



# STB18NF25, STD18NF25

N-channel 250 V, 0.14  $\Omega$ , 17 A low gate charge STripFET™ II  
Power MOSFET in D<sup>2</sup>PAK and DPAK packages

Datasheet — production data

## Features

| Type      | V <sub>DSS</sub> | R <sub>DS(on) max</sub> | I <sub>D</sub> | P <sub>TOT</sub> |
|-----------|------------------|-------------------------|----------------|------------------|
| STB18NF25 | 250 V            | < 0.165 $\Omega$        | 17 A           | 110 W            |
| STD18NF25 | 250 V            | < 0.165 $\Omega$        | 17 A           | 110 W            |

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

## Application

- Switching applications
  - Automotive

## Description

These Power MOSFETs have been developed using STMicroelectronics' unique STripFET process, which is specifically designed to minimize input capacitance and gate charge. This renders the devices 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.

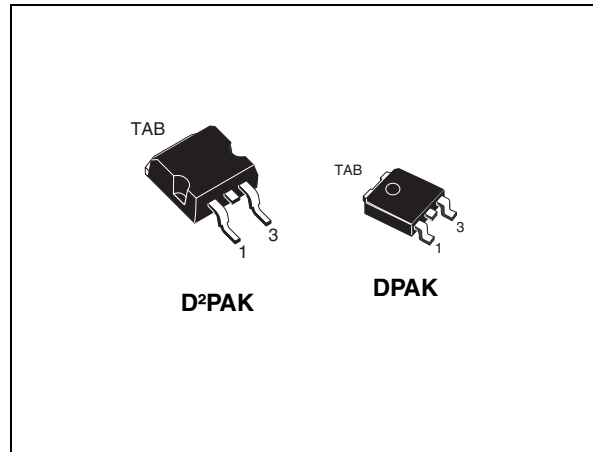


Figure 1. Internal schematic diagram

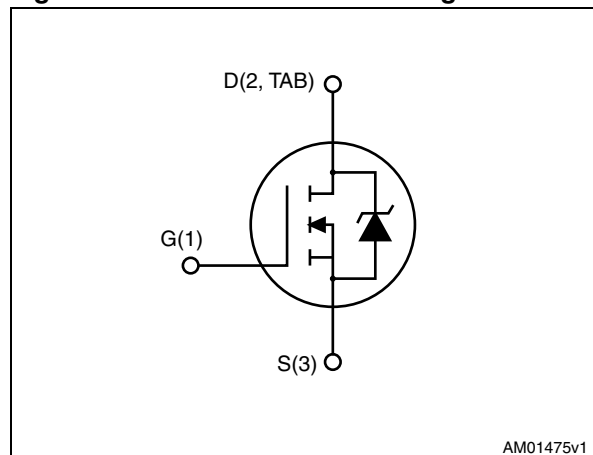


Table 1. Device summary

| Order codes | Marking | Package            | Packaging     |
|-------------|---------|--------------------|---------------|
| STB18NF25   | 18NF25  | D <sup>2</sup> PAK | Tape and reel |
| STD18NF25   | 18NF25  | DPAK               | Tape and reel |

## Contents

|          |   |           |
|----------|---|-----------|
| <b>1</b> | <b>Electrical ratings</b> .....           | <b>3</b>  |
| <b>2</b> | <b>Electrical characteristics</b> .....   | <b>4</b>  |
| 2.1      | Electrical characteristics (curves) ..... | 6         |
| <b>3</b> | <b>Test circuits</b> .....                | <b>9</b>  |
| <b>4</b> | <b>Package mechanical data</b> .....      | <b>10</b> |
| <b>5</b> | <b>Packaging mechanical data</b> .....    | <b>14</b> |
| <b>6</b> | <b>Revision history</b> .....             | <b>17</b> |

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol             | Parameter   | Value      | Unit             |
|--------------------|---|------------|------------------|
| $V_{DS}$           | Drain-source voltage  | 250        | V                |
| $V_{GS}$           | Gate-source voltage   | $\pm 20$   | V                |
| $I_D$              | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$  | 17         | A                |
| $I_D$              | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 12         | A                |
| $I_{DM}^{(1)}$     | Drain current (pulsed)  | 68         | A                |
| $P_{TOT}$          | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$           | 110        | 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 175 | $^\circ\text{C}$ |

1. Pulse width limited by safe operating area.
2.  $I_{SD} \leq 17\text{ A}$ ,  $di/dt \leq 200\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq 80\%V_{(BR)DSS}$

**Table 3. Thermal data**

| Symbol              | Parameter                            | Value              |      | Unit                      |
|---------------------|--------------------------------------|--------------------|------|---------------------------|
|                     |                                      | D <sup>2</sup> PAK | DPAK |                           |
| $R_{thj-case}$      | Thermal resistance junction-case max | 1.36               |      | $^\circ\text{C}/\text{W}$ |
| $R_{thj-pcb}^{(1)}$ | Thermal resistance junction-pcb max  | 30                 | 50   | $^\circ\text{C}/\text{W}$ |

1. When mounted on 1inch<sup>2</sup> FR-4, 2 Oz copper board.

**Table 4. Avalanche data**

| Symbol   | Parameter  | Value | Unit |
|----------|--|-------|------|
| $I_{AR}$ | Avalanche current, repetitive or not repetitive (pulse width limited by $T_{jmax}$ )                                 | 17    | A    |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ ) | 170   | mJ   |

## 2 Electrical characteristics

( $T_{CASE}=25\text{ °C}$  unless otherwise specified)

**Table 5. On/off states**

| Symbol        | Parameter                         | Test conditions  | Min. | Typ. | Max.      | Unit          |
|---------------|-----------------------------------|--|------|------|-----------|---------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage    | $V_{GS}=0, I_D=1\text{ mA}$                            | 250  |      |           | V             |
| $I_{DSS}$     | Zero gate voltage drain current   | $V_{GS}=0, V_{DS}=250\text{ V},$                       |      |      | 1         | $\mu\text{A}$ |
|               |                                   | $V_{GS}=0$<br>$V_{DS}=250\text{ V}, T_C=125\text{ °C}$ |      |      | 10        | $\mu\text{A}$ |
| $I_{GSS}$     | Gate body leakage current         | $V_{DS}=0, V_{GS}=\pm 20\text{ V}$                     |      |      | $\pm 100$ | nA            |
| $V_{GS(th)}$  | Gate threshold voltage            | $V_{DS}=V_{GS}, I_D=250\text{ }\mu\text{A}$            | 2    | 3    | 4         | V             |
| $R_{DS(on)}$  | Static drain-source on-resistance | $V_{GS}=10\text{ V}, I_D=8.5\text{ A}$                 |      | 0.14 | 0.165     | $\Omega$      |

**Table 6. Dynamic**

| Symbol                              | Parameter   | Test conditions   | Min. | Typ.                | Max. | Unit           |
|-------------------------------------|---|---|------|---------------------|------|----------------|
| $g_{fs}^{(1)}$                      | Forward transconductance  | $V_{DS}=15\text{ V}, I_D=8.5\text{ A}$  | -    | 14                  | -    | S              |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS}=25\text{ V}, f=1\text{ MHz}, V_{GS}=0$  | -    | 1000<br>178<br>28   | -    | pF<br>pF<br>pF |
| $C_{o(tr)}$                         | Equivalent capacitance time related                                     | $V_{DS}=0\text{ to }200\text{ V}, V_{GS}=0$   | -    | 106                 | -    | pF             |
| $C_{o(er)}$                         | Equivalent capacitance energy related                                   |   | -    | 79                  | -    | pF             |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$       | Total gate charge<br>Gate-source charge<br>Gate-drain charge            | $V_{DD}=200\text{ V}, I_D=17\text{ A}$<br>$V_{GS}=10\text{ V}$ (see <a href="#">Figure 17</a> ) | -    | 29.5<br>4.8<br>15.6 | -    | nC<br>nC<br>nC |
| $R_G$                               | Gate input resistance   | f=1 MHz gate DC bias=0 test signal level=20 mV open drain                                       | -    | 2                   | -    | $\Omega$       |

1. Pulsed: pulse duration=300 $\mu\text{s}$ , duty cycle 1.5%

Table 7. Switching times

| Symbol                | Parameter                        | Test conditions  | Min. | Typ.        | Max. | Unit     |
|-----------------------|----------------------------------|--|------|-------------|------|----------|
| $t_{d(on)}$<br>$t_r$  | Turn-on delay time<br>Rise time  | $V_{DD}=125\text{ V}$ , $I_D=8.5\text{ A}$ ,<br>$R_G=4.7\ \Omega$ , $V_{GS}=10\text{ V}$<br>(see <a href="#">Figure 16</a> ) | -    | 8.8<br>17.2 | -    | ns<br>ns |
| $t_{d(off)}$<br>$t_f$ | Turn-off delay time<br>Fall time | $V_{DD}=125\text{ V}$ , $I_D=8.5\text{ A}$ ,<br>$R_G=4.7\ \Omega$ , $V_{GS}=10\text{ V}$<br>(see <a href="#">Figure 16</a> ) | -    | 21<br>8.8   | -    | ns<br>ns |

Table 8. Source drain diode

| Symbol                            | Parameter  | Test conditions   | Min. | Typ.                | Max.     | Unit                     |
|-----------------------------------|--|---|------|---------------------|----------|--------------------------|
| $I_{SD}$<br>$I_{SDM}^{(1)}$       | Source-drain current<br>Source-drain current<br>(pulsed)                     |   | -    |                     | 17<br>68 | A<br>A                   |
| $V_{SD}^{(2)}$                    | Forward on voltage   | $I_{SD}=17\text{ A}$ , $V_{GS}=0$   | -    |                     | 1.5      | V                        |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD} = 17\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 50\text{ V}$<br>(see <a href="#">Figure 18</a> )                                   | -    | 157<br>0.91<br>11.6 |          | ns<br>$\mu\text{C}$<br>A |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD} = 17\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 50\text{ V}$ , $T_j=150\text{ }^\circ\text{C}$<br>(see <a href="#">Figure 18</a> ) | -    | 196<br>1.34<br>13.7 |          | ns<br>$\mu\text{C}$<br>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 for D<sup>2</sup>PAK

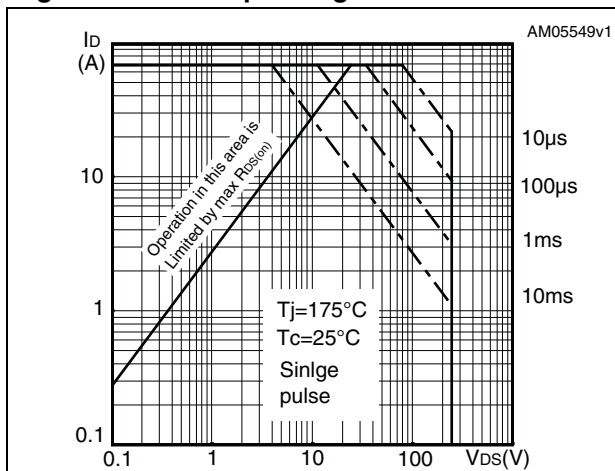


Figure 3. Thermal impedance for D<sup>2</sup>PAK

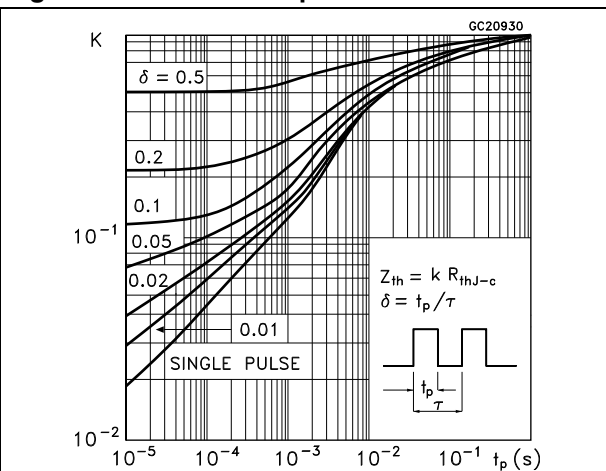


Figure 4. Safe operating area for DPAK

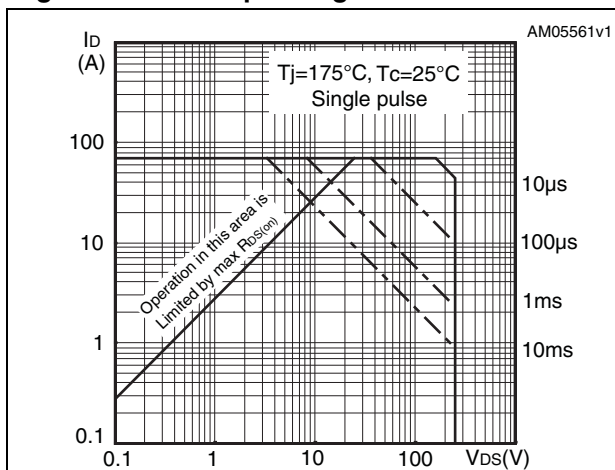


Figure 5. Thermal impedance for DPAK

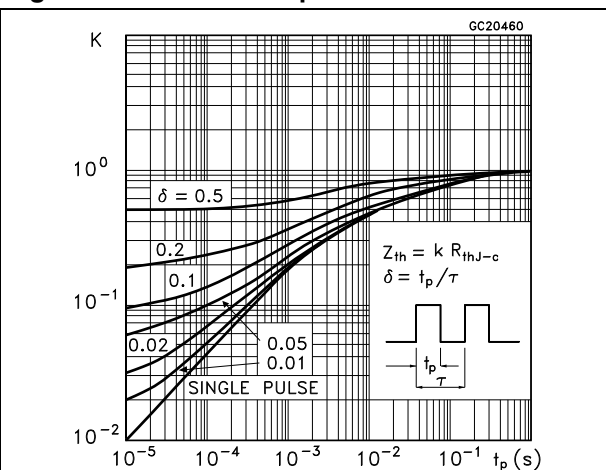


Figure 6. Output characteristics

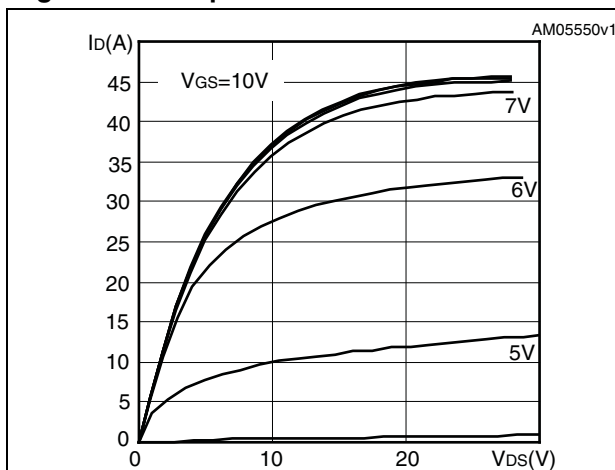


Figure 7. Transfer characteristics

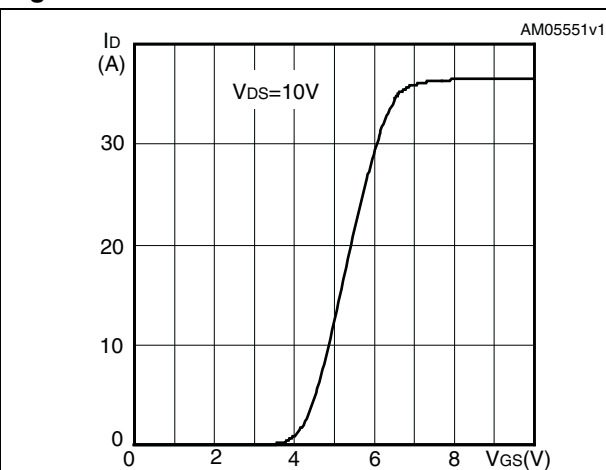


Figure 8. Gate charge vs gate-source voltage Figure 9. Static drain-source on-resistance

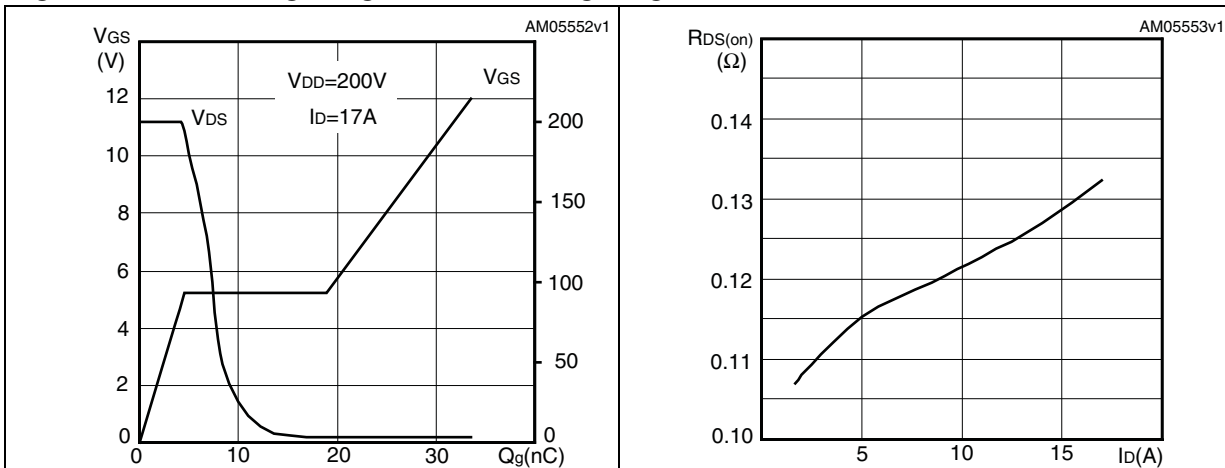


Figure 10. Output capacitance stored energy Figure 11. Capacitance variations

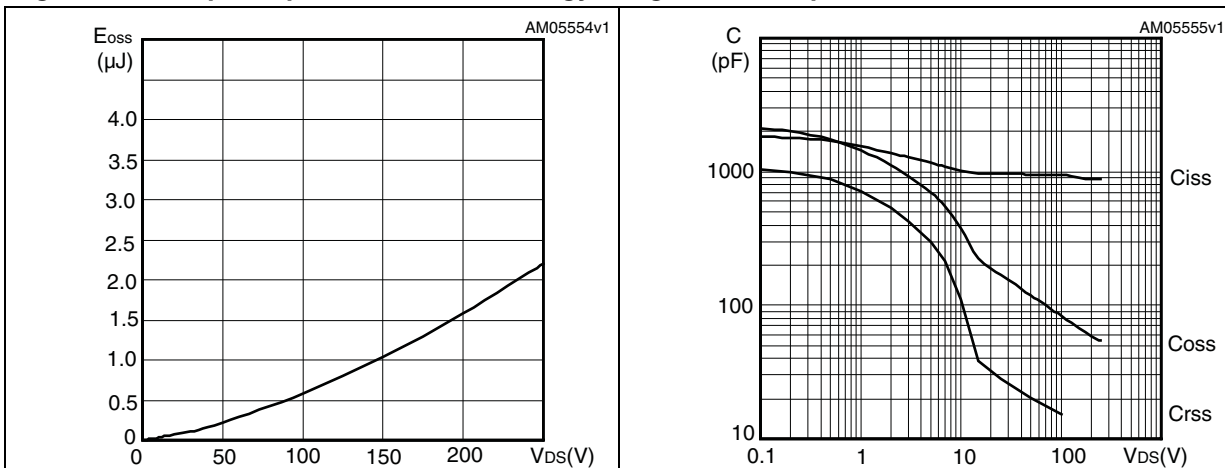


Figure 12. Normalized gate threshold voltage vs temperature Figure 13. Normalized on resistance vs temperature

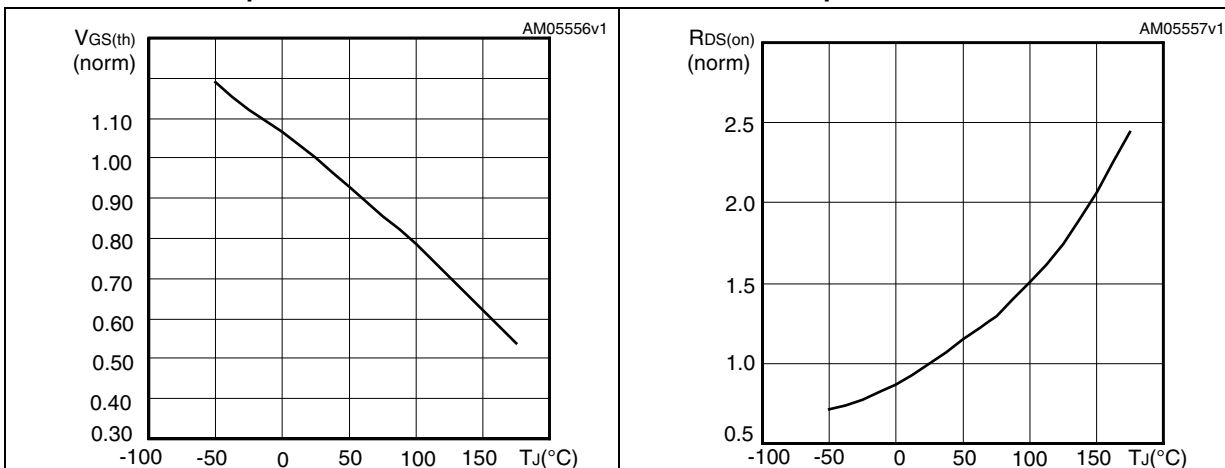


Figure 14. Source-drain diode forward characteristics

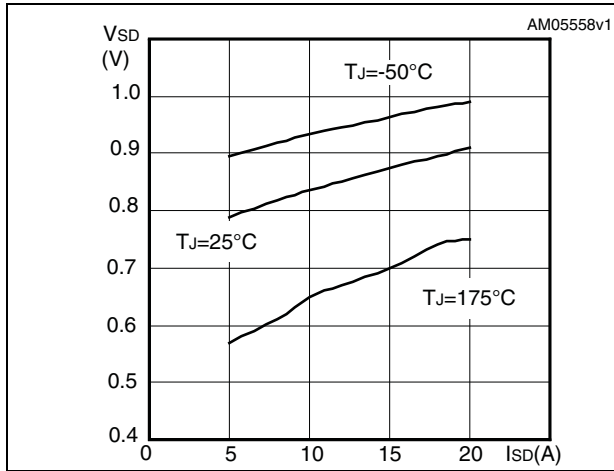
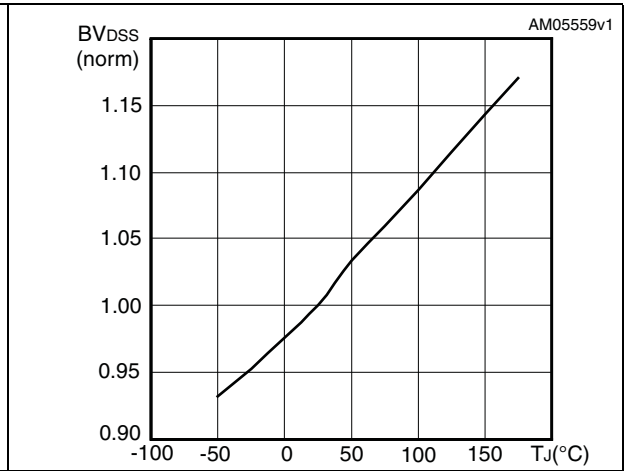


Figure 15. Normalized BV<sub>DSS</sub> vs temperature





### 3 Test circuits

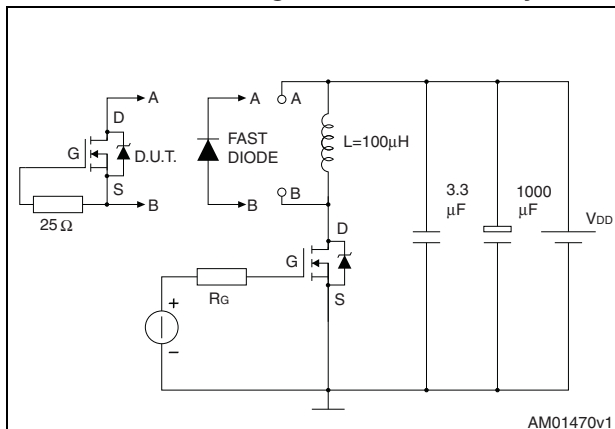
**Figure 16. Switching times test circuit for resistive load**



**Figure 17. Gate charge test circuit**



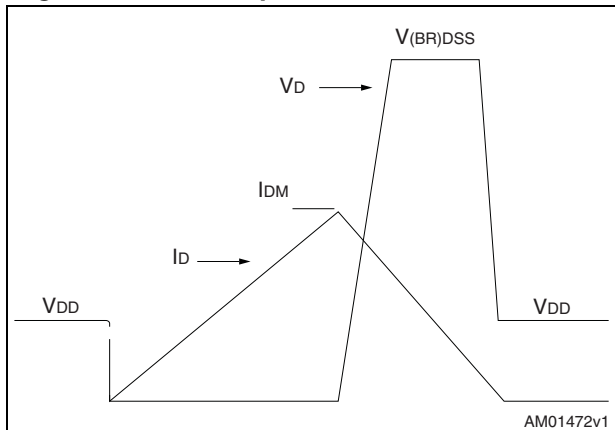
**Figure 18. Test circuit for inductive load switching and diode recovery times**



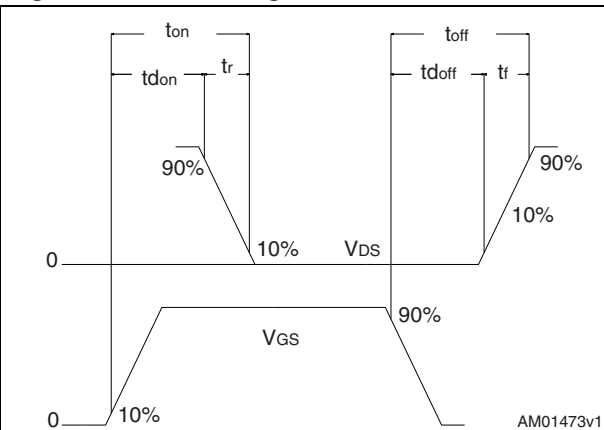
**Figure 19. Unclamped inductive load test circuit**



**Figure 20. Unclamped inductive waveform**



**Figure 21. 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. D<sup>2</sup>PAK (TO-263) mechanical data**

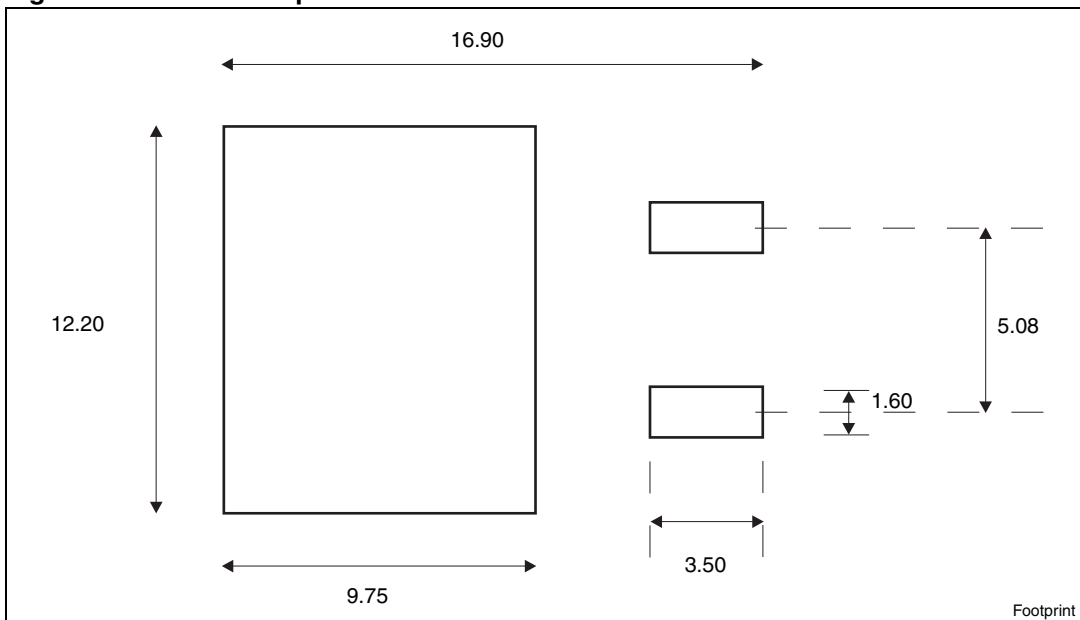
| Dim. | mm   |      |       |
|------|------|------|-------|
|      | Min. | Typ. | Max.  |
| A    | 4.40 |      | 4.60  |
| A1   | 0.03 |      | 0.23  |
| b    | 0.70 |      | 0.93  |
| b2   | 1.14 |      | 1.70  |
| c    | 0.45 |      | 0.60  |
| c2   | 1.23 |      | 1.36  |
| D    | 8.95 |      | 9.35  |
| D1   | 7.50 |      |       |
| E    | 10   |      | 10.40 |
| E1   | 8.50 |      |       |
| e    |      | 2.54 |       |
| e1   | 4.88 |      | 5.28  |
| H    | 15   |      | 15.85 |
| J1   | 2.49 |      | 2.69  |
| L    | 2.29 |      | 2.79  |
| L1   | 1.27 |      | 1.40  |
| L2   | 1.30 |      | 1.75  |
| R    |      | 0.4  |       |
| V2   | 0°   |      | 8°    |

Figure 22. D<sup>2</sup>PAK (TO-263) drawing



0079457\_T

Figure 23. D<sup>2</sup>PAK footprint<sup>(a)</sup>

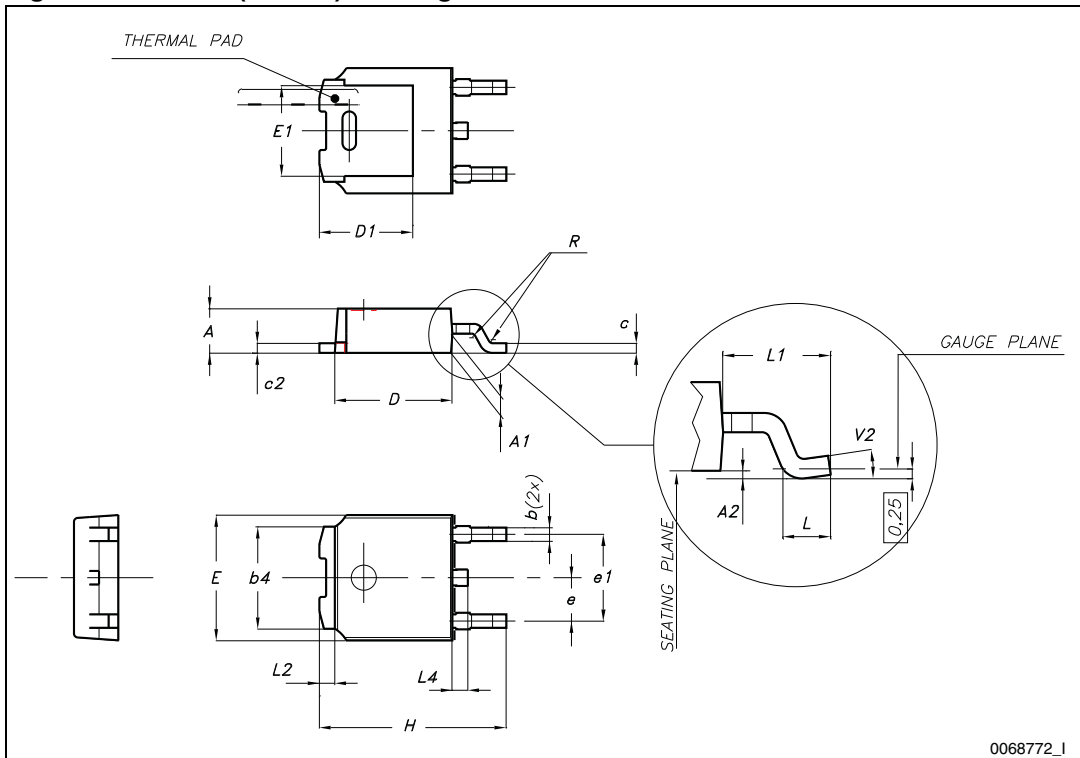


a. All dimensions are in millimeters

Table 10. DPAK (TO-252) mechanical data

| Dim. | mm   |      |       |
|------|------|------|-------|
|      | Min. | Typ. | Max.  |
| A    | 2.20 |      | 2.40  |
| A1   | 0.90 |      | 1.10  |
| A2   | 0.03 |      | 0.23  |
| b    | 0.64 |      | 0.90  |
| b4   | 5.20 |      | 5.40  |
| c    | 0.45 |      | 0.60  |
| c2   | 0.48 |      | 0.60  |
| D    | 6.00 |      | 6.20  |
| D1   |      | 5.10 |       |
| E    | 6.40 |      | 6.60  |
| E1   |      | 4.70 |       |
| e    |      | 2.28 |       |
| e1   | 4.40 |      | 4.60  |
| H    | 9.35 |      | 10.10 |
| L    | 1    |      | 1.50  |
| L1   |      | 2.80 |       |
| L2   |      | 0.80 |       |
| L4   | 0.60 |      | 1     |
| R    |      | 0.20 |       |
| V2   | 0°   |      | 8°    |

Figure 24. DPAK (TO-252) drawing



## 5 Packaging mechanical data

Table 11. D<sup>2</sup>PAK (TO-263) tape and reel mechanical data

| Tape |      |      | Reel |          |      |
|------|------|------|------|----------|------|
| Dim. | mm   |      | Dim. | mm       |      |
|      | Min. | Max. |      | Min.     | Max. |
| A0   | 10.5 | 10.7 | A    |          | 330  |
| B0   | 15.7 | 15.9 | B    | 1.5      |      |
| D    | 1.5  | 1.6  | C    | 12.8     | 13.2 |
| D1   | 1.59 | 1.61 | D    | 20.2     |      |
| E    | 1.65 | 1.85 | G    | 24.4     | 26.4 |
| F    | 11.4 | 11.6 | N    | 100      |      |
| K0   | 4.8  | 5.0  | T    |          | 30.4 |
| P0   | 3.9  | 4.1  |      |          |      |
| P1   | 11.9 | 12.1 |      | Base qty | 1000 |
| P2   | 1.9  | 2.1  |      | Bulk qty | 1000 |
| R    | 50   |      |      |          |      |
| T    | 0.25 | 0.35 |      |          |      |
| W    | 23.7 | 24.3 |      |          |      |

Table 12. DPAK (TO-252) tape and reel mechanical data

| Tape |      |      | Reel |           |      |
|------|------|------|------|-----------|------|
| Dim. | mm   |      | Dim. | mm        |      |
|      | Min. | Max. |      | Min.      | Max. |
| A0   | 6.8  | 7    | A    |           | 330  |
| B0   | 10.4 | 10.6 | B    | 1.5       |      |
| B1   |      | 12.1 | C    | 12.8      | 13.2 |
| D    | 1.5  | 1.6  | D    | 20.2      |      |
| D1   | 1.5  |      | G    | 16.4      | 18.4 |
| E    | 1.65 | 1.85 | N    | 50        |      |
| F    | 7.4  | 7.6  | T    |           | 22.4 |
| K0   | 2.55 | 2.75 |      |           |      |
| P0   | 3.9  | 4.1  |      | Base qty. | 2500 |
| P1   | 7.9  | 8.1  |      | Bulk qty. | 2500 |

Table 12. DPAK (TO-252) tape and reel mechanical data (continued)

| Tape |      |      | Reel |      |      |
|------|------|------|------|------|------|
| Dim. | mm   |      | Dim. | mm   |      |
|      | Min. | Max. |      | Min. | Max. |
| P2   | 1.9  | 2.1  |      |      |      |
| R    | 40   |      |      |      |      |
| T    | 0.25 | 0.35 |      |      |      |
| W    | 15.7 | 16.3 |      |      |      |

Figure 25. Tape

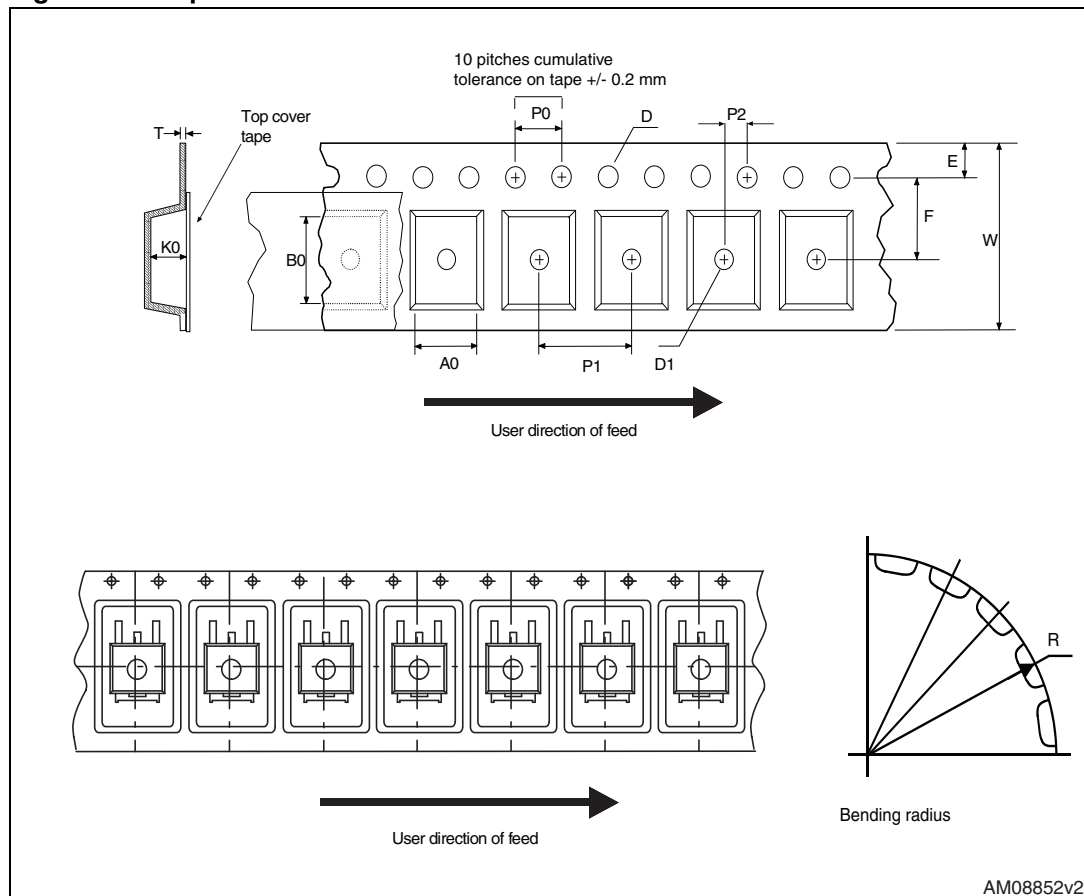
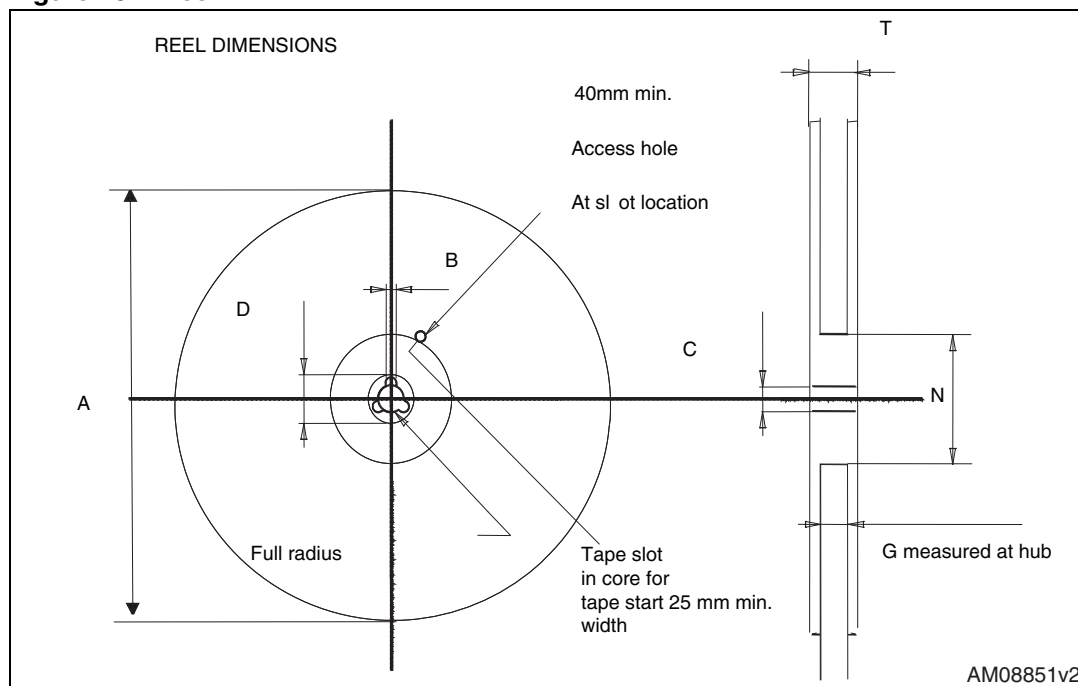


Figure 26. Reel





## 6 Revision history

**Table 13. Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 16-Nov-2009 | 1        | First release  |
| 19-Feb-2010 | 2        | $V_{DS}$ value in <a href="#">Table 8</a> has been corrected.  |
| 26-Apr-2012 | 3        | Updated $E_{AS}$ in <a href="#">Table 4: Avalanche data</a> , <a href="#">Section 4: Package mechanical data</a> and <a href="#">Section 5: Packaging mechanical data</a> .<br>Minor text changes. |

**Please Read Carefully:**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY TWO AUTHORIZED ST REPRESENTATIVES, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2012 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

[www.st.com](http://www.st.com)