



# STW26NM50

N-channel 500 V, 0.10  $\Omega$ , 30 A TO-247  
MDmesh™ Power MOSFET

## Features

| Type      | V <sub>DSS</sub> | R <sub>DS(on)</sub><br>max | I <sub>D</sub> |
|-----------|------------------|----------------------------|----------------|
| STW26NM50 | 500 V            | < 0.12 $\Omega$            | 30 A           |

- High dv/dt and avalanche capabilities
- Improved ESD capability
- Low input capacitance and gate charge

## Application

- Switching applications

## Description

MDmesh™ technology applies the benefits of the multiple drain process to STMicroelectronics' well-known PowerMESH™ horizontal layout structure. The resulting product offers low on-resistance, high dv/dt capability and excellent avalanche characteristics.

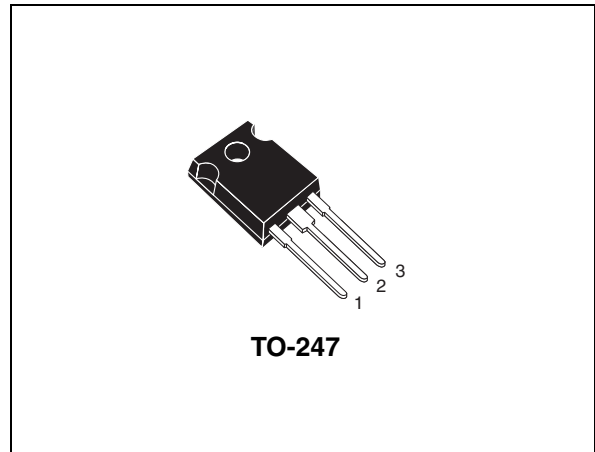


Figure 1. Internal schematic diagram

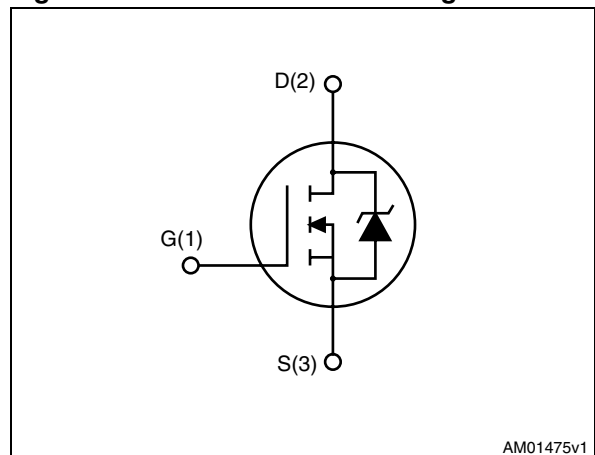


Table 1. Device summary

| Order codes | Marking | Package | Packaging |
|-------------|---------|---------|-----------|
| STW26NM50   | W26NM50 | TO-247  | Tube      |

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol         | Parameter                                                         | Value      | Unit                  |
|----------------|-------------------------------------------------------------------|------------|-----------------------|
| $V_{DS}$       | Drain-source voltage ( $V_{GS} = 0$ )                             | 500        | V                     |
| $V_{GS}$       | Gate-source voltage                                               | $\pm 30$   | V                     |
| $I_D$          | Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$  | 30         | A                     |
| $I_D$          | Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$ | 18.9       | A                     |
| $I_{DM}^{(1)}$ | Drain current (pulsed)                                            | 120        | A                     |
| $P_{TOT}$      | Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$           | 313        | W                     |
|                | Derating factor                                                   | 2.5        | W/ $^{\circ}\text{C}$ |
| $V_{ESD(G-S)}$ | Gate source ESD (HBM-C=100 pF, R=1.5 k $\Omega$ )                 | 6000       | V                     |
| $dv/dt^{(2)}$  | Peak diode recovery voltage slope                                 | 15         | V/ns                  |
| $T_{stg}$      | Storage temperature                                               | -55 to 150 | $^{\circ}\text{C}$    |
| $T_j$          | Max. operating junction temperature                               | 150        | $^{\circ}\text{C}$    |

1. Pulse width limited by safe operating area

2.  $I_{SD} \leq 26\text{ A}$ ,  $di/dt \leq 200\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_j \leq T_{JMAX}$

**Table 3. Thermal data**

| Symbol         | Parameter                                      | Value | Unit                        |
|----------------|------------------------------------------------|-------|-----------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case max           | 0.4   | $^{\circ}\text{C}/\text{W}$ |
| $R_{thj-amb}$  | Thermal resistance junction-ambient max        | 62.5  | $^{\circ}\text{C}/\text{W}$ |
| $T_l$          | Maximum lead temperature for soldering purpose | 300   | $^{\circ}\text{C}$          |

**Table 4. Avalanche characteristics**

| Symbol   | Parameter                                                                                                        | Value | Unit |
|----------|------------------------------------------------------------------------------------------------------------------|-------|------|
| $I_{AR}$ | Avalanche current, repetitive or not-repetitive (pulse width limited by $T_{jmax}$ )                             | 13    | A    |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_j=25\text{ }^{\circ}\text{C}$ , $I_D=I_{AR}$ , $V_{DD}=50\text{ V}$ ) | 740   | 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                   | $I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0$                                        | 500  |      |           | V                              |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max rating}$<br>$V_{DS} = \text{Max rating}$ , $T_C = 125\text{ °C}$ |      |      | 10<br>100 | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate-body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20\text{ V}$                                                           |      |      | $\pm 10$  | $\mu\text{A}$                  |
| $V_{GS(th)}$  | Gate threshold voltage                           | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                   | 3    | 4    | 5         | V                              |
| $R_{DS(on)}$  | Static drain-source on resistance                | $V_{GS} = 10\text{ V}$ , $I_D = 13\text{ A}$                                         |      | 0.10 | 0.12      | $\Omega$                       |

**Table 6. Dynamic**

| Symbol                              | Parameter                                                               | Test conditions                                                                                | Min. | Typ.              | Max. | Unit           |
|-------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------|-------------------|------|----------------|
| $g_{fs}^{(1)}$                      | Forward transconductance                                                | $V_{DS} = 15\text{ V}$ , $I_D = 13\text{ A}$                                                   | -    | 20                | -    | S              |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer Capacitance | $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ ,<br>$V_{GS} = 0$                                  | -    | 3000<br>700<br>50 | -    | pF<br>pF<br>pF |
| $C_{oss\text{ eq.}}^{(2)}$          | Equivalent output capacitance                                           | $V_{GS} = 0$ , $V_{DS} = 0\text{ to }400\text{ V}$                                             | -    | 300               | -    | pF             |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$       | Total gate charge<br>Gate-source charge<br>Gate-drain charge            | $V_{DD} = 400\text{ V}$ , $I_D = 26\text{ A}$ ,<br>$V_{GS} = 10\text{ V}$ ,<br>(see Figure 15) | -    | 76<br>20<br>36    | -    | nC<br>nC<br>nC |

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

2.  $C_{oss\text{ eq.}}$  is defined as a constant equivalent capacitance giving the same charging time as  $C_{oss}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DS}$

**Table 7. Switching times**

| Symbol                                        | Parameter                                                           | Test conditions                                                                                                            | Min. | Typ.                 | Max. | Unit                 |
|-----------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------|----------------------|------|----------------------|
| $t_{d(on)}$<br>$t_r$<br>$t_{d(off)}$<br>$t_f$ | Turn-on delay time<br>Rise time<br>Turn-off-delay time<br>Fall time | $V_{DD} = 250\text{ V}$ , $I_D = 13\text{ A}$ ,<br>$R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ ,<br>(see Figure 15) | -    | 28<br>15<br>13<br>19 | -    | ns<br>ns<br>ns<br>ns |

**Table 8. Source drain diode**

| Symbol          | Parameter                     | Test conditions                                             | Min | Typ. | Max | Unit          |
|-----------------|-------------------------------|-------------------------------------------------------------|-----|------|-----|---------------|
| $I_{SD}$        | Source-drain current          |                                                             | -   |      | 26  | A             |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) |                                                             | -   |      | 104 | A             |
| $V_{SD}^{(2)}$  | Forward on voltage            | $I_{SD} = 26\text{ A}$ , $V_{GS} = 0$                       | -   |      | 1.5 | V             |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 26\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ | -   | 400  |     | ns            |
| $Q_{rr}$        | Reverse recovery charge       | $V_{DD} = 100\text{ V}$                                     | -   | 5.5  |     | $\mu\text{C}$ |
| $I_{RRM}$       | Reverse recovery current      | (see Figure 16)                                             | -   | 27.8 |     | A             |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 26\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ | -   | 492  |     | ns            |
| $Q_{rr}$        | Reverse recovery charge       | $V_{DD} = 100\text{ V}$ , $T_j = 150\text{ }^\circ\text{C}$ | -   | 7    |     | $\mu\text{C}$ |
| $I_{RRM}$       | Reverse recovery current      | (see Figure 16)                                             | -   | 28.8 |     | A             |

1. Pulse width limited by safe operating area

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

**Table 9. Gate-source Zener diode**

| Symbol     | Parameter                     | Test conditions                         | Min. | Typ. | Max. | Unit |
|------------|-------------------------------|-----------------------------------------|------|------|------|------|
| $BV_{GSO}$ | Gate-source breakdown voltage | $I_{GS} = \pm 1\text{ mA}$ (open drain) | 30   | -    | -    | V    |

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

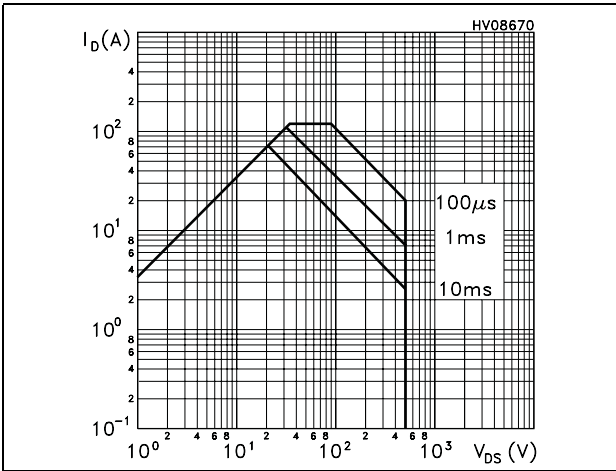


Figure 3. Thermal impedance

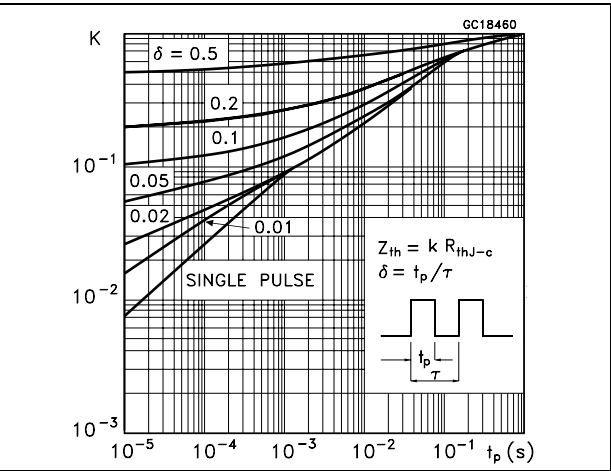


Figure 4. Output characteristics

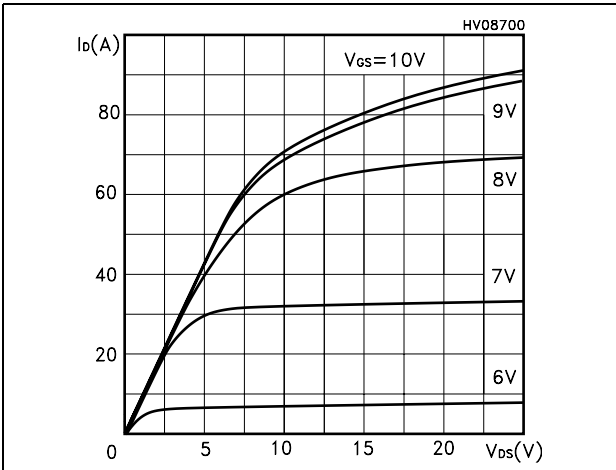


Figure 5. Transfer characteristics

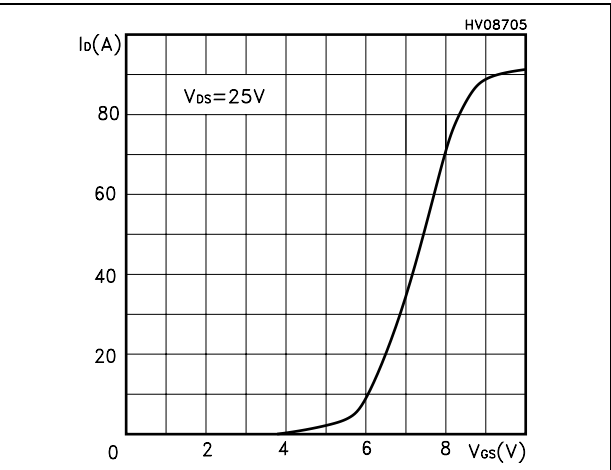


Figure 6. Transconductance

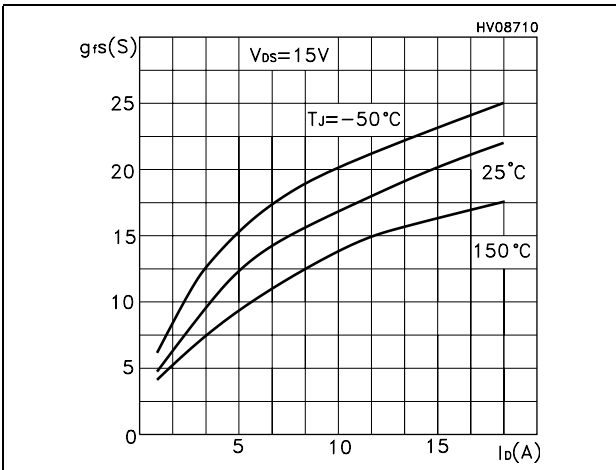


Figure 7. Static drain-source on resistance

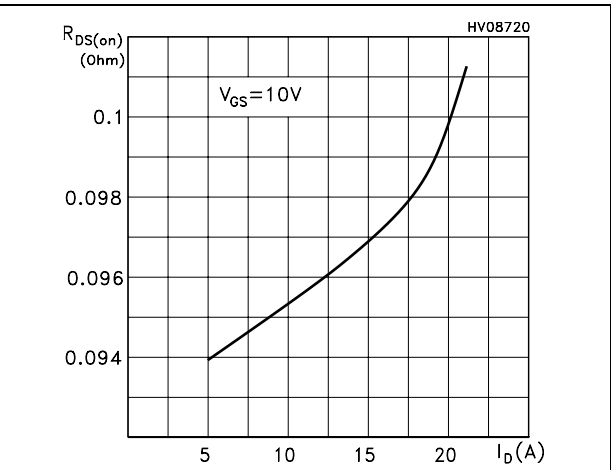


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

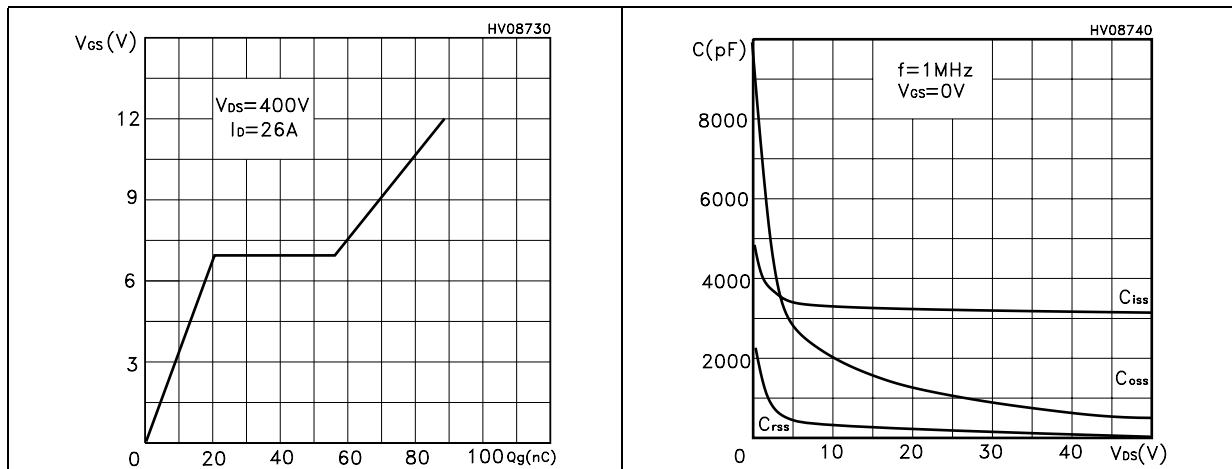


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

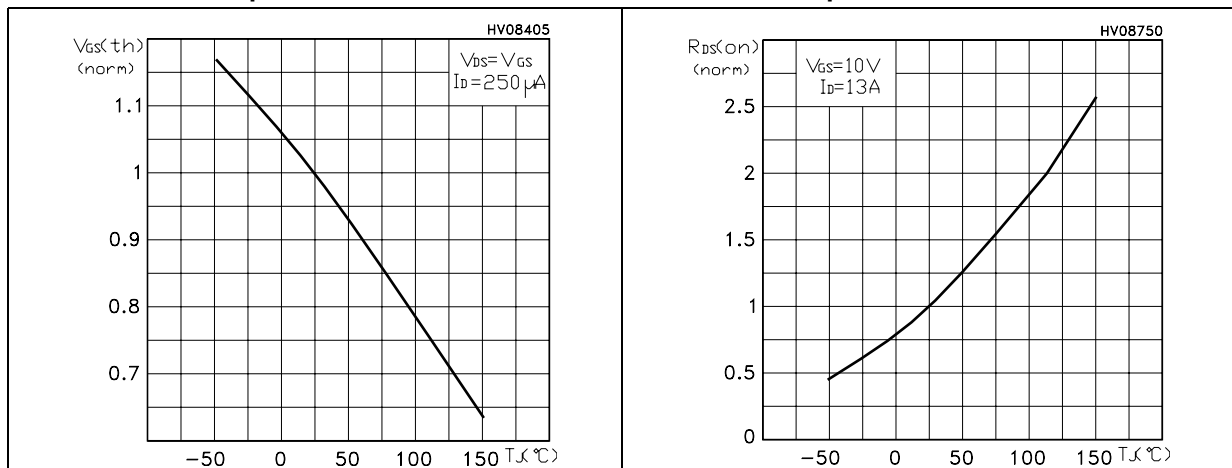
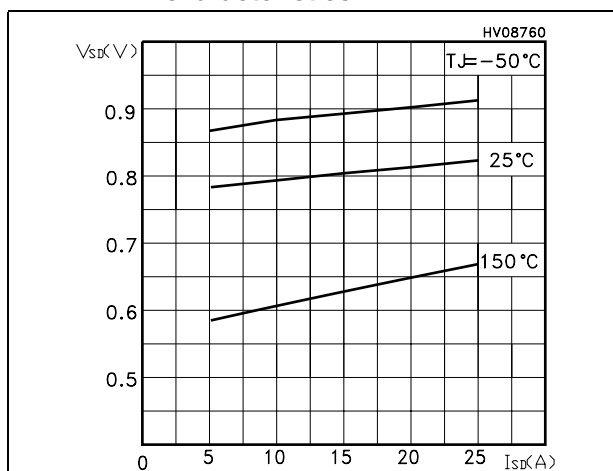
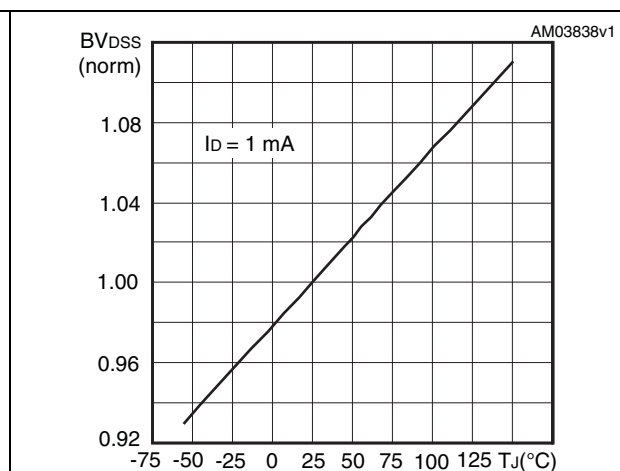
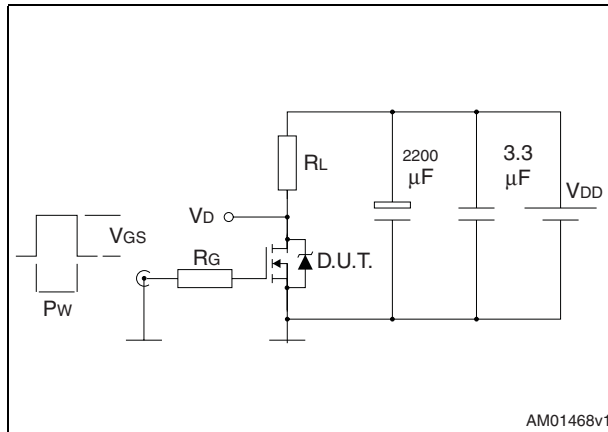


Figure 12. Source-drain diode forward characteristics

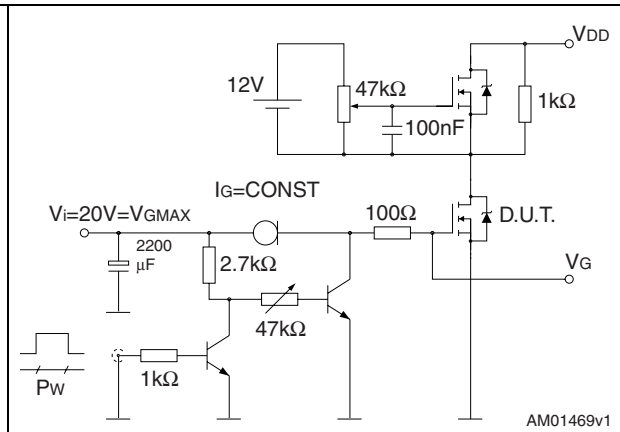
Figure 13. Normalized  $B_{VDS}$  vs temperature

### 3 Test circuits

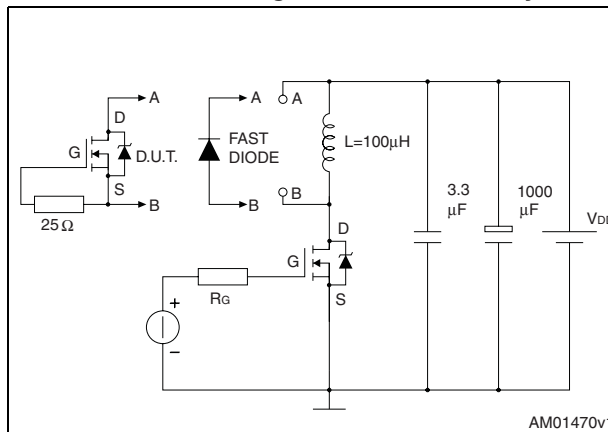
**Figure 14. Switching times test circuit for resistive load**



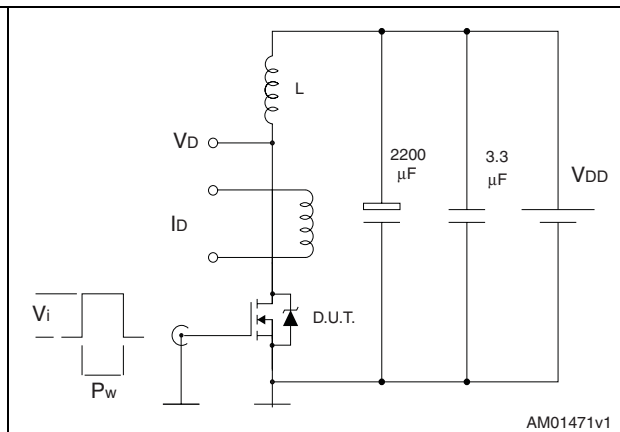
**Figure 15. Gate charge test circuit**



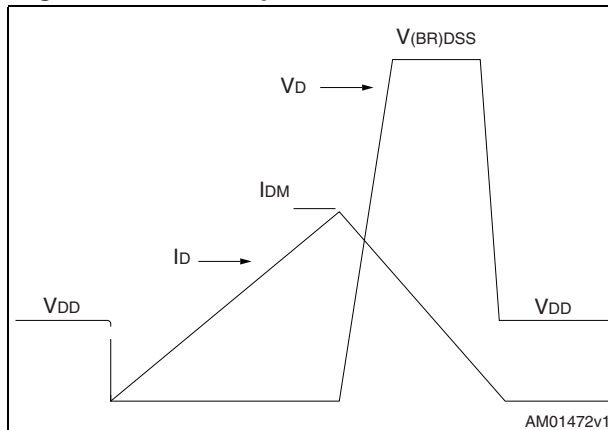
**Figure 16. Test circuit for inductive load switching and diode recovery times**



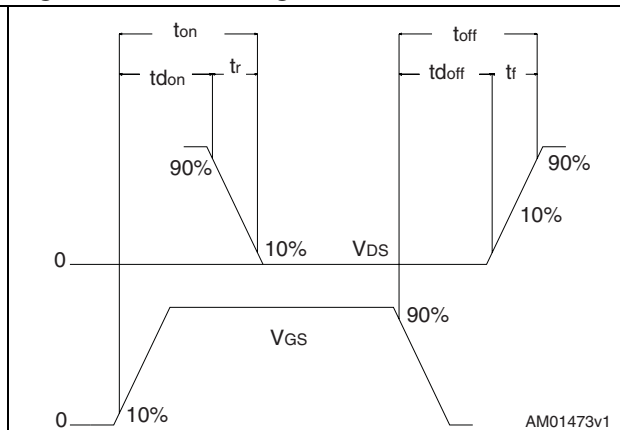
**Figure 17. Unclamped inductive load test circuit**



**Figure 18. Unclamped inductive waveform**



**Figure 19. Switching time waveform**



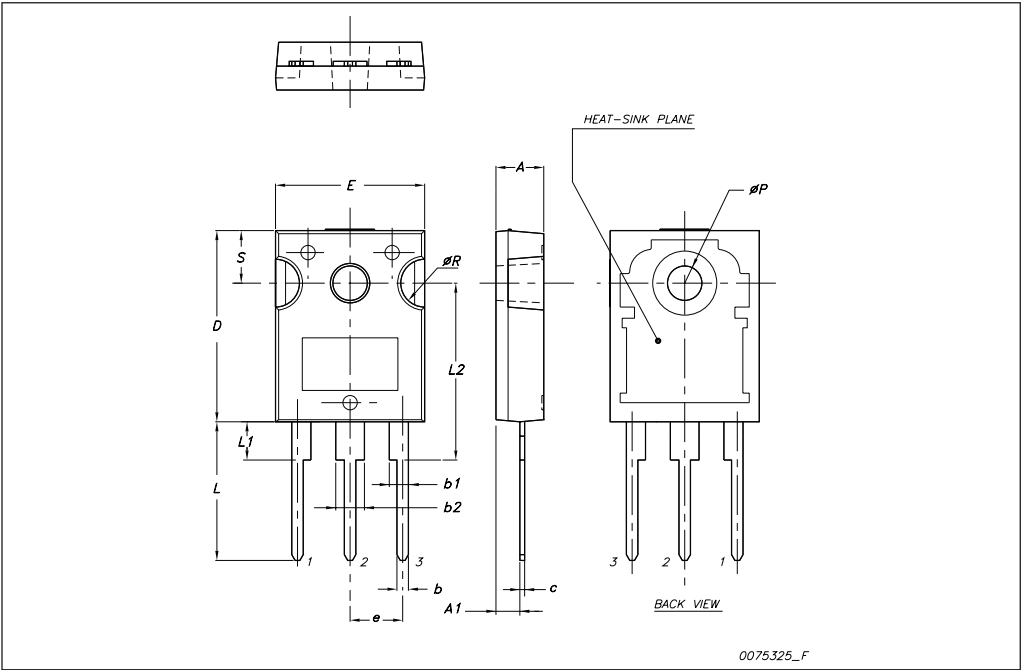


## 4      **Package mechanical data**

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.

TO-247 mechanical data

| Dim. | mm.   |       |       |
|------|-------|-------|-------|
|      | Min.  | Typ.  | Max.  |
| A    | 4.85  |       | 5.15  |
| A1   | 2.20  |       | 2.60  |
| b    | 1.0   |       | 1.40  |
| b1   | 2.0   |       | 2.40  |
| b2   | 3.0   |       | 3.40  |
| c    | 0.40  |       | 0.80  |
| D    | 19.85 |       | 20.15 |
| E    | 15.45 |       | 15.75 |
| e    |       | 5.45  |       |
| L    | 14.20 |       | 14.80 |
| L1   | 3.70  |       | 4.30  |
| L2   |       | 18.50 |       |
| øP   | 3.55  |       | 3.65  |
| øR   | 4.50  |       | 5.50  |
| S    |       | 5.50  |       |



## 5 Revision history

**Table 10. Document revision history**

| Date        | Revision | Changes                                                              |
|-------------|----------|----------------------------------------------------------------------|
| 24-Jun-2004 | 9        | New stylesheet.                                                      |
| 07-Feb-2005 | 10       | $I_D$ value changed                                                  |
| 02-Oct-2009 | 11       | Modified: test condition of $V_{(BR)DSS}$ in <a href="#">Table 5</a> |

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