(off)}$ t_f	Turn-off delay time fall time	$V_{DD} = 30\ \text{V}$, $I_D = 1.5\text{A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{V}$ (see Figure 13)		17 6		ns ns

Table 6. 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	$I_{SD}=4A$, $V_{GS}=0$			1.3	V
t_{rr}	Reverse recovery time	$I_{SD}=4 A$, $di/dt = 100A/\mu s$, $V_{DD}=25 V$, $T_j=150^\circ C$ (see Figure 15)		50		ns
Q_{rr}	Reverse recovery charge			88		nC
I_{RRM}	Reverse recovery current			3.5		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 1. Safe operating area

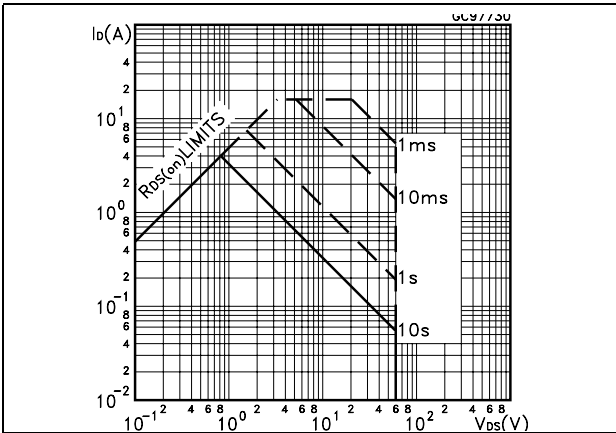


Figure 2. Thermal impedance

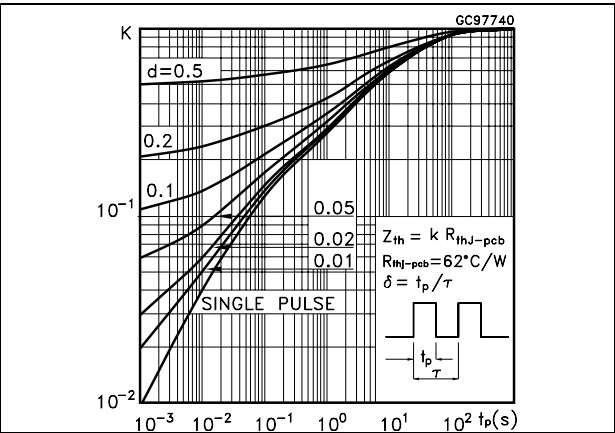


Figure 3. Output characteristics

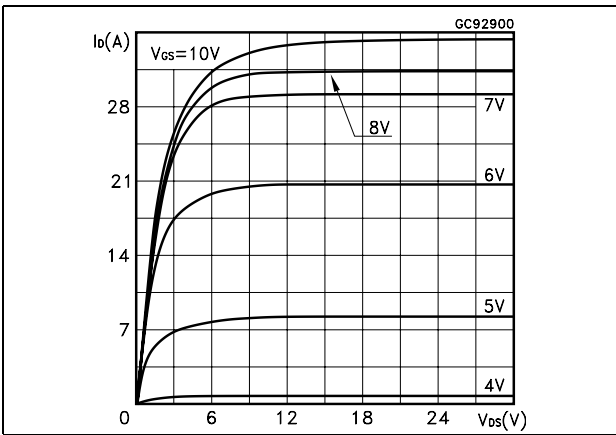


Figure 4. Transfer characteristics

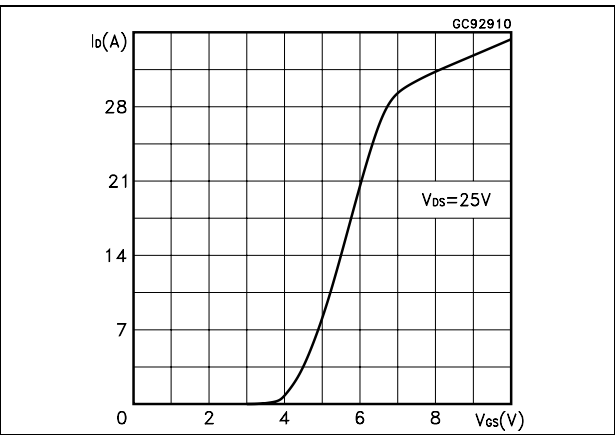


Figure 5. Transconductance

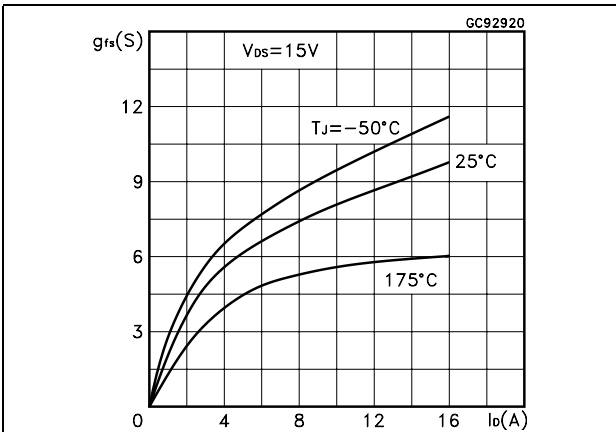


Figure 6. Static drain-source on resistance

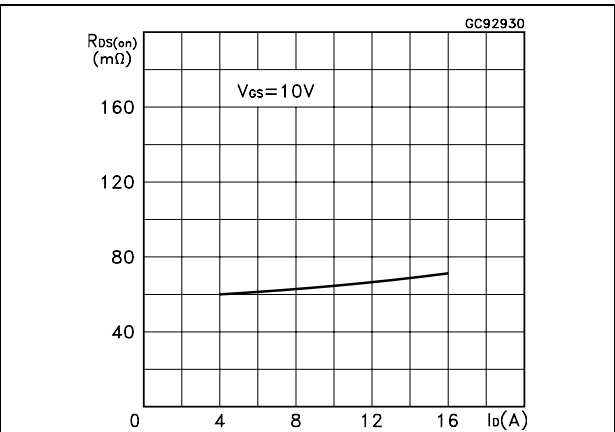


Figure 7. Gate charge vs. gate-source voltage Figure 8. Capacitance variations

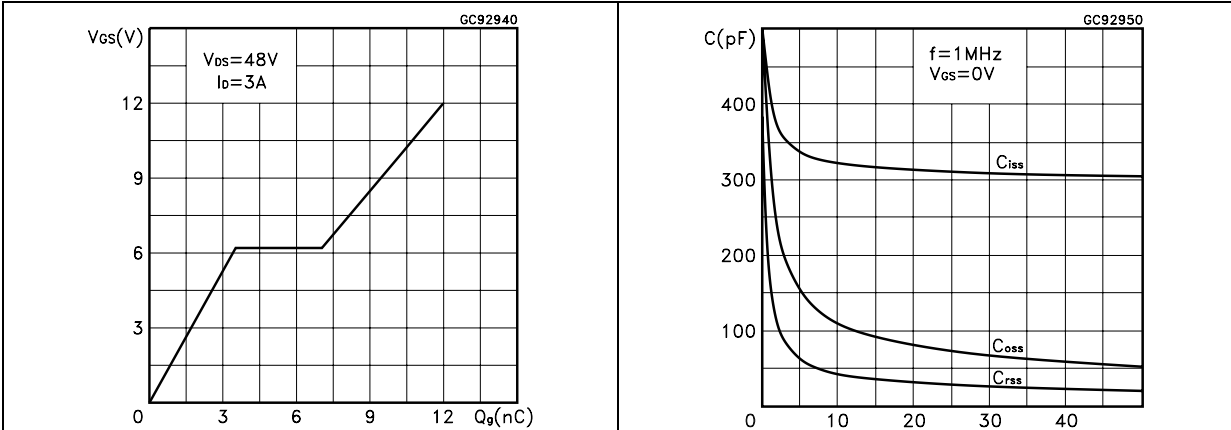


Figure 9. Normalized gate threshold voltage vs. temperature Figure 10. Normalized on resistance vs. temperature

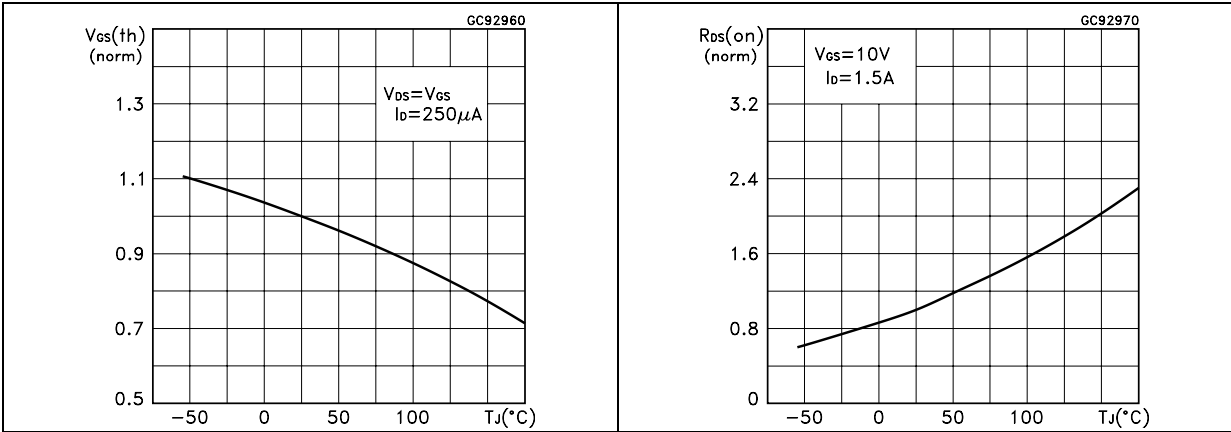
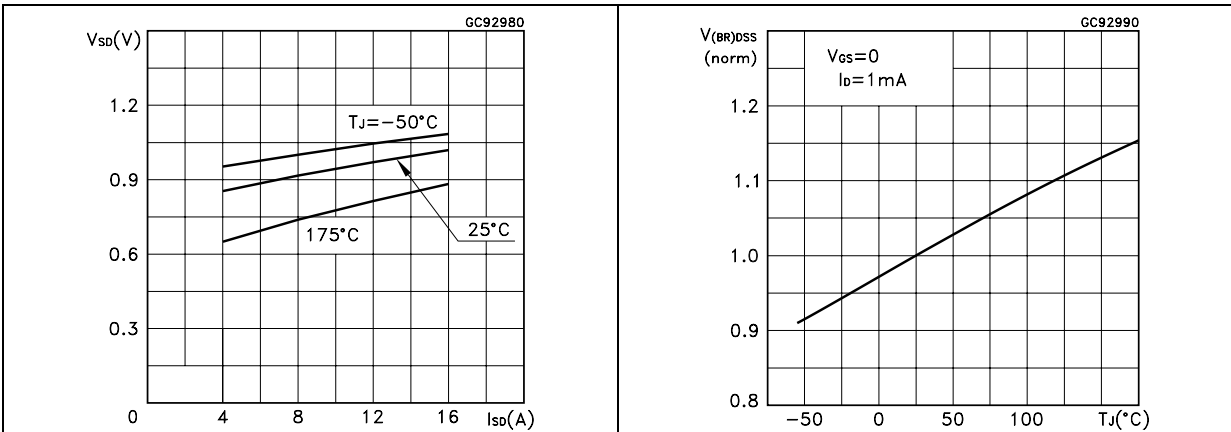


Figure 11. Source-drain diode forward characteristics Figure 12. Normalized breakdown voltage vs. temperature



3 Test circuit

Figure 13. Switching times test circuit for resistive load

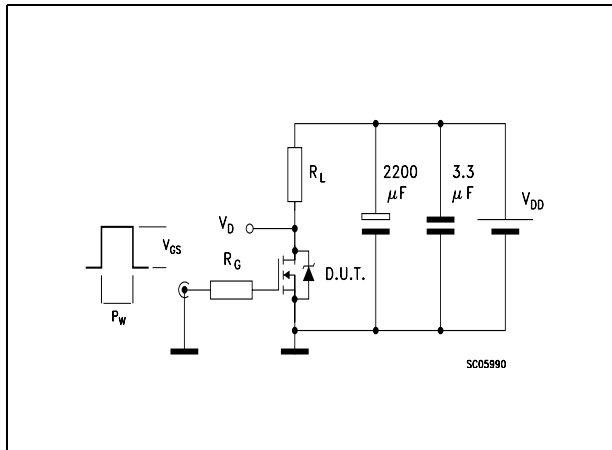


Figure 14. Gate charge test circuit

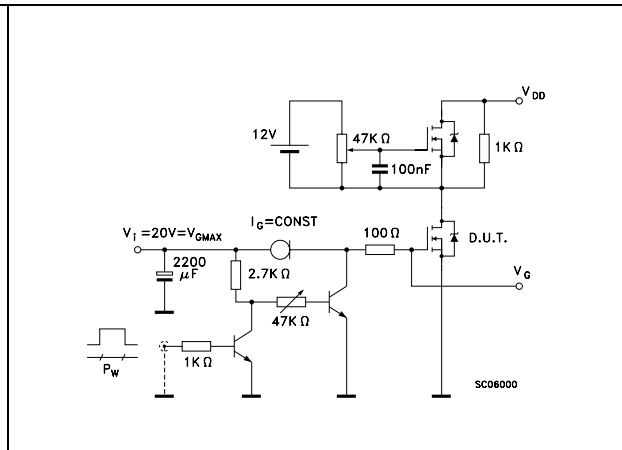


Figure 15. Test circuit for inductive load switching and diode recovery times

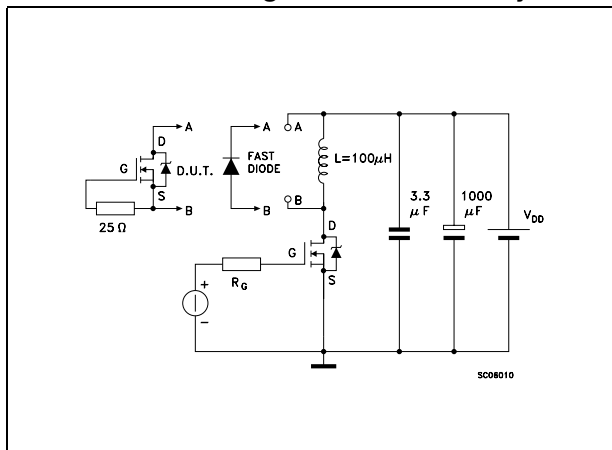


Figure 16. Unclamped Inductive load test circuit

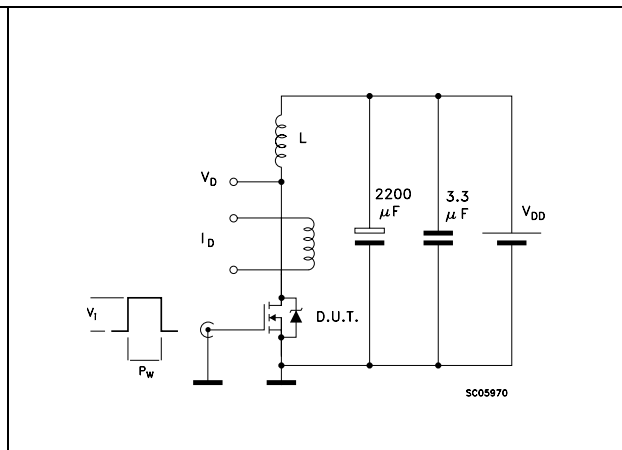


Figure 17. Unclamped inductive waveform

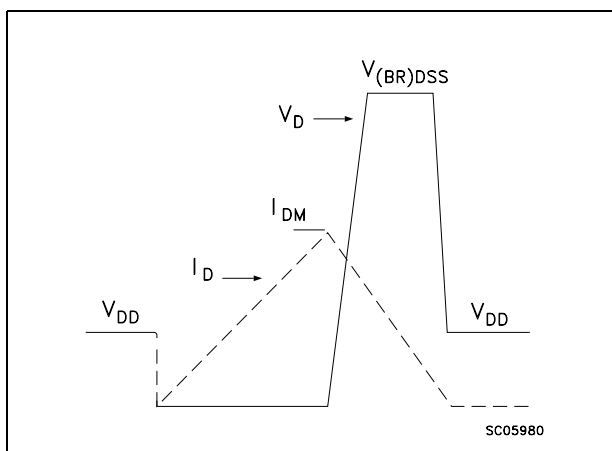
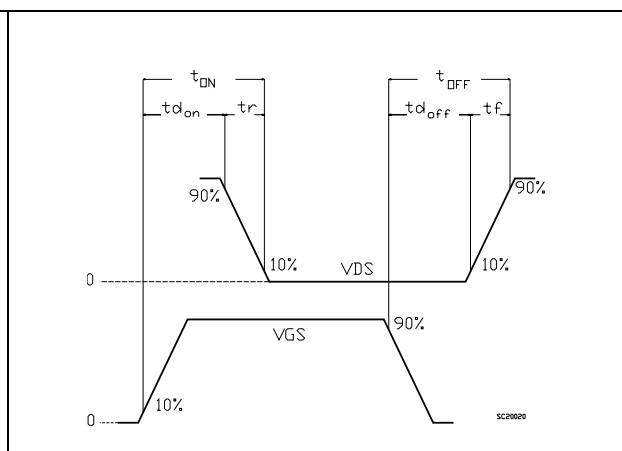


Figure 18. Switching time waveform

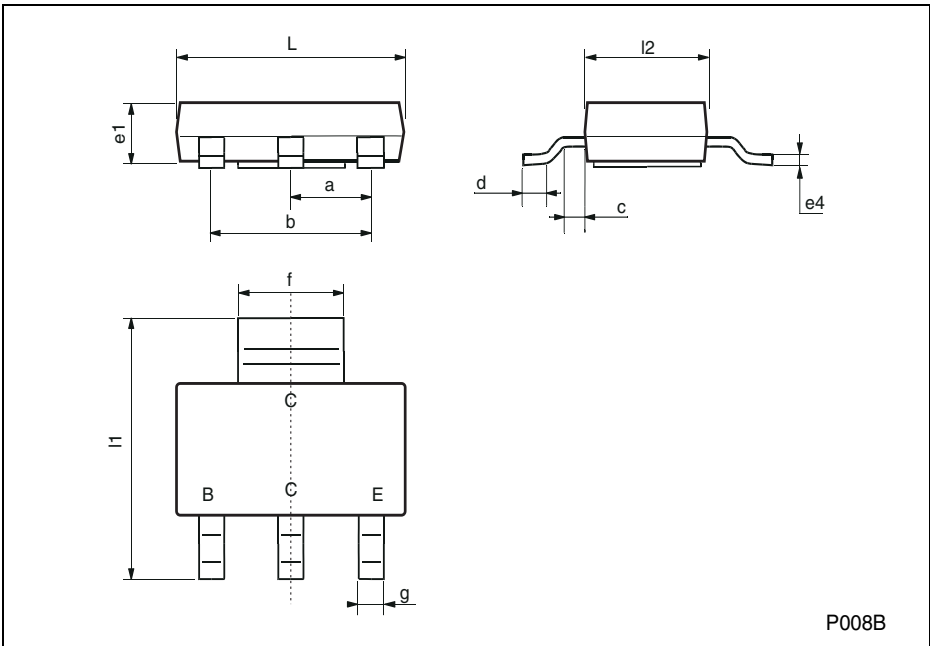


4 Package mechanical data

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

SOT-223 MECHANICAL DATA

DIM.	mm			mils		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a	2.27	2.3	2.33	89.4	90.6	91.7
b	4.57	4.6	4.63	179.9	181.1	182.3
c	0.2	0.4	0.6	7.9	15.7	23.6
d	0.63	0.65	0.67	24.8	25.6	26.4
e1	1.5	1.6	1.7	59.1	63	66.9
e4			0.32			12.6
f	2.9	3	3.1	114.2	118.1	122.1
g	0.67	0.7	0.73	26.4	27.6	28.7
l1	6.7	7	7.3	263.8	275.6	287.4
l2	3.5	3.5	3.7	137.8	137.8	145.7
L	6.3	6.5	6.7	248	255.9	263.8



5 Revision history

Table 7. Revision history

Date	Revision	Changes
21-Jun-2004	4	Complete datasheet
04-Oct-2006	5	The document has been reformatted
01-Feb-2007	6	Typo mistake on Table 1 .

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