



# THE DATASHEET OF STN1NF20





## STN1NF20

N-channel 200 V, 1.1  $\Omega$ , 1 A SOT-223  
STripFET™ II Power MOSFET

### Features

Order code	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STN1NF20	200 V	< 1.5 $\Omega$	1 A

- 100% avalanche tested
- Low gate charge
- Exceptional dv/dt capability

### Applications

- Switching applications

### Description

This Power MOSFET has been developed using STMicroelectronics' unique STripFET™ process, which is specifically designed to minimize input capacitance and gate charge. This renders the device suitable for use as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer applications, and applications with low gate charge driving requirements.

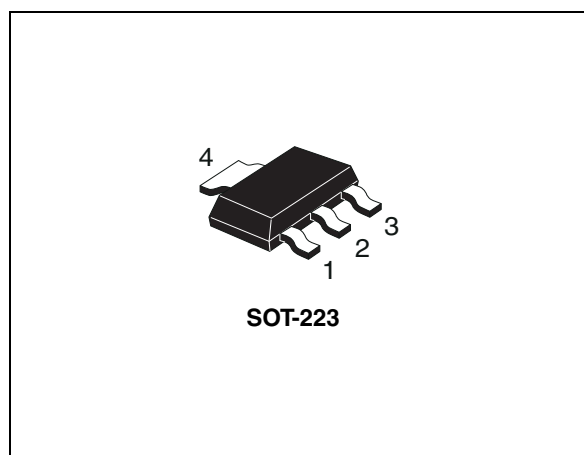


Figure 1. Internal schematic diagram

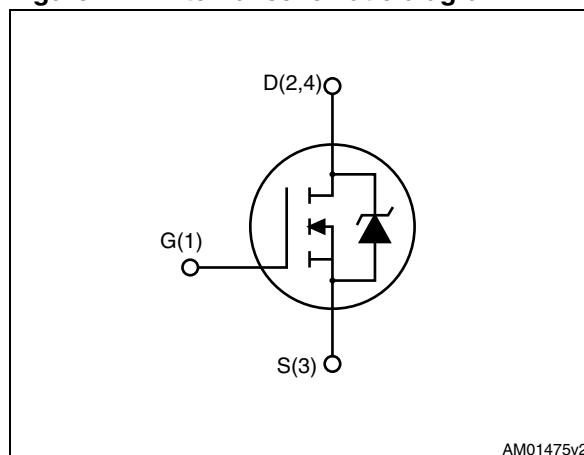


Table 1. Device summary

Order code	Marking	Package	Packaging
STN1NF20	1NF20	SOT-223	Tape and reel

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D$	Drain current continuous $T_{amb} = 25\text{ }^\circ\text{C}$	1	A
$I_D$	Drain current continuous $T_{amb} = 100\text{ }^\circ\text{C}$	1	A
$I_{DM}^{(1)}$	Drain current pulsed	4	A
$P_{TOT}$	Total dissipation at $T_{amb} = 25\text{ }^\circ\text{C}$	2	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	10	V/ns
$T_j$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 150	$^\circ\text{C}$

1. Pulse width limited by safe operating area.
2.  $I_{sd} \leq 1\text{ A}$ ,  $di/dt \leq 200\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq 80\% V_{(BR)DSS}$ .

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-amb}$	Thermal resistance junction to ambient	62.50	$^\circ\text{C}/\text{W}$

**Table 4. Thermal data**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not repetitive <sup>(1)</sup>	1	A
$E_{AS}$	Single pulse avalanche energy <sup>(2)</sup>	70	mJ

1. Pulse width limited by  $T_{JMAX}$ .
2. Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = I_{AR}$ ,  $V_{DD} = 50\text{ V}$ .

## 2 Electrical characteristics

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

**Table 5. On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	I <sub>D</sub> = 1 mA, V <sub>GS</sub> = 0	200			V
I <sub>DSS</sub>	Zero gate voltage drain current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = 200 V V <sub>DS</sub> = 200 V, T <sub>C</sub> =125 °C			1 50	μA μA
I <sub>GSS</sub>	Gate-body leakage current	V <sub>GS</sub> = ± 20 V, V <sub>DS</sub> =0			±100	nA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA	2	3	4	V
R <sub>DS(on)</sub>	Static drain-source on resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 0.5 A		1.1	1.5	Ω

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 25 V, f = 1 MHz, V <sub>GS</sub> = 0	-	90	-	pF
C <sub>oss</sub>	Output capacitance			30		pF
C <sub>rss</sub>	Reverse transfer capacitance			4		pF
R <sub>g</sub>	Intrinsic gate resistance	f=1 MHz open drain	-	4.8	-	Ω
Q <sub>g</sub>	Total gate charge	V <sub>DD</sub> = 160 V, I <sub>D</sub> = 1 A, V <sub>GS</sub> = 10 V (see <a href="#">Figure 14</a> )	-	5.7	-	nC
Q <sub>gs</sub>	Gate-source charge			1.1		nC
Q <sub>gd</sub>	Gate-drain charge			3.0		nC

**Table 7. Switching times**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(v)}$	Voltage delay time	$V_{DD} = 100\text{ V}$ , $I_D = 0.5\text{ A}$ , $R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 13</a> )	-	4	-	ns
$t_r$	Voltage rise time			5.6		ns
$t_f$	Current fall time			12.4		ns
$t_{c(off)}$	Crossing time			15.8		ns

**Table 8. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		1	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				4	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 1\text{ A}$ , $V_{GS} = 0$	-		1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 1\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$	-	51.8		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 20\text{ V}$		90.7		nC
$I_{RRM}$	Reverse recovery current	(see <a href="#">Figure 15</a> )		3.5		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 1\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$	-	58.0		ns
$Q_{rr}$	Reverse recovery charge	$V_{DD} = 20\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$		106.7		nC
$I_{RRM}$	Reverse recovery current	(see <a href="#">Figure 15</a> )		3.7		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

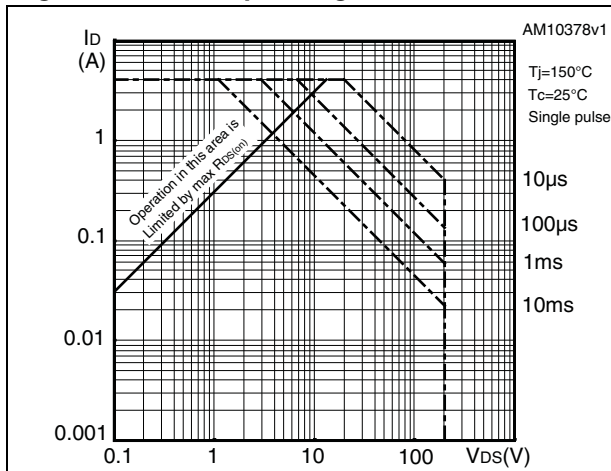


Figure 3. Thermal impedance

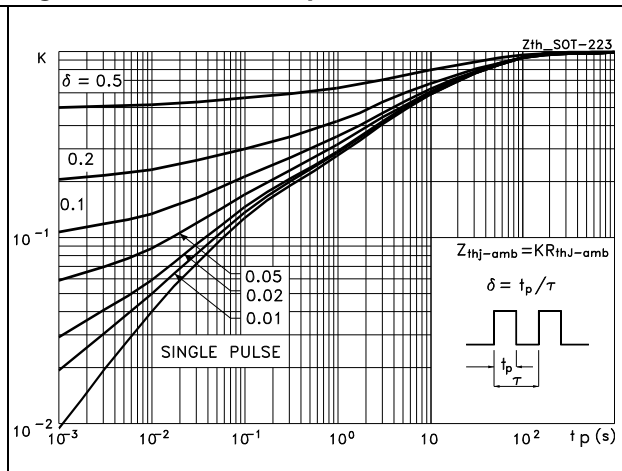


Figure 4. Output characteristics

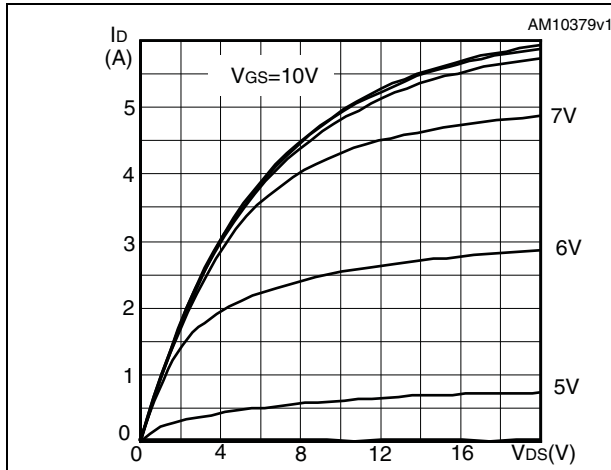


Figure 5. Transfer characteristics

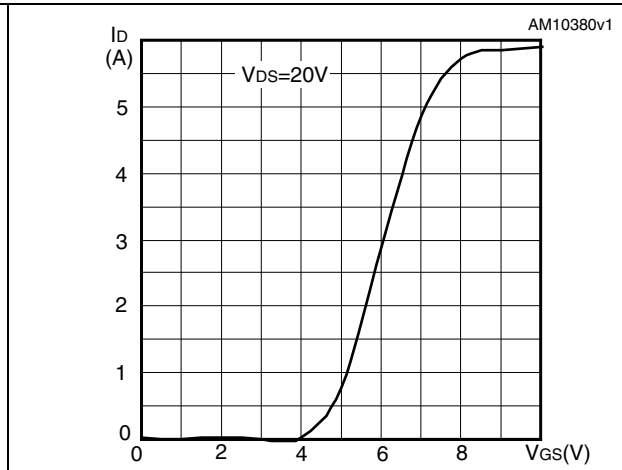


Figure 6. Normalized  $B_{V_{DS}}$  vs temperature

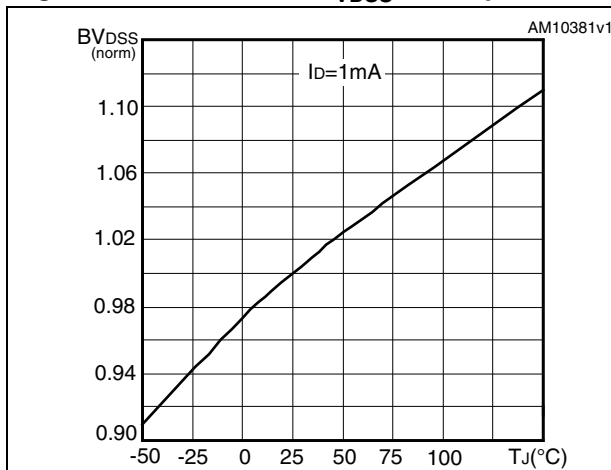


Figure 7. Static drain-source on resistance

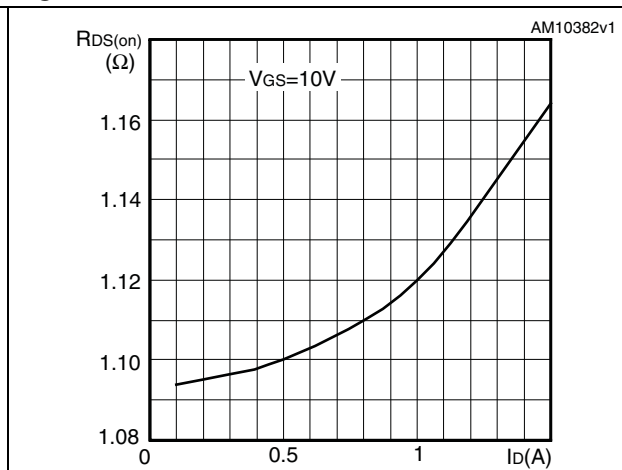


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

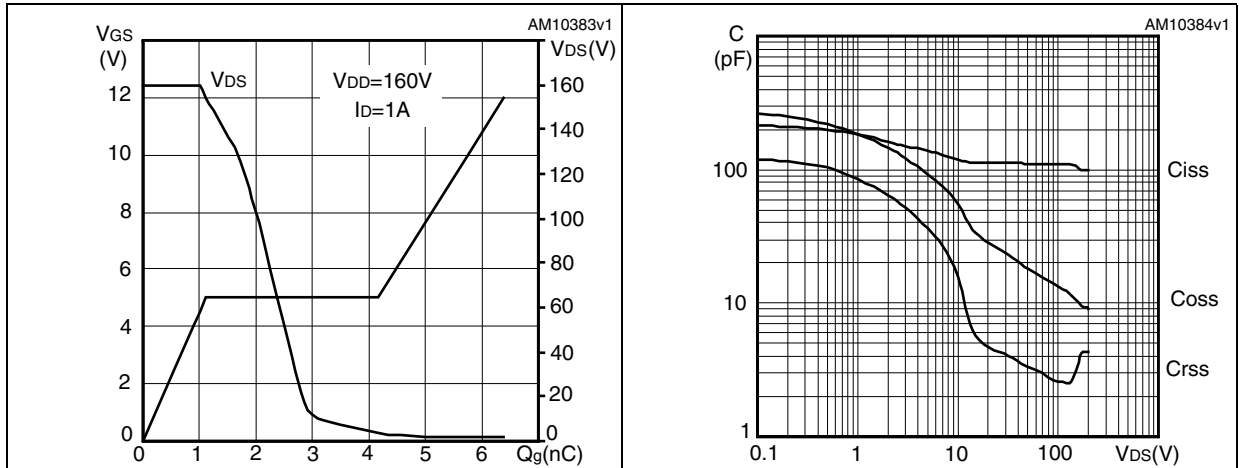


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

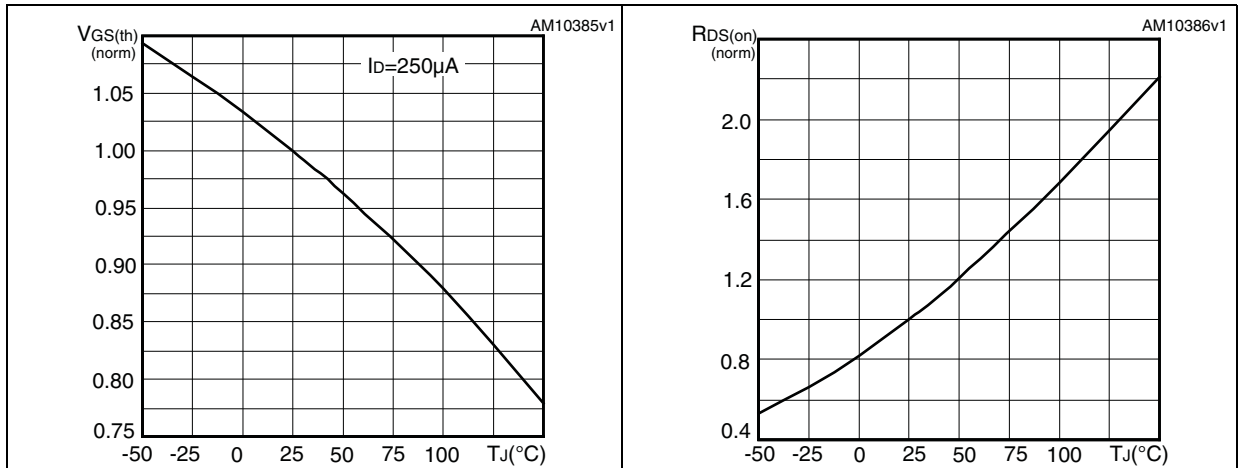
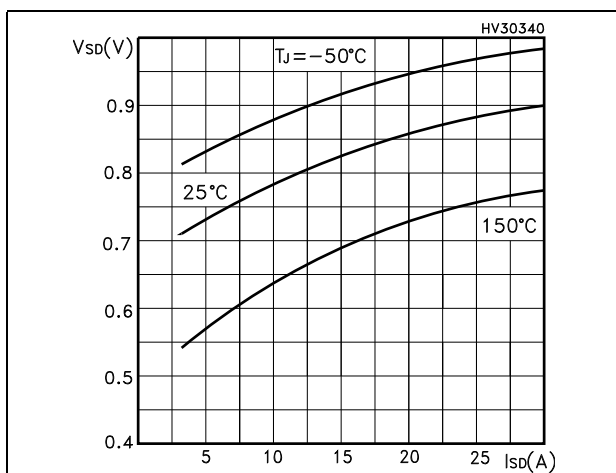
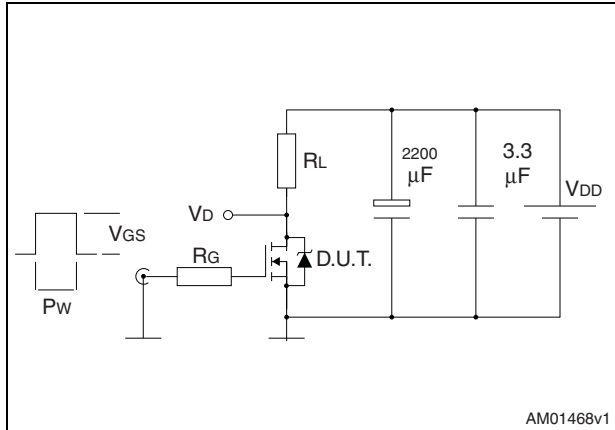


Figure 12. Source-drain diode forward characteristics

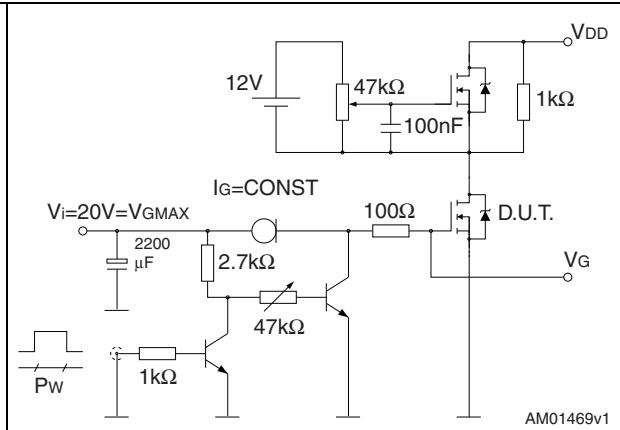


### 3 Test circuits

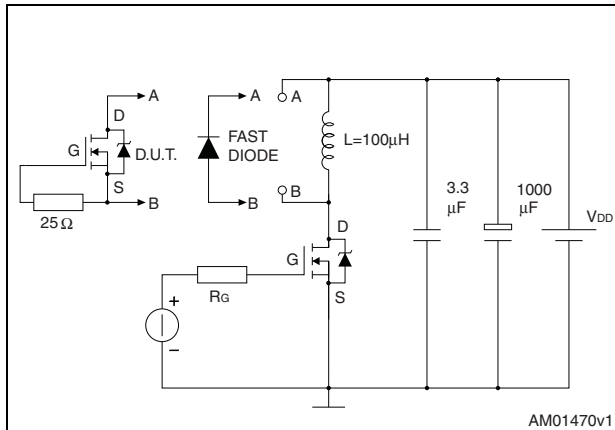
**Figure 13. Switching times test circuit for resistive load**



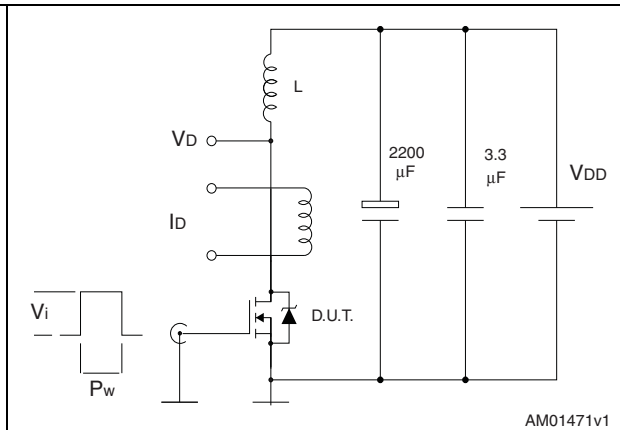
**Figure 14. Gate charge test circuit**



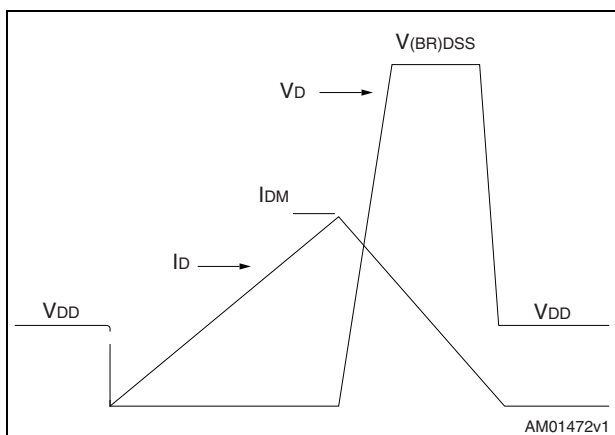
**Figure 15. Test circuit for inductive load switching and diode recovery times**



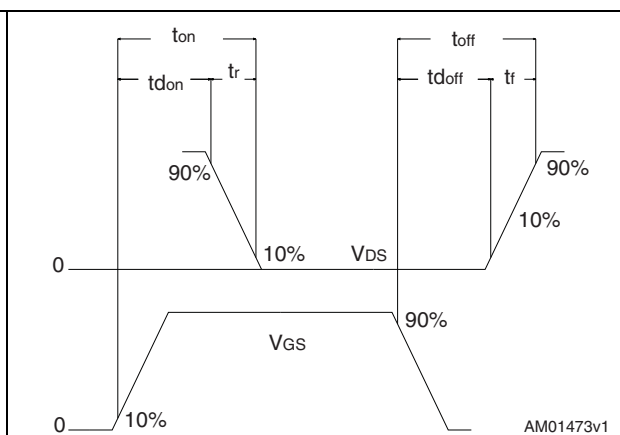
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**



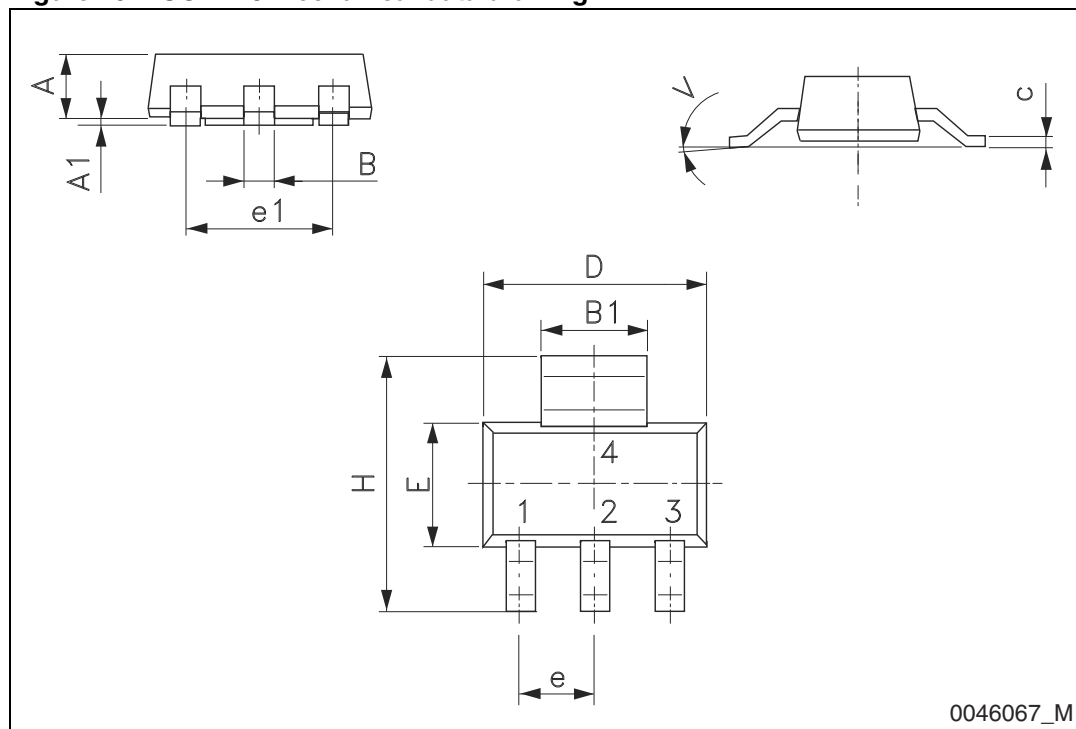
## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

Table 9. SOT-223 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			1.80
A1	0.02		0.1
B	0.60	0.70	0.85
B1	2.90	3.00	3.15
c	0.24	0.26	0.35
D	6.30	6.50	6.70
e		2.30	
e1		4.60	
E	3.30	3.50	3.70
H	6.70	7.00	7.30
V			10°

Figure 19. SOT-223 mechanical data drawing



0046067\_M

## 5 Revision history

Table 10. Document revision history

Date	Revision	Changes
04-Nov-2011	1	First release.

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