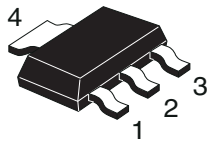
# STN1NF20

## N-channel 200 V, 1.1 Ω, 1 A SOT-223 STripFET™ II Power MOSFET

## Features

| Order code | $V_{DSS}$ | $R_{DS(on)}$ max | $I_D$ |
|---|---|---|---|
| STN1NF20 | 200 V | < 1.5 Ω | 1 A |

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




SOT-223

## 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**

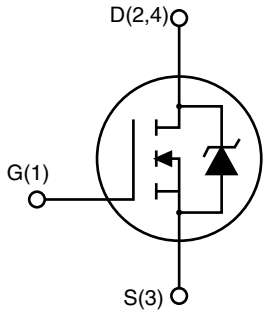



**Table 1. Device summary**

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

# Contents

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

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

1. Pulse width limited by safe operating area.
2. Isd ≤1 A, di/dt ≤200 A/µs, $V_{DD}$ ≤80% $V_{(BR)DSS}$.

**Table 3. Thermal data**

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

**Table 4. Thermal data**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $I_{AR}$ | Avalanche current, repetetive or not repetetive(1) | 1 | A |
| $E_{AS}$ | Single pulse avalanche energy (2) | 70 | mJ |

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

# 2 Electrical characteristics

(Tcase = 25 °C unless otherwise specified)

**Table 5. 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 | 200 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current ($V_{GS}$ = 0)<br>$V_{DS}$ = 200 V, $T_C$=125 °C | $V_{DS}$ = 200 V | | | 1<br>50 | µA<br>µA |
| $I_{GSS}$ | Gate-body leakage current | $V_{GS}$ = ± 20 V, $V_{DS}$=0 | | | ±100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 µA | 2 | 3 | 4 | V |
| $R_{DS(on)}$ | Static drain-source on resistance | $V_{GS}$ = 10 V, $I_D$ = 0.5 A | | 1.1 | 1.5 | Ω |

**Table 6. Dynamic**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS}$ = 25 V, f = 1 MHz, $V_{GS}$ = 0 | - | 90<br>30<br>4 | - | pF<br>pF<br>pF |
| $R_g$ | Instrinsic gate resistance | f=1 MHz open drain | - | 4.8 | - | Ω |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total gate charge<br>Gate-source charge<br>Gate-drain charge | $V_{DD}$ = 160 V, $I_D$ = 1 A, $V_{GS}$ = 10 V (see *Figure 14*) | - | 5.7<br>1.1<br>3.0 | - | nC<br>nC<br>nC |

**Table 7. Switching times**

| Symbol | Parameter | Test conditions | Min. | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| $t_{d(v)}$ | Voltage delay time | $V_{DD}$ = 100 V, $I_D$ = 0.5 A, | - | 4 | - | ns |
| $t_r$ | Voltage rise time | $R_G$ = 4.7 Ω, $V_{GS}$ = 10 V | | 5.6 | | ns |
| $t_f$ | Current fall time | (see *Figure 13*) | | 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 A, $V_{GS}$ = 0 | - | | 1.6 | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 1 A, di/dt = 100 A/µs | - | 51.8 | | ns |
| $Q_{rr}$ | Reverse recovery charge | $V_{DD}$ = 20 V | | 90.7 | | nC |
| $I_{RRM}$ | Reverse recovery current | (see *Figure 15*) | | 3.5 | | A |
| $t_{rr}$ | Reverse recovery time | $I_{SD}$ = 1 A, di/dt = 100 A/µs | - | 58.0 | | ns |
| $Q_{rr}$ | Reverse recovery charge | $V_{DD}$ = 20 V, $T_j$ = 150 °C | | 106.7 | | nC |
| $I_{RRM}$ | Reverse recovery current | (see *Figure 15*) | | 3.7 | | 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**

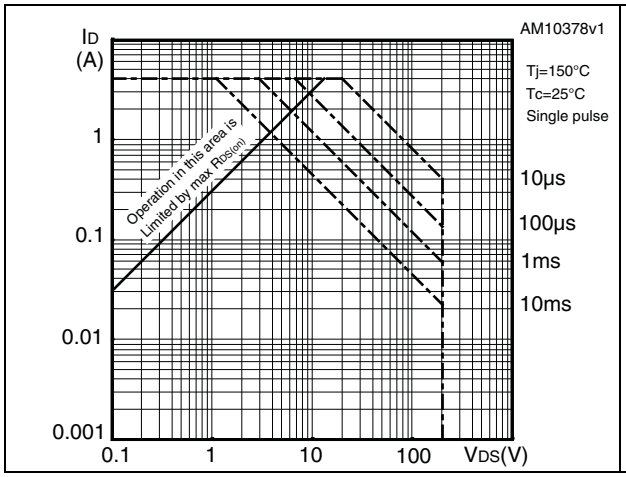



**Figure 3. Thermal impedance**

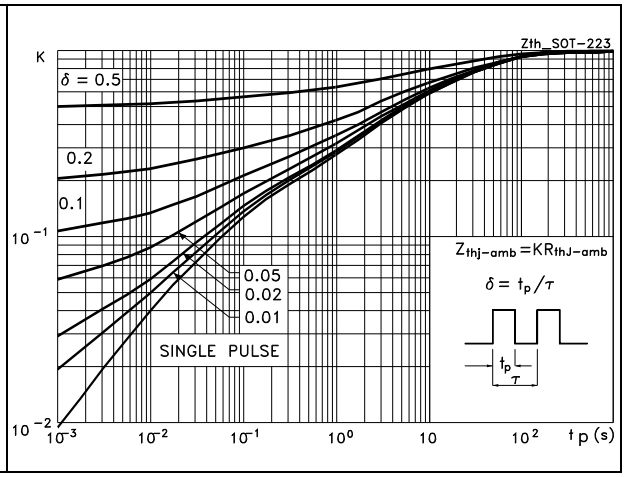



**Figure 4. Output characteristics**

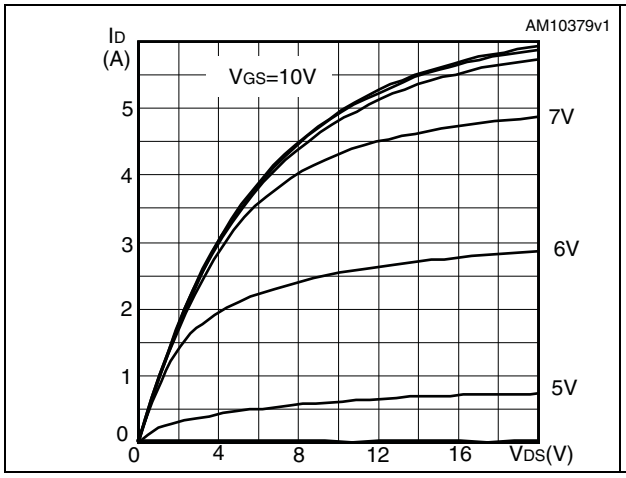



**Figure 5. Transfer characteristics**

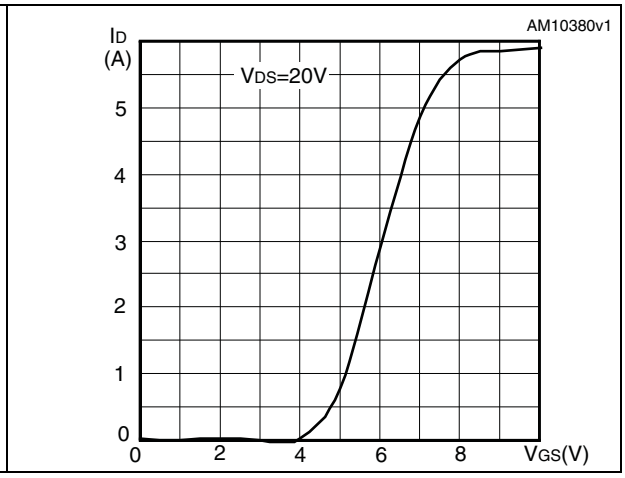



**Figure 6. Normalized $B_{VDSS}$ vs temperature**

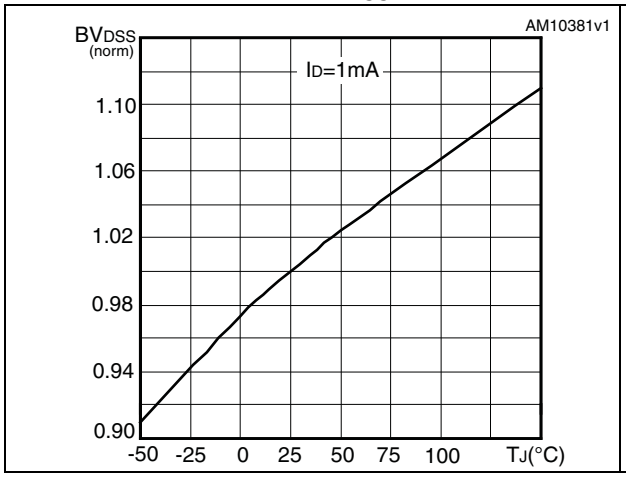



**Figure 7. Static drain-source on resistance**

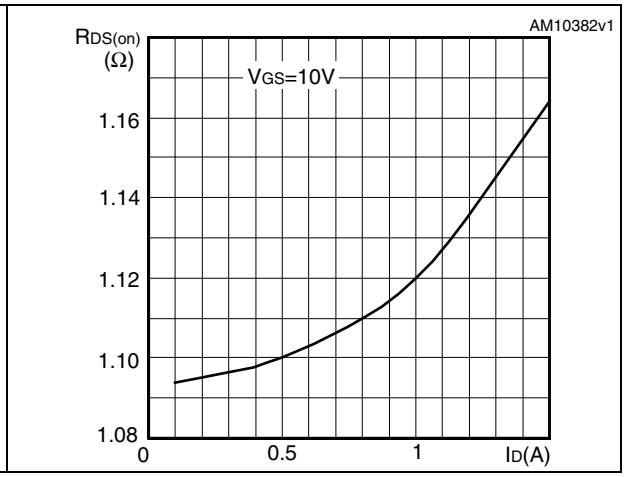


**Figure 8. Gate charge vs gate-source voltage**

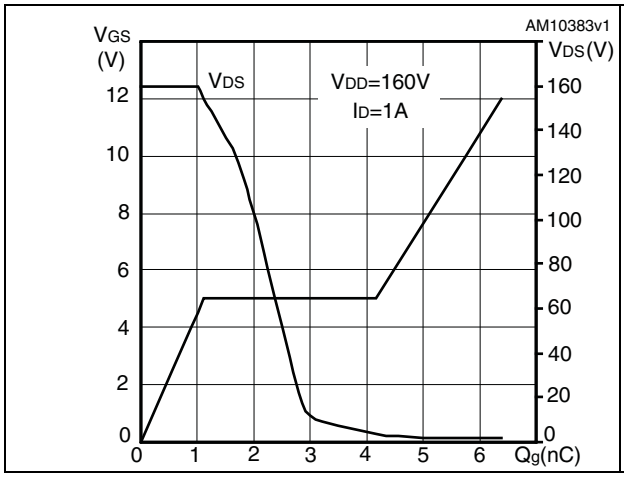



**Figure 9. Capacitance variations**

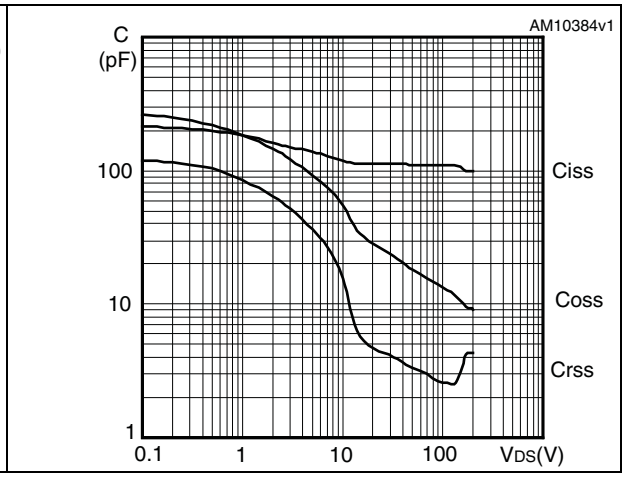



**Figure 10. Normalized gate threshold voltage vs temperature**

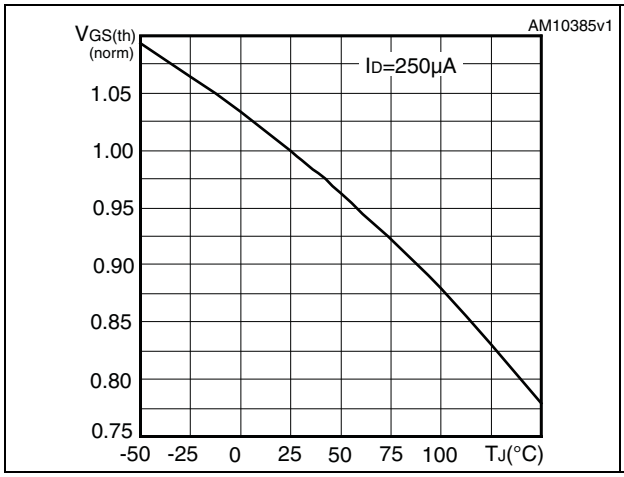



**Figure 11. Normalized on resistance vs temperature**

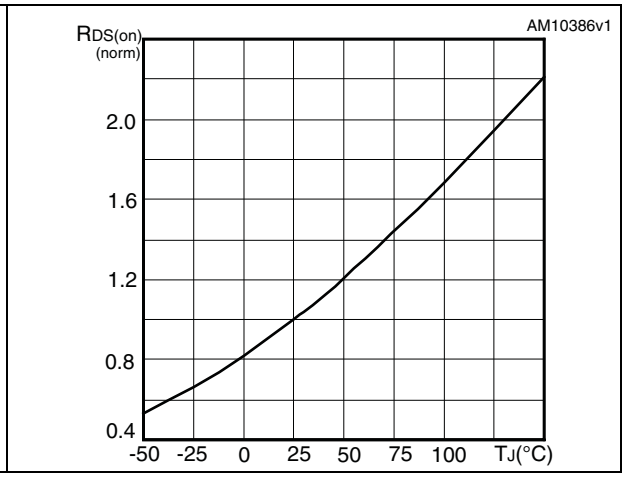
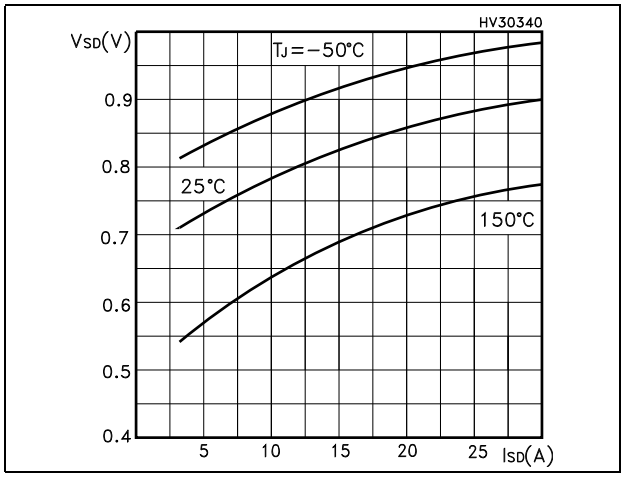



**Figure 12. Source-drain diode forward characteristics**



# 3 Test circuits

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

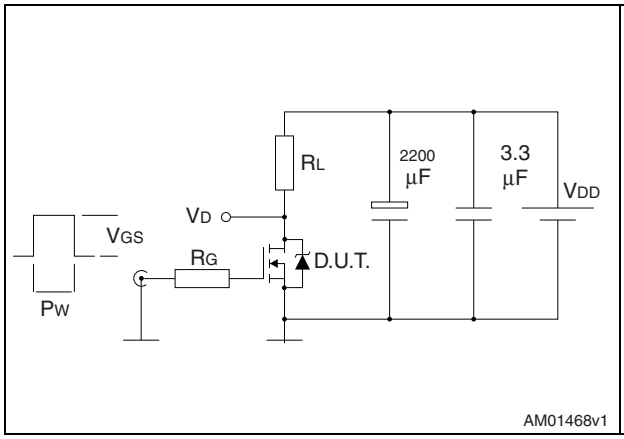



**Figure 14. Gate charge test circuit**

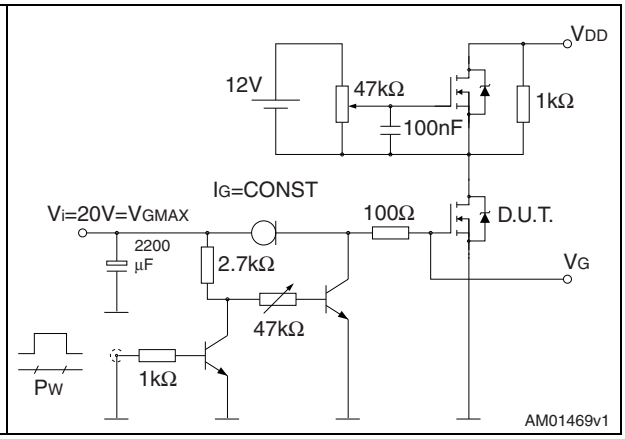



**Figure 15. Test circuit for inductive load switching and diode recovery times**

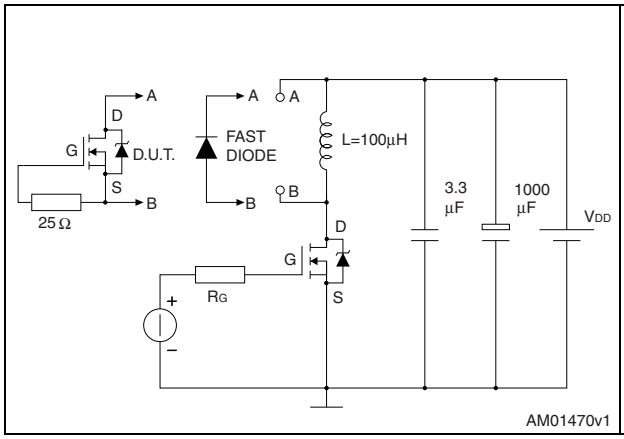



**Figure 16. Unclamped inductive load test circuit**

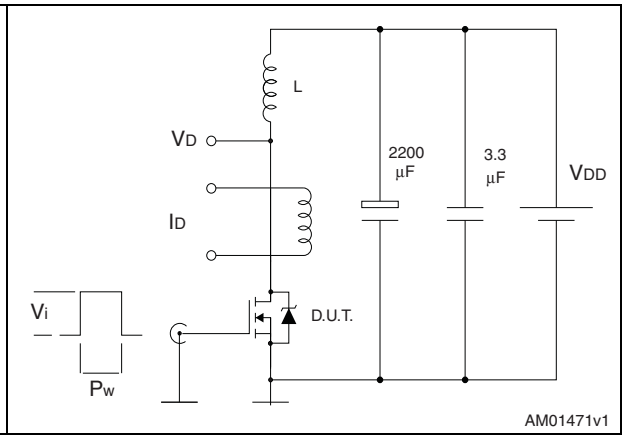



**Figure 17. Unclamped inductive waveform**

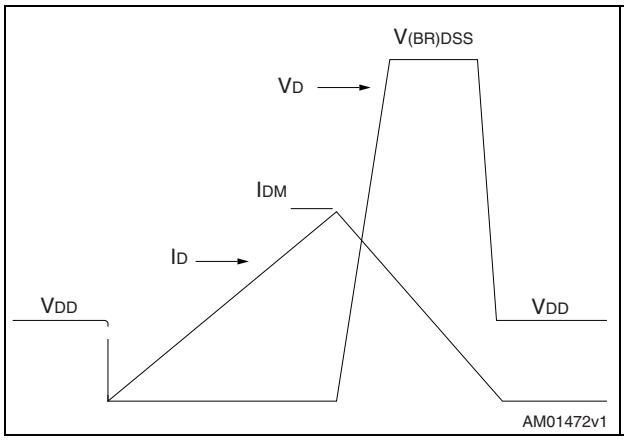
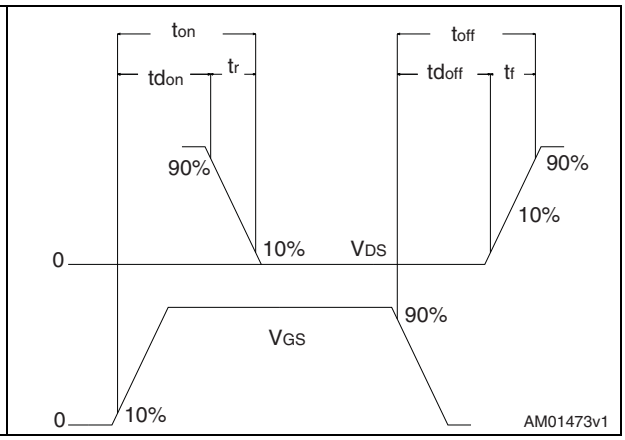



**Figure 18. Switching time waveform**



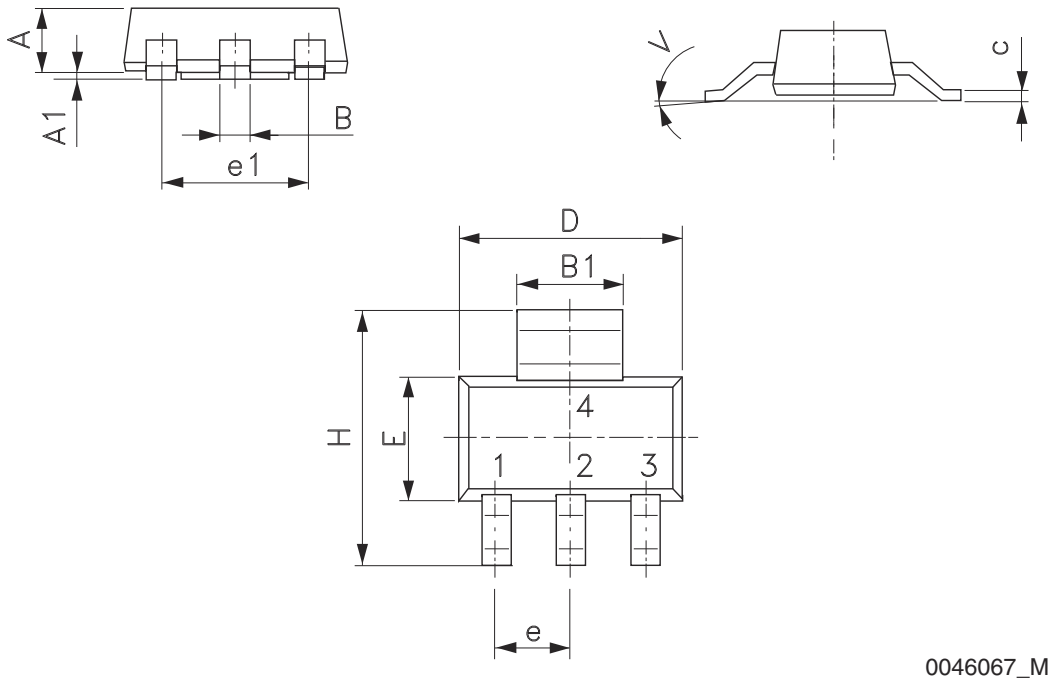
# 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® 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 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**



# 5 Revision history

Table 10. Document revision history

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

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