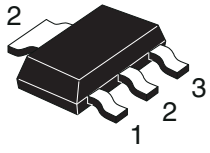
STN3N40K3

N-channel 400 V, 3 Ω, 1.8 A SOT-223 SuperMESH3™ Power MOSFET

Features

Order code	V_{DSS}	$R_{DS(on)}$ max	I_D	P_W
STN3N40K3	400 V	< 3.4 Ω	1.8 A	3.3 W

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitance
- Improved diode reverse rcovery characteristics
- Zener-protected



SOT-223

Application

- Switching applications

Description

The device is made using the SuperMESH3™ Power MOSFET technology that is obtained via improvements applied to STMicroelectronics' SuperMESH3™ technology combined with a new optimized vertical structure. The resulting product has an extremely low on resistance, superior dynamic performance and high avalanche capability, making it especially suitable for the most demanding applications.

Figure 1. Internal schematic diagram

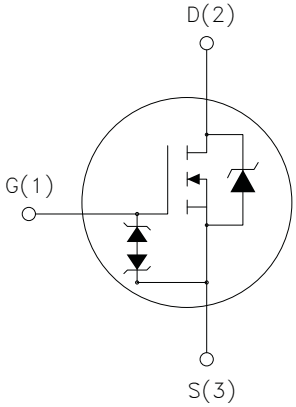


Table 1. Device summary

Order code	Marking	Package	Packaging
STN3N40K3	3N40K3	SOT-223	Tape and reel

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain source voltage	400	V
V_{GS}	Gate-source voltage	± 30	V
I_D	Drain current continuous T_C = 25 °C	1.8 (1)	A
I_D	Drain current continuous T_C = 100 °C	1 (1)	A
I_{DM} (2)	Drain current pulsed	7.2	A
I_{AR} (3)	Avalanche current, repetetive or not repetetive	0.6	A
E_{AS} (4)	Single pulse avalanche energy	45	mJ
P_{TOT}	Total dissipation at T_C = 25 °C	3.3	W
dv/dt (5)	Peak diode recovery voltage slope	12	V/ns
$V_{esd-(g-s)}$	G-S ESD (HBM C 0 100 pF; R = 1.5 kΩ)	1000	V
T_j T_{stg}	Operating junction temperature Storage temperature	-55 to 150	°C

1. Drain current limited by maximum temperature allowed.
2. Pulse width limited by safe operating area.
3. Pulse width limited by T_{Jmax}.
4. Starting T_j = 25 °C, I_D = I_{AR}, V_{DD} = 50 V.
5. Isd ≤1.8 A, di/dt ≤400 A/µs, V_{DD} ≤80% $V_{(BR)DSS}$.

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max.	37.88	°C/W
R_{thj-a}	Thermal resistance junction-amb max.	60	°C/W
T_l	Maximum lead temperature for soldering purpose	260	°C

2 Electrical characteristics

(Tcase = 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 = 1 mA, V_{GS} = 0	400			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0) V_{DS} = Max rating V_{DS} = Max rating, T_C=125 °C				1 50	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20 V, V_{DS}=0			±10	µA
$V_{GS(th)}$	Gate threshold voltage	V_{GS} = V_{DS}, I_D = 50 µA	3	3.75	4.5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 0.6 A		3	3.4	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0	-	165 17 3	-	pF pF pF
$C_{oss(er)}$ (1)	Equivalent output capacitance energy related	V_{DS}=0 to 320 V, V_{GS}=0	-	9	-	pF
$C_{oss(tr)}$ (2)	Equivalent output capacitance time related		-	14	-	pF
R_g	Instrinsic gate resistance	f=1 MHz open drain	-	10	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 320 V, I_D = 1.8 A, V_{GS} = 10 V (see *Figure 16*)	-	11 2 7	-	nC nC nC

1. Is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}
2. Is defined as a constant equivalent capacitance giving the same storage energy as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn on delay time Rise time Turn off delay time Fall time	V_{DD} = 200 V, I_D = 0.6, R_G = 4.7 Ω V_{GS} = 10 V (see *Figure 15*)	-	7 8 18 14	-	ns ns ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)		-		1.8 7.2	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 0.6 A, V_{GS} = 0	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 1.8 A, di/dt = 100 A/µs V_{DD} = 60 V (see *Figure 17*)	-	145 490 7		ns nC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 1.8 A, di/dt = 100 A/µs V_{DD} = 60 V, T_j = 150 °C (see *Figure 17*)	-	166 580 7		ns nC A

1. Pulse width limited by safe operating area.
2. Pulsed: pulse duration = 300 µs, duty cycle 1.5%

2.1 Electrical characteristics

Figure 2. Safe operating area

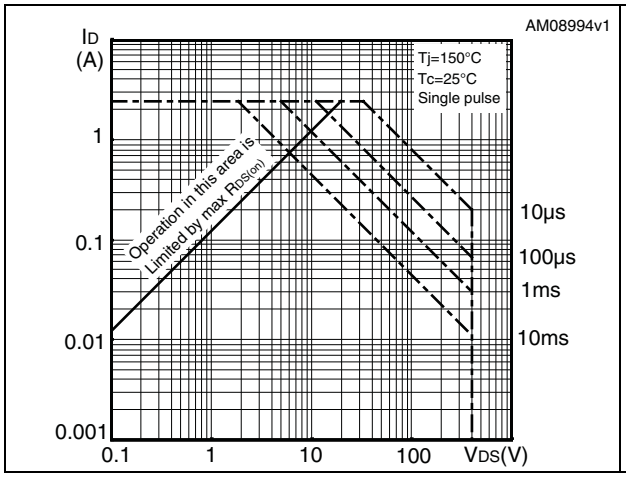


Figure 3. Thermal impedance

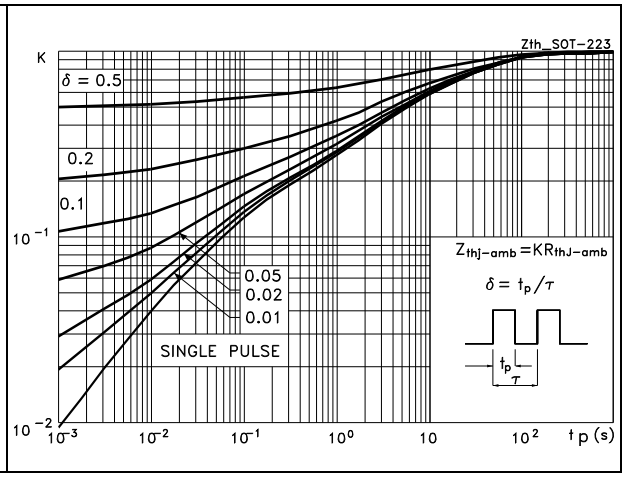


Figure 4. Output characteristics

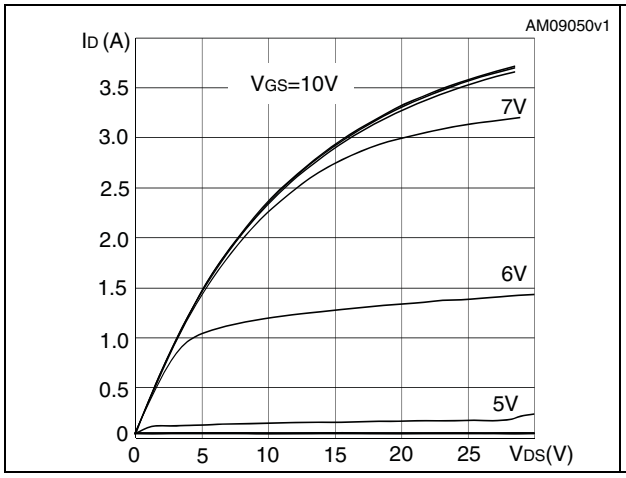


Figure 5. Transfer characteristics

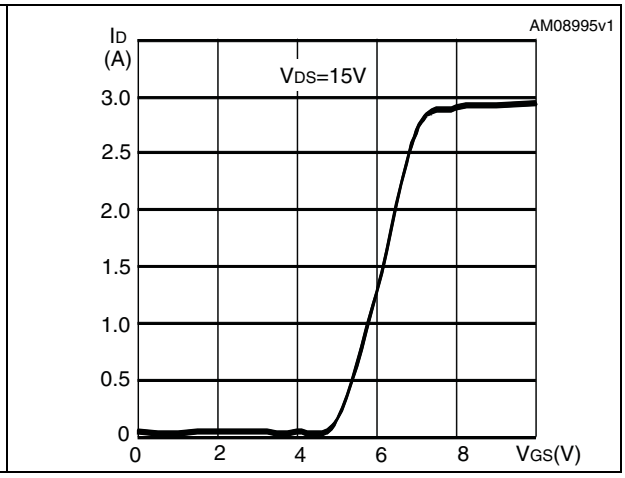


Figure 6. Gate charge vs gate-source voltage

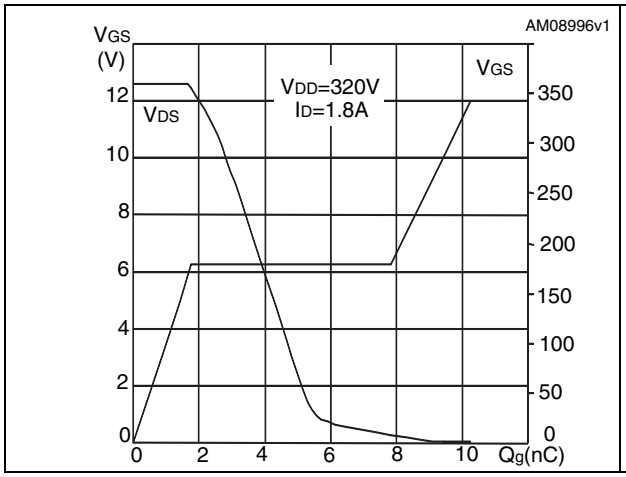


Figure 7. Static drain-source on resistance

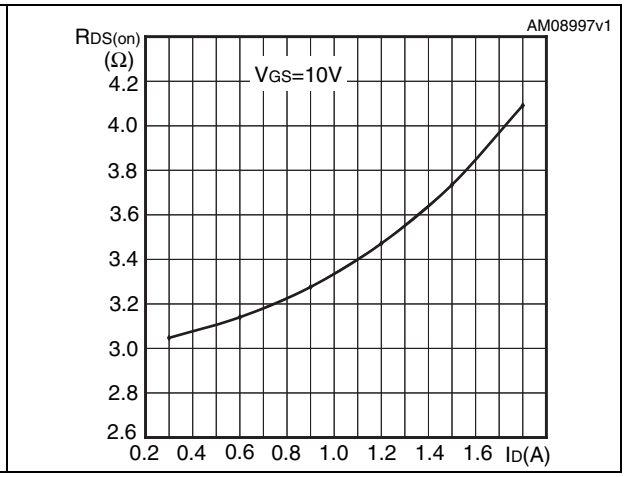


Figure 8. Capacitance variations

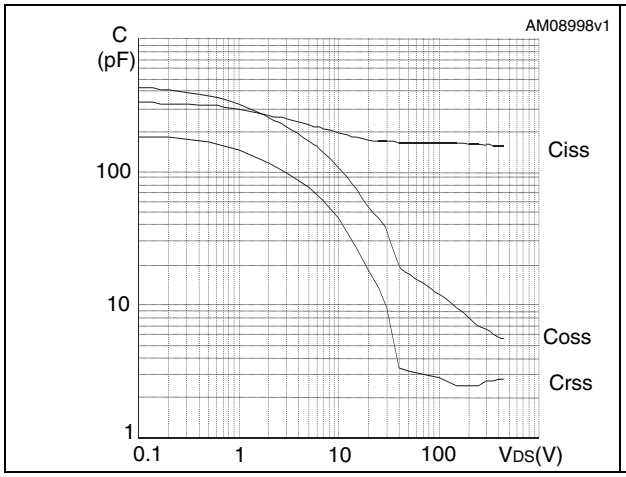


Figure 9. Output capacitance stored energy

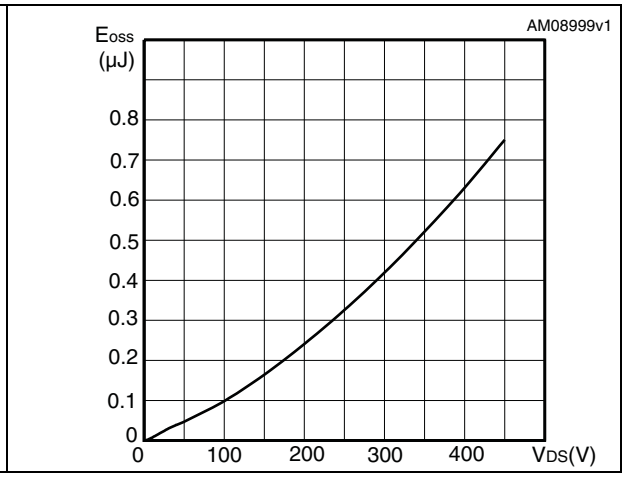


Figure 10. Normalized gate threshold voltage vs. temperature

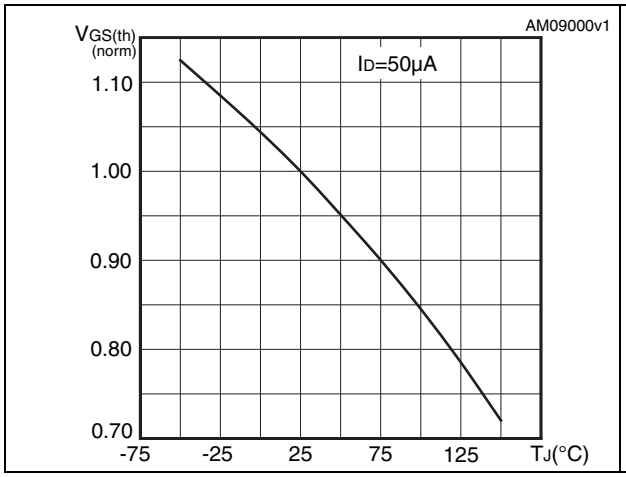


Figure 11. Normalized on resistance vs. temperature

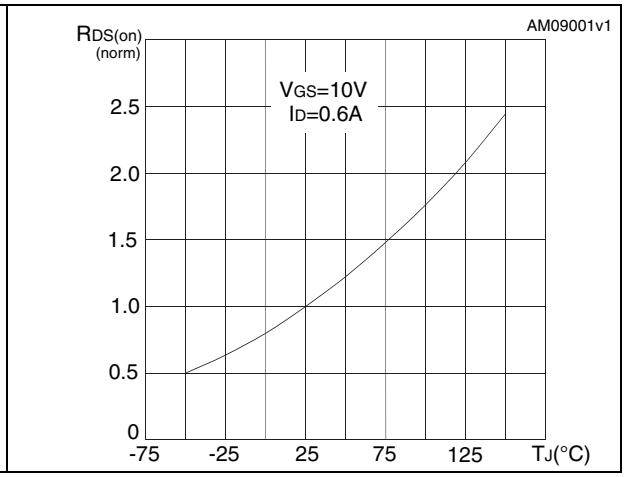


Figure 12. Source-drain diode forward characteristics

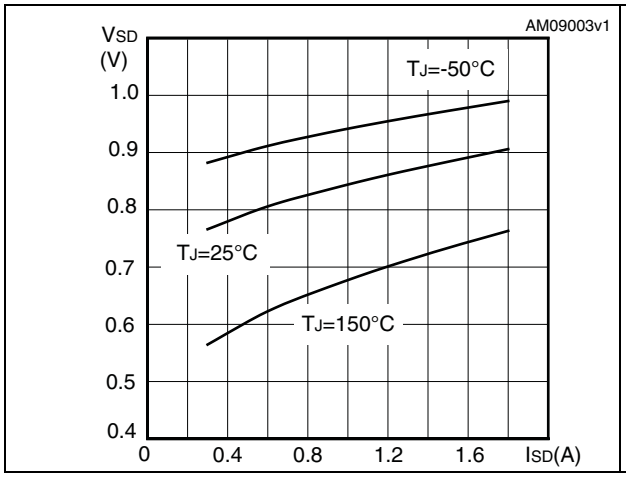


Figure 13. Normalized B_{VDSS} vs. temperature

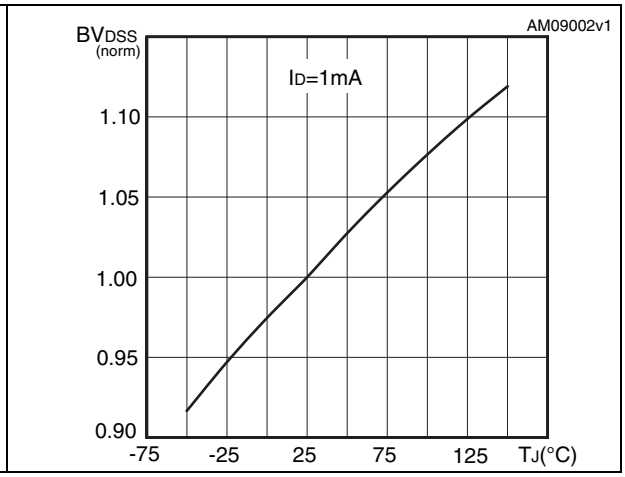
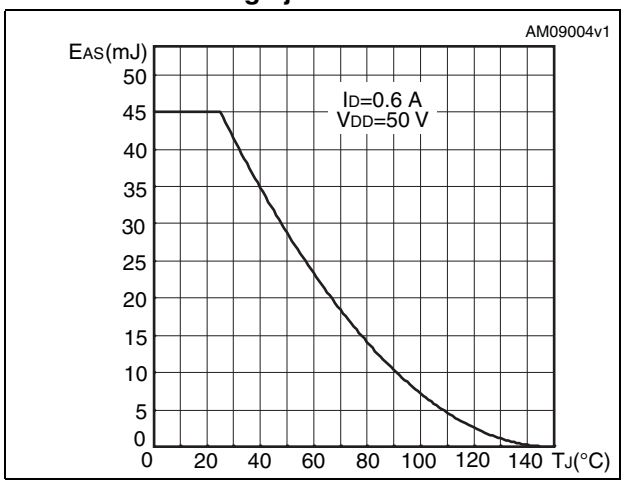


Figure 14. Maximum avalanche energy vs. starting Tj



3 Test circuits

Figure 15. Switching times test circuit for resistive load

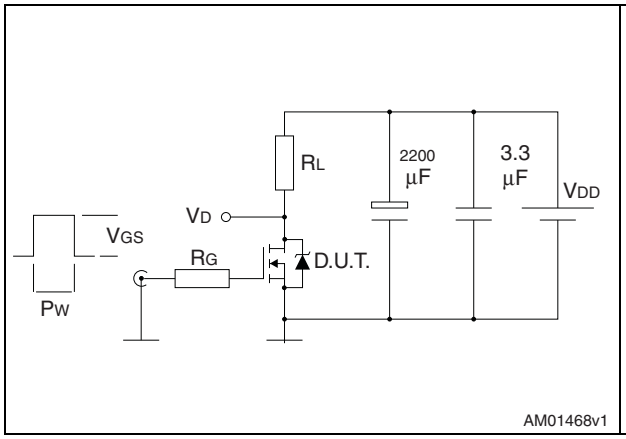


Figure 16. Gate charge test circuit

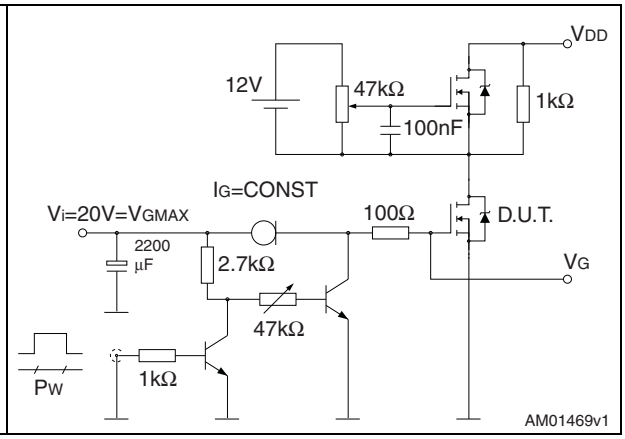


Figure 17. Test circuit for inductive load switching and diode recovery times

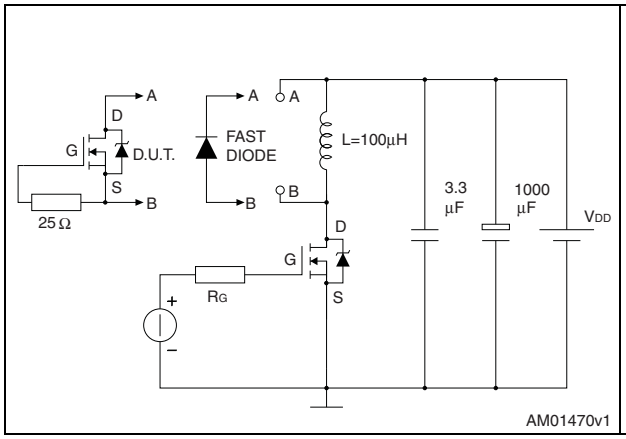


Figure 18. Unclamped inductive load test circuit

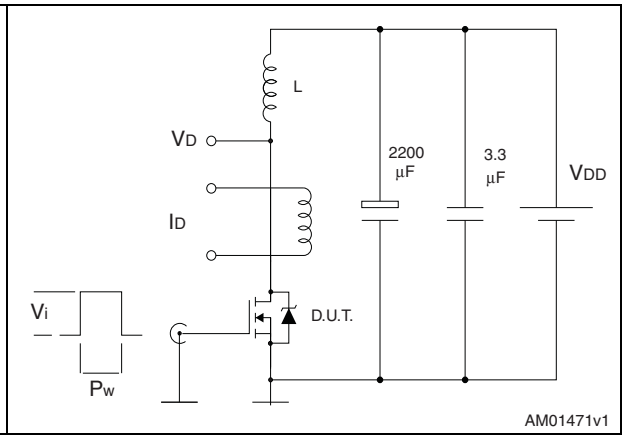


Figure 19. Unclamped inductive waveform

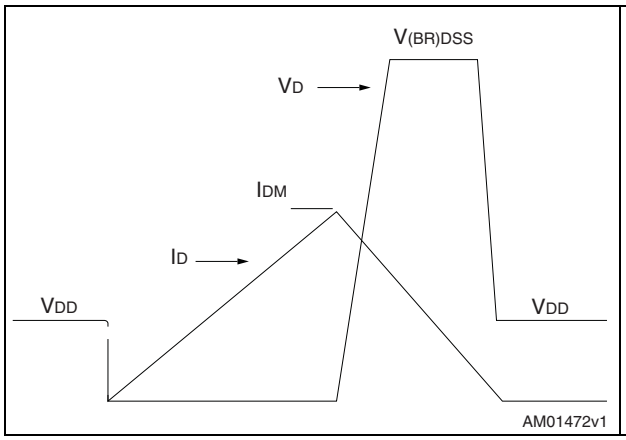
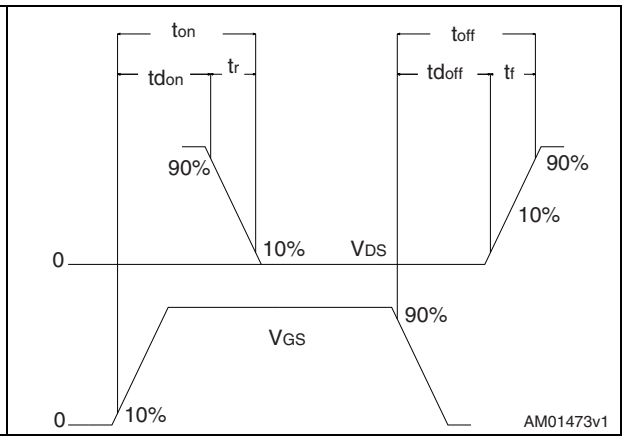


Figure 20. Switching time waveform



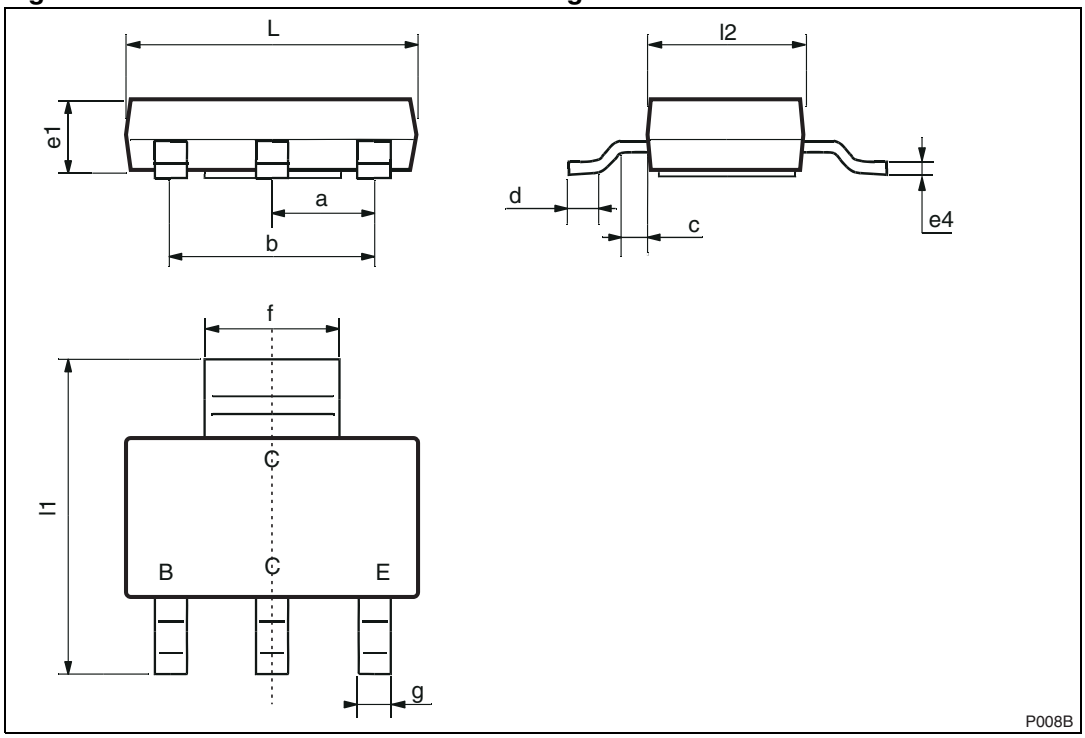
4 Package mechanical data

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. ECOPACK is an ST trademark.

Table 8. SOT-223 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
a	2.27	2.3	2.33
b	4.57	4.6	4.63
c	0.2	0.4	0.6
d	0.63	0.65	0.67
e1	1.5	1.6	1.7
e4			0.32
f	2.9	3	3.1
g	0.67	0.7	0.73
l1	6.7	7	7.3
l2	3.5	3.5	3.7
L	6.3	6.5	6.7

Figure 21. SOT-223 mechanical data drawing



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
29-Jun-2010	1	First release.
08-Apr-2011	2	Document status promoted from preliminary data to datasheet.

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