



# 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.

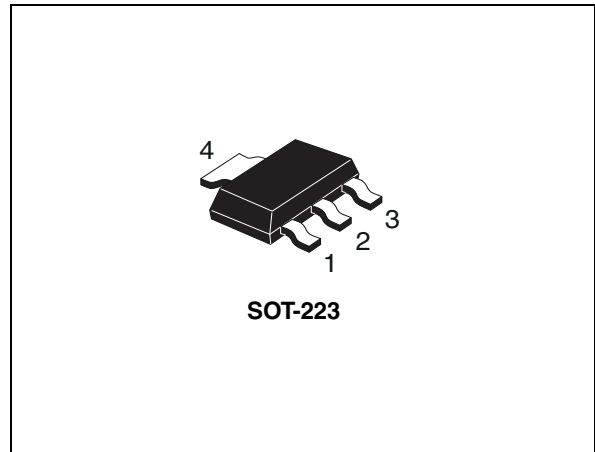


Figure 1. Internal schematic diagram

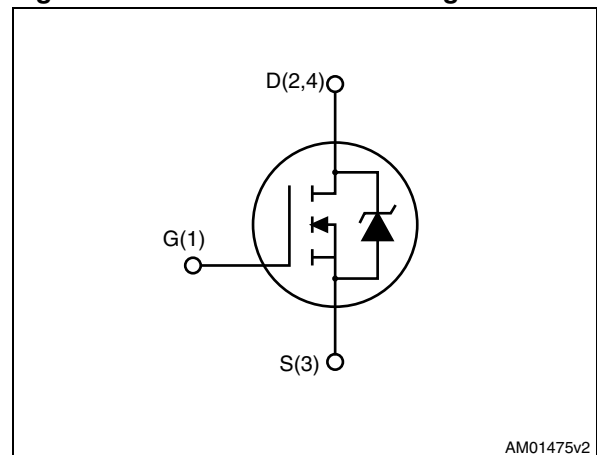


Table 1. Device summary

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

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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               |
| $T_j$<br>$T_{stg}$ | Operating junction temperature<br>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, repetetive or not repetetive <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                           |
|---------------|--------------------------------------------------|-------------------------------------------------------------------------------|------|------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage                   | $I_D = 1 \text{ mA}$ , $V_{GS} = 0$                                           | 200  |      |           | V                              |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = 200 \text{ V}$<br>$V_{DS} = 200 \text{ V}$ , $T_C = 125 \text{ °C}$ |      |      | 1<br>50   | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate-body leakage current                        | $V_{GS} = \pm 20 \text{ V}$ , $V_{DS} = 0$                                    |      |      | $\pm 100$ | nA                             |
| $V_{GS(th)}$  | Gate threshold voltage                           | $V_{GS} = V_{DS}$ , $I_D = 250 \mu\text{A}$                                   | 2    | 3    | 4         | V                              |
| $R_{DS(on)}$  | Static drain-source on resistance                | $V_{GS} = 10 \text{ V}$ , $I_D = 0.5 \text{ A}$                               |      | 1.1  | 1.5       | $\Omega$                       |

**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 | $V_{DS} = 25 \text{ V}$ , $f = 1 \text{ MHz}$ ,<br>$V_{GS} = 0$                                                 | -    | 90<br>30<br>4     | -    | pF<br>pF<br>pF |
| $R_g$                               | Intrinsic gate resistance                                               | $f = 1 \text{ MHz}$ open drain                                                                                  | -    | 4.8               | -    | $\Omega$       |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$       | Total gate charge<br>Gate-source charge<br>Gate-drain charge            | $V_{DD} = 160 \text{ V}$ , $I_D = 1 \text{ A}$ ,<br>$V_{GS} = 10 \text{ V}$<br>(see <a href="#">Figure 14</a> ) | -    | 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 | $V_{DD} = 100\text{ V}$ , $I_D = 0.5\text{ A}$ ,<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$<br>(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         | $I_{SD} = 1\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 20\text{ V}$<br>(see <a href="#">Figure 15</a> )                                     | -    | 51.8  |      | ns   |
| $Q_{rr}$        | Reverse recovery charge       |                                                                                                                                                              |      | 90.7  |      | nC   |
| $I_{RRM}$       | Reverse recovery current      |                                                                                                                                                              |      | 3.5   |      | A    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 1\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 20\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$<br>(see <a href="#">Figure 15</a> ) | -    | 58.0  |      | ns   |
| $Q_{rr}$        | Reverse recovery charge       |                                                                                                                                                              |      | 106.7 |      | nC   |
| $I_{RRM}$       | Reverse recovery current      |                                                                                                                                                              |      | 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

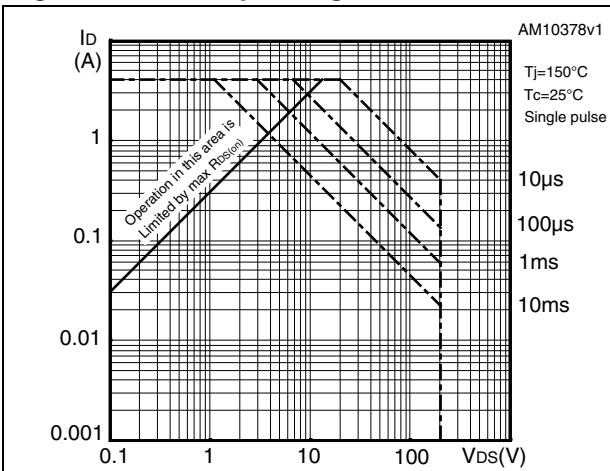


Figure 3. Thermal impedance

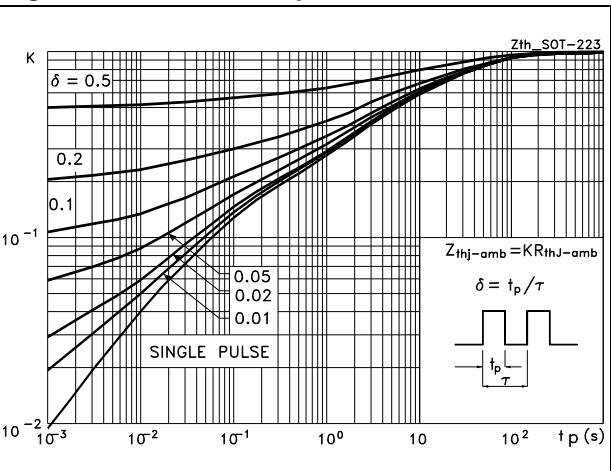


Figure 4. Output characteristics

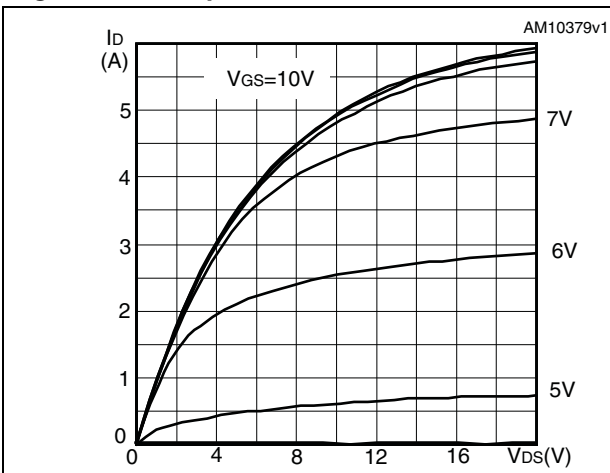


Figure 5. Transfer characteristics

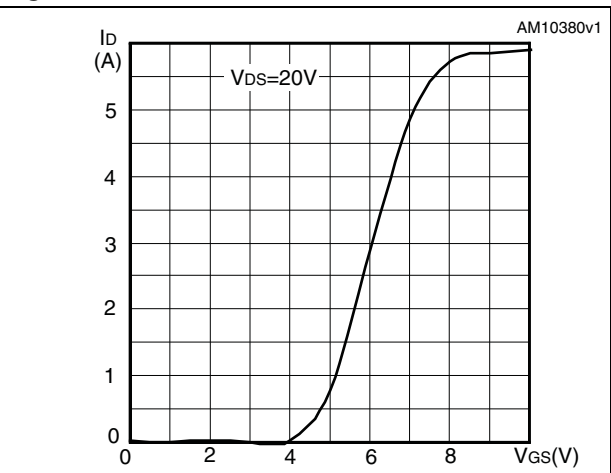


Figure 6. Normalized  $B_{V_{DSS}}$  vs temperature

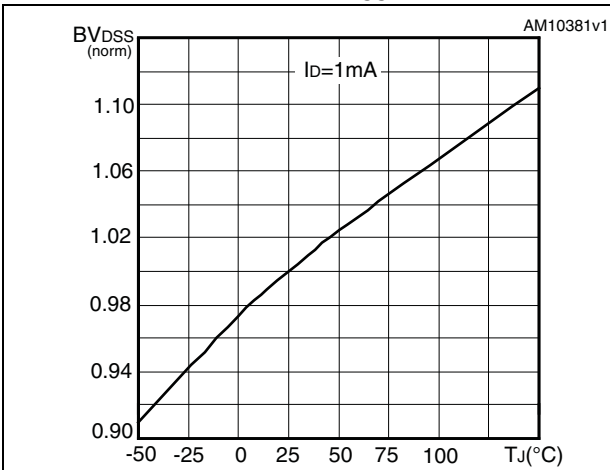


Figure 7. Static drain-source on resistance

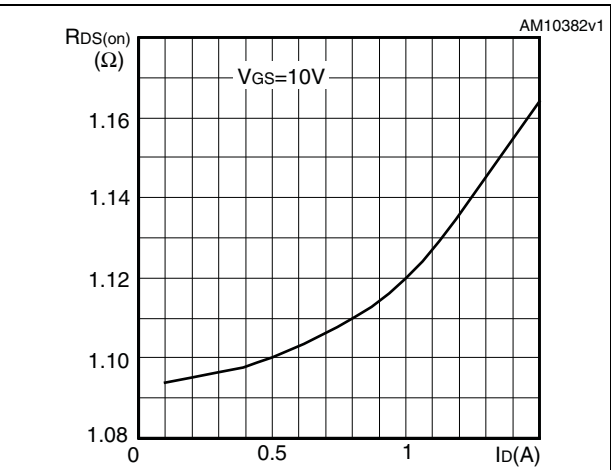


Figure 8. Gate charge vs gate-source voltage

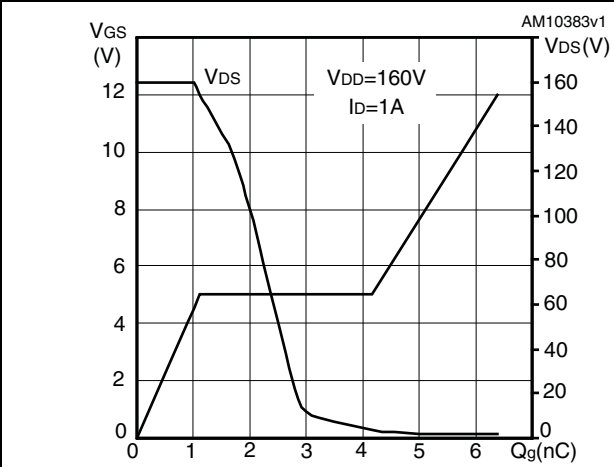


Figure 9. Capacitance variations

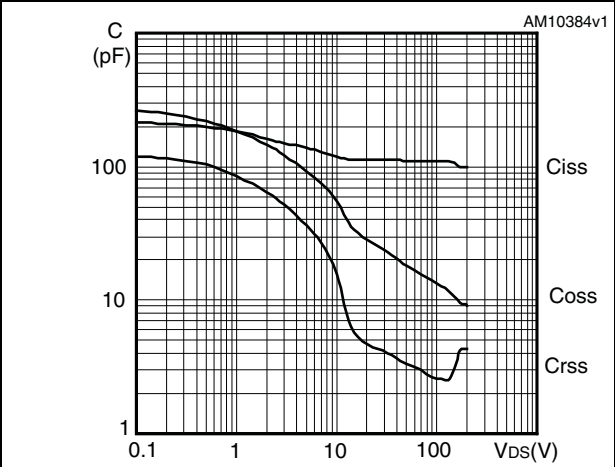


Figure 10. Normalized gate threshold voltage vs temperature

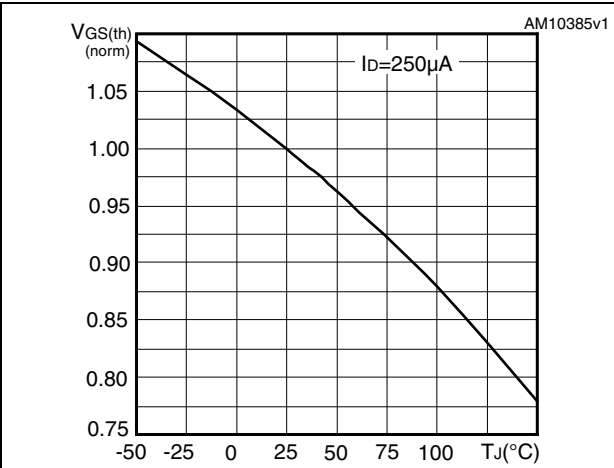


Figure 11. Normalized on resistance vs temperature

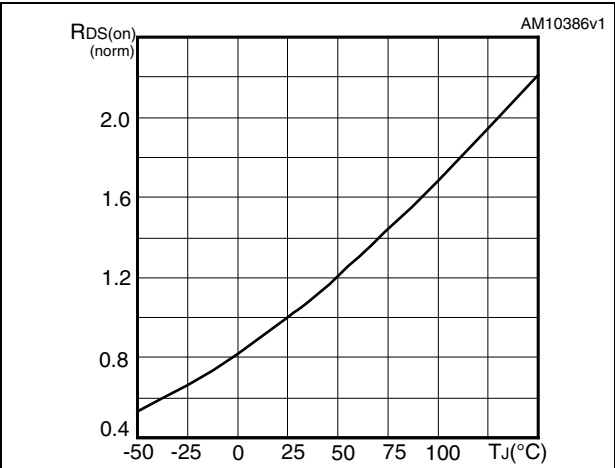
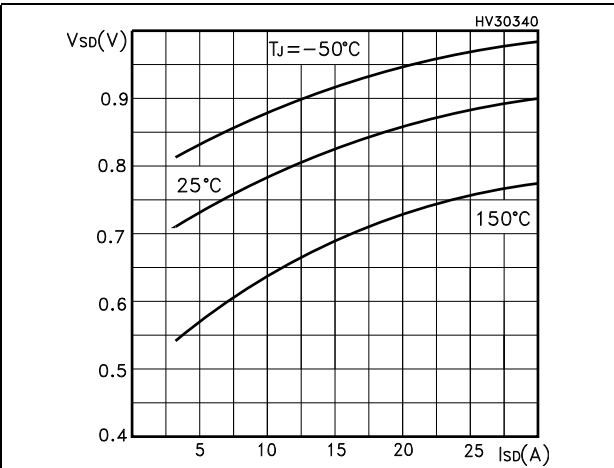
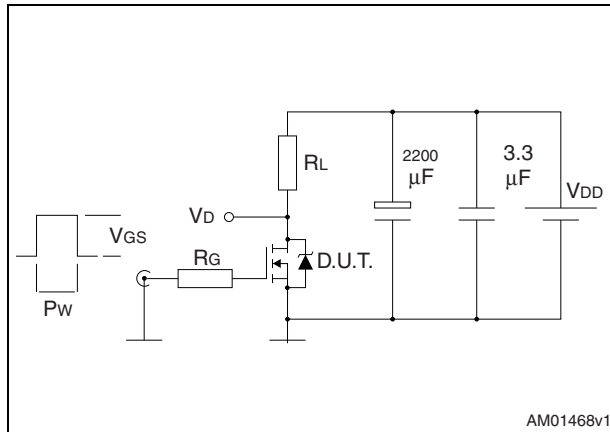


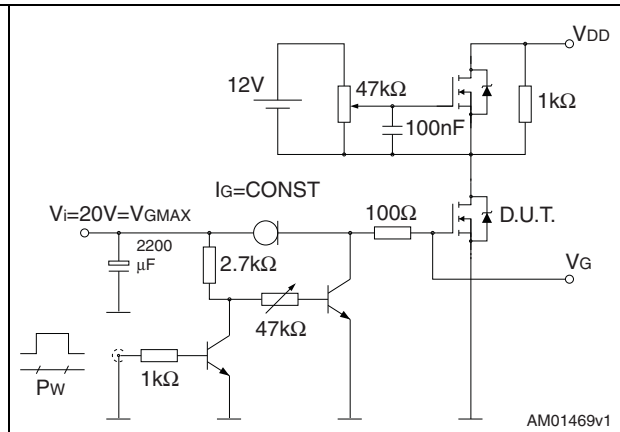
Figure 12. Source-drain diode forward characteristics



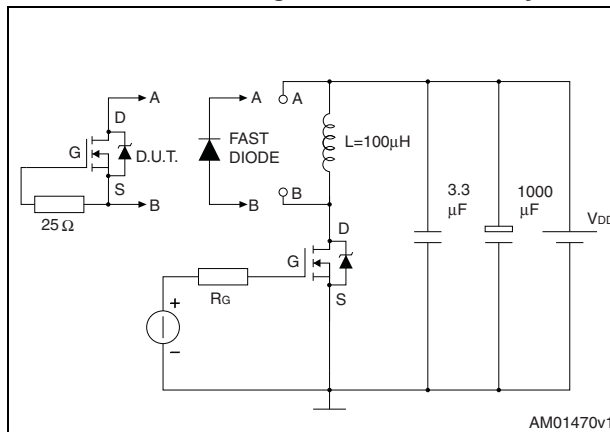
**Figure 13. Switching times test circuit for resistive load**



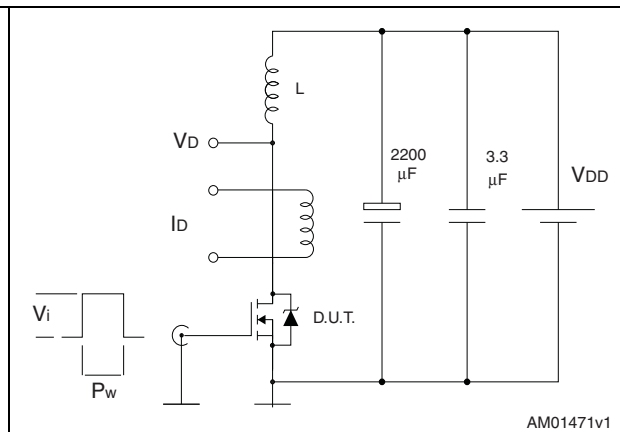
**Figure 15. Test circuit for inductive load switching and diode recovery times**



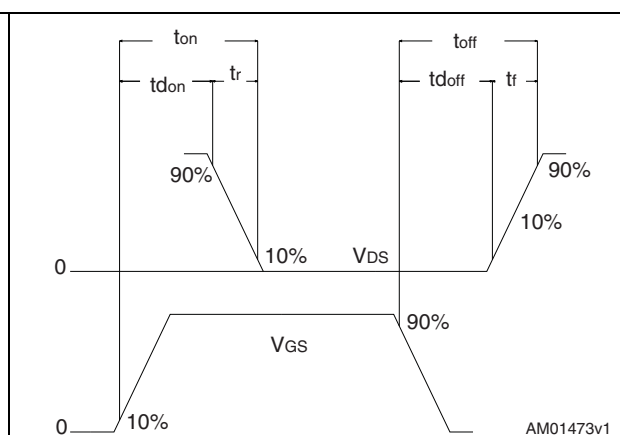
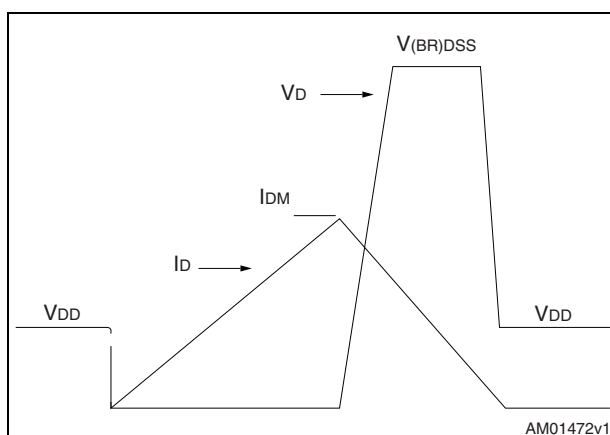
**Figure 16. Unclamped inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**



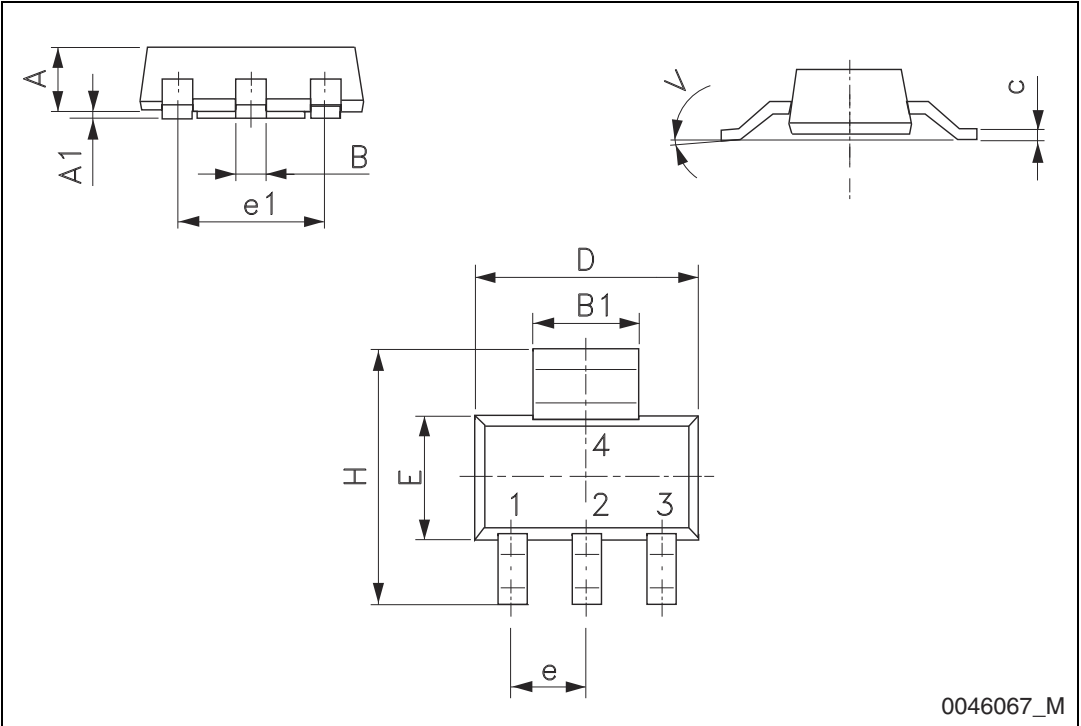
## 4 Package mechanical data

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](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



## 5 Revision history

**Table 10. Document revision history**

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

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