

## N-channel 600 V, 0.135 $\Omega$ typ., 20 A MDmesh™ II Power MOSFET in a TO-220FP package

Datasheet - production data

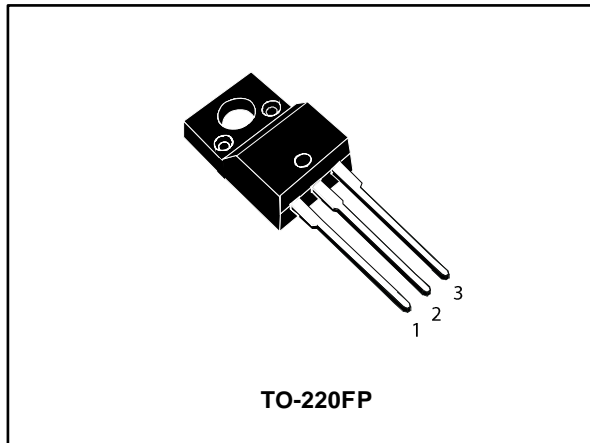
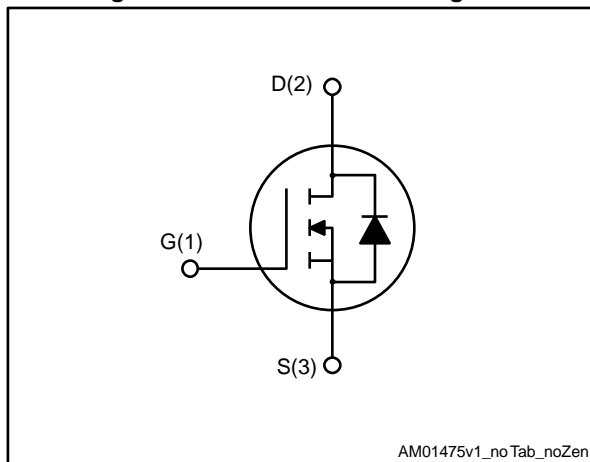


Figure 1: Internal schematic diagram



### Features

| Order code | V <sub>DS</sub> | R <sub>DS(on)</sub> max | I <sub>D</sub> |
|------------|-----------------|-------------------------|----------------|
| STF26NM60N | 600 V           | 0.165 $\Omega$          | 20 A           |

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

### Applications

- Switching applications

### Description

This device is an N-channel Power MOSFET developed using the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

Table 1: Device summary

| Order code | Marking | Package  | Packaging |
|------------|---------|----------|-----------|
| STF26NM60N | 26NM60N | TO-220FP | Tube      |

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# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

| Symbol            | Parameter  | Value      | Unit |
|-------------------|--|------------|------|
| $V_{DS}$          | Drain-source voltage   | 600        | V    |
| $V_{GS}$          | Gate-source voltage  | $\pm 30$   | V    |
| $I_D^{(1)}$       | Drain current (continuous) at $T_C = 25\text{ °C}$   | 20         | A    |
| $I_D^{(1)}$       | Drain current (continuous) at $T_C = 100\text{ °C}$  | 12.6       | A    |
| $I_{DM}^{(1)(2)}$ | Drain current (pulsed)   | 80         | A    |
| $P_{TOT}$         | Total dissipation at $T_C = 25\text{ °C}$  | 35         | W    |
| $dv/dt^{(3)}$     | Peak diode recovery voltage slope  | 15         | V/ns |
| $V_{ISO}$         | Insulation withstand voltage (RMS) from all three leads to external heat sink<br>( $t = 1\text{ s}$ ; $T_C = 25\text{ °C}$ ) | 2500       | V    |
| $T_{stg}$         | Storage temperature range  | -55 to 150 | °C   |
| $T_j$             | Operating junction temperature range   |            |      |

**Notes:**

(1)Limited by package.

(2)Pulse width limited by safe operating area.

(3) $I_{SD} \leq 20\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ,  $V_{DS(peak)} \leq V_{(BR)DSS}$ ,  $V_{DD} \leq 80\% V_{(BR)DSS}$

**Table 3: Thermal data**

| Symbol         | Parameter                           | Value | Unit |
|----------------|-------------------------------------|-------|------|
| $R_{thj-case}$ | Thermal resistance junction-case    | 3.6   | °C/W |
| $R_{thj-amb}$  | Thermal resistance junction-ambient | 62.5  | °C/W |

**Table 4: Avalanche characteristics**

| Symbol   | Parameter   | Value | Unit |
|----------|---|-------|------|
| $I_{AS}$ | Single pulse avalanche current (pulse width limited by $T_{jmax}$ )                                   | 6     | A    |
| $E_{AS}$ | Single pulse avalanche energy<br>(starting $T_J=25\text{ °C}$ , $I_D=I_{AR}$ , $V_{DD}=50\text{ V}$ ) | 610   | 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    | $I_D = 1\text{ mA}$ , $V_{GS} = 0\text{ V}$   | 600  |       |           | V             |
| $I_{DSS}$     | Zero gate voltage drain current   | $V_{GS} = 0\text{ V}$ , $V_{DS} = 600\text{ V}$   |      |       | 1         | $\mu\text{A}$ |
|               |                                   | $V_{GS} = 0\text{ V}$ , $V_{DS} = 600\text{ V}$ ,<br>$T_C = 125\text{ °C}$ <sup>(1)</sup> |      |       | 100       |               |
| $I_{GSS}$     | Gate-body leakage current         | $V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 25\text{ V}$  |      |       | $\pm 0.1$ | $\mu\text{A}$ |
| $V_{GS(th)}$  | 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 | $V_{GS} = 10\text{ V}$ , $I_D = 10\text{ A}$  |      | 0.135 | 0.165     | $\Omega$      |

**Notes:**

<sup>(1)</sup>Defined by design, not subject to production test.

**Table 6: Dynamic**

| Symbol                              | Parameter                     | Test conditions  | Min. | Typ. | Max. | Unit     |
|-------------------------------------|-------------------------------|--|------|------|------|----------|
| $C_{iss}$                           | Input capacitance             | $V_{DS} = 50\text{ V}$ , $f = 1\text{ MHz}$ ,<br>$V_{GS} = 0\text{ V}$   | -    | 1800 | -    | pF       |
| $C_{oss}$                           | Output capacitance            |  | -    | 115  | -    | pF       |
| $C_{rss}$                           | Reverse transfer capacitance  |  | -    | 6    | -    | pF       |
| $C_{oss\text{ eq.}}$ <sup>(1)</sup> | Equivalent output capacitance | $V_{GS} = 0\text{ V}$ , $V_{DS} = 0\text{ to }480\text{ V}$  | -    | 310  | -    | pF       |
| $Q_g$                               | Total gate charge             | $V_{DD} = 480\text{ V}$ , $I_D = 20\text{ A}$ ,<br>$V_{GS} = 10\text{ V}$<br>(see <a href="#">Figure 14: "Test circuit for gate charge behavior"</a> ) | -    | 60   | -    | nC       |
| $Q_{gs}$                            | Gate-source charge            |  | -    | 8.5  | -    | nC       |
| $Q_{gd}$                            | Gate-drain charge             |  | -    | 30   | -    | nC       |
| $R_G$                               | Gate input resistance         | $f = 1\text{ MHz}$ , $I_D = 0\text{ A}$  | -    | 2.8  | -    | $\Omega$ |

**Notes:**

<sup>(1)</sup> $C_{oss\text{ eq.}}$  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 |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 300\text{ V}$ , $I_D = 10\text{ A}$ ,<br>$R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$<br>(see <a href="#">Figure 13: "Test circuit for resistive load switching times"</a><br>and <a href="#">Figure 18: "Switching time waveform"</a> ) | -    | 13   | -    | ns   |
| $t_r$        | Rise time           |  | -    | 25   | -    | ns   |
| $t_{d(off)}$ | Turn-off delay time |  | -    | 85   | -    | ns   |
| $t_f$        | Fall time           |  | -    | 50   | -    | ns   |

Table 8: Source-drain diode

| Symbol          | Parameter                     | Test conditions  | Min. | Typ. | Max. | Unit          |
|-----------------|-------------------------------|--|------|------|------|---------------|
| $I_{SD}^{(1)}$  | Source-drain current          |  | -    |      | 20   | A             |
| $I_{SDM}^{(2)}$ | Source-drain current (pulsed) |  | -    |      | 80   | A             |
| $V_{SD}^{(3)}$  | Forward on voltage            | $I_{SD} = 20 \text{ A}$ , $V_{GS} = 0 \text{ V}$   | -    |      | 1.5  | V             |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 20 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$<br>$V_{DD} = 60 \text{ V}$<br>(see <a href="#">Figure 15: "Test circuit for inductive load switching and diode recovery times"</a> )                                   | -    | 370  |      | ns            |
| $Q_{rr}$        | Reverse recovery charge       |  | -    | 5.8  |      | $\mu\text{C}$ |
| $I_{RRM}$       | Reverse recovery current      |  | -    | 31.6 |      | A             |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 20 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$<br>$V_{DD} = 60 \text{ V}$ , $T_j = 150 \text{ }^\circ\text{C}$ (see <a href="#">Figure 15: "Test circuit for inductive load switching and diode recovery times"</a> ) | -    | 450  |      | ns            |
| $Q_{rr}$        | Reverse recovery charge       |  | -    | 7.5  |      | $\mu\text{C}$ |
| $I_{RRM}$       | Reverse recovery current      |  | -    | 32.5 |      | A             |

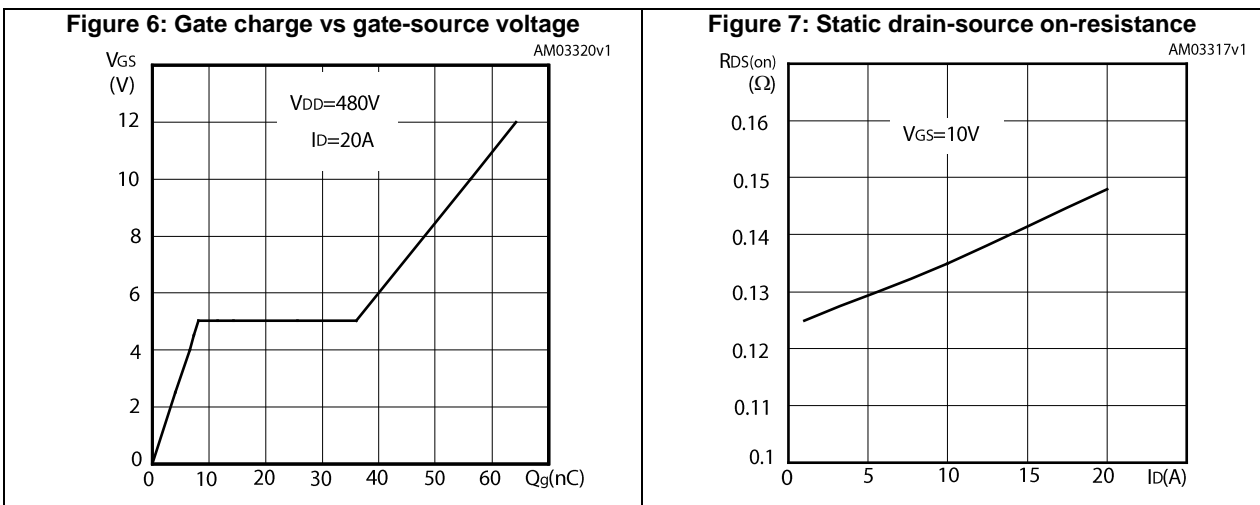
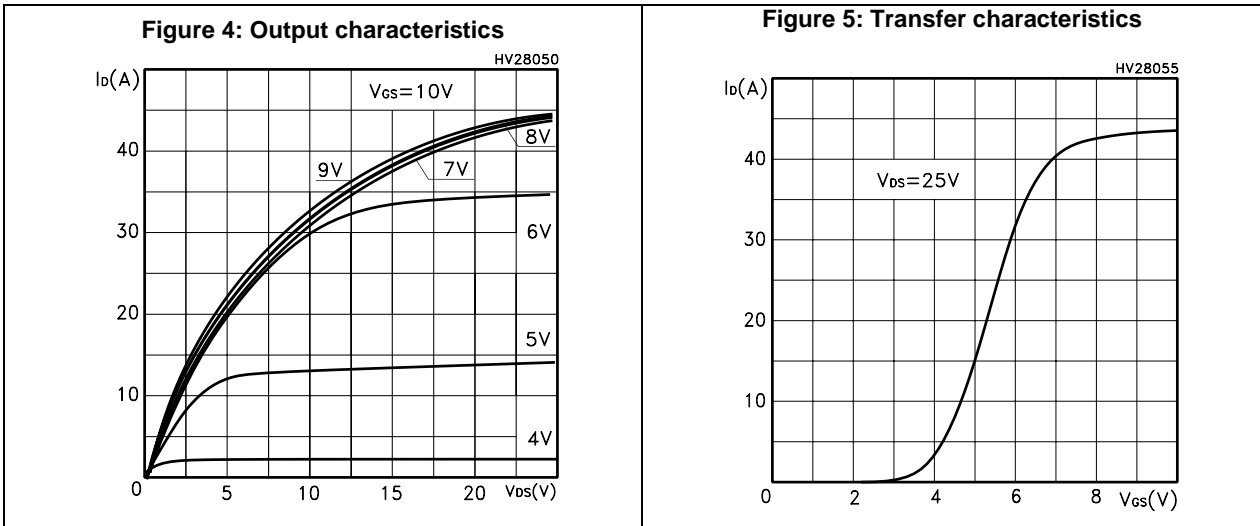
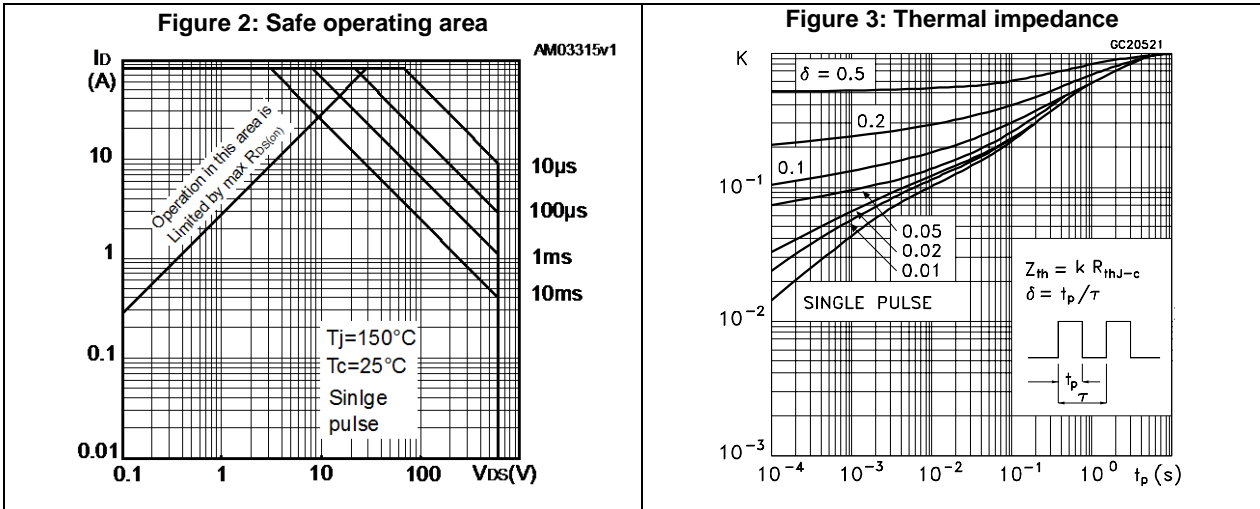
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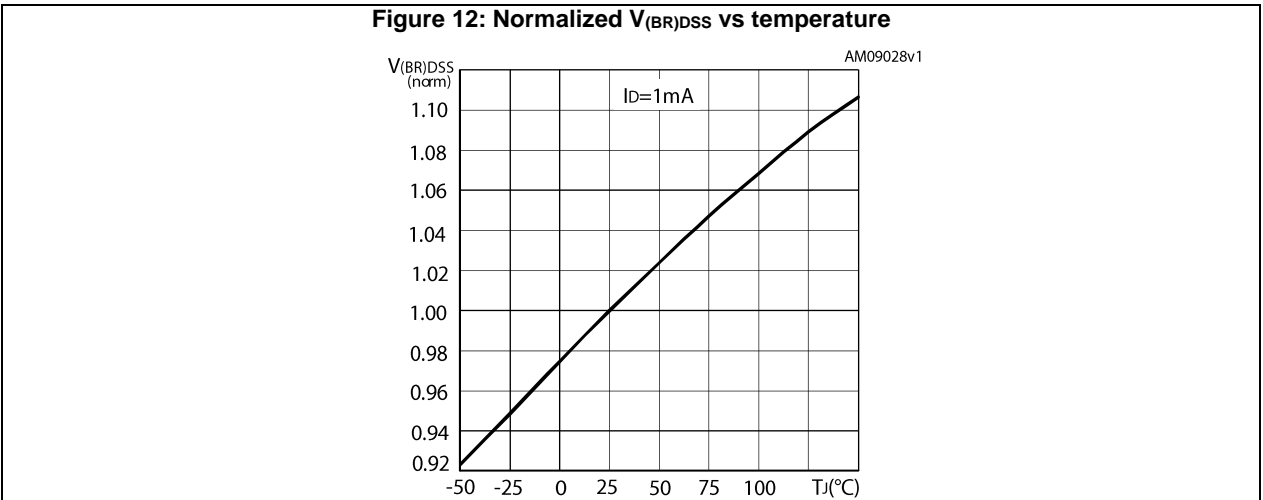
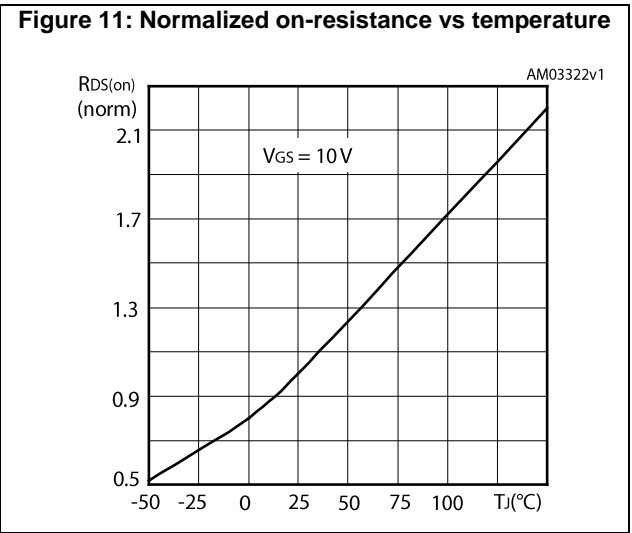
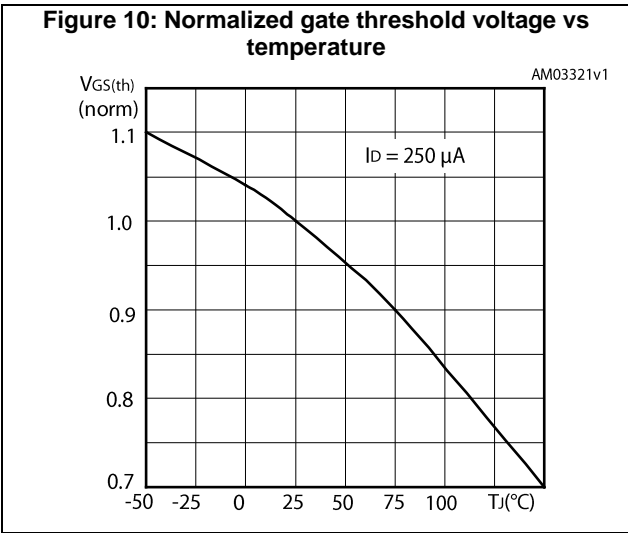
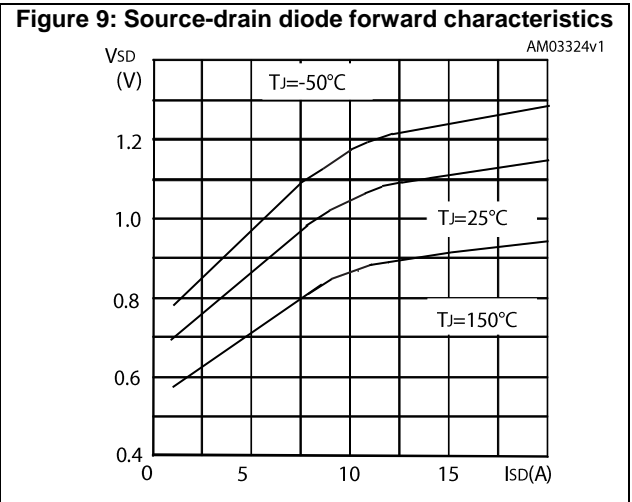
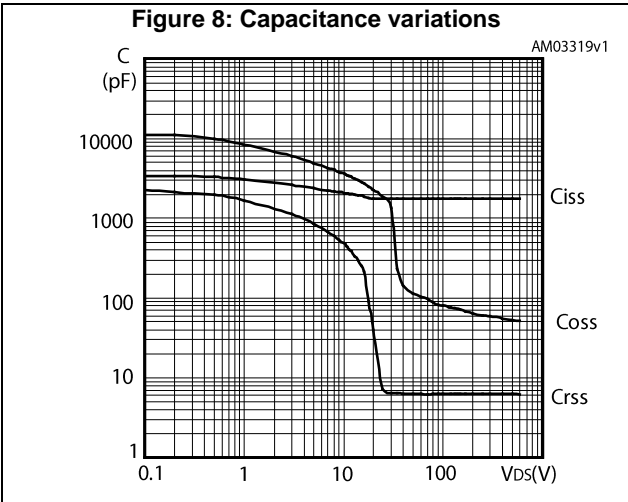
(1) Pulse width limited by package.

(2) Pulse width limited by safe operating area.

(3) Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)





### 3 Test circuits

**Figure 13: Test circuit for resistive load switching times**



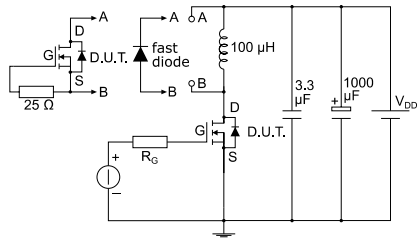
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**Figure 14: Test circuit for gate charge behavior**



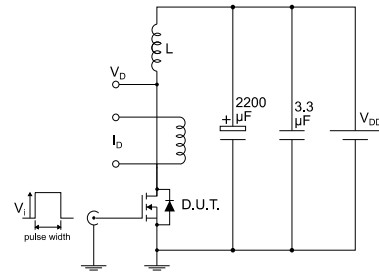
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**Figure 15: Test circuit for inductive load switching and diode recovery times**



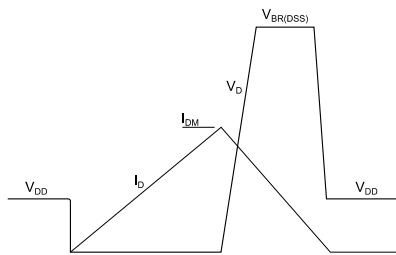
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**Figure 16: Unclamped inductive load test circuit**



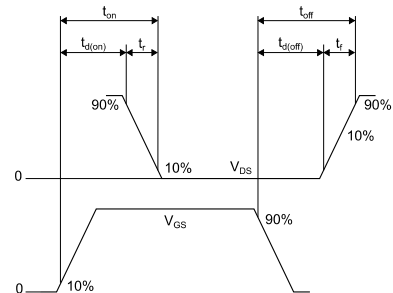
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**Figure 17: Unclamped inductive waveform**



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**Figure 18: Switching time waveform**



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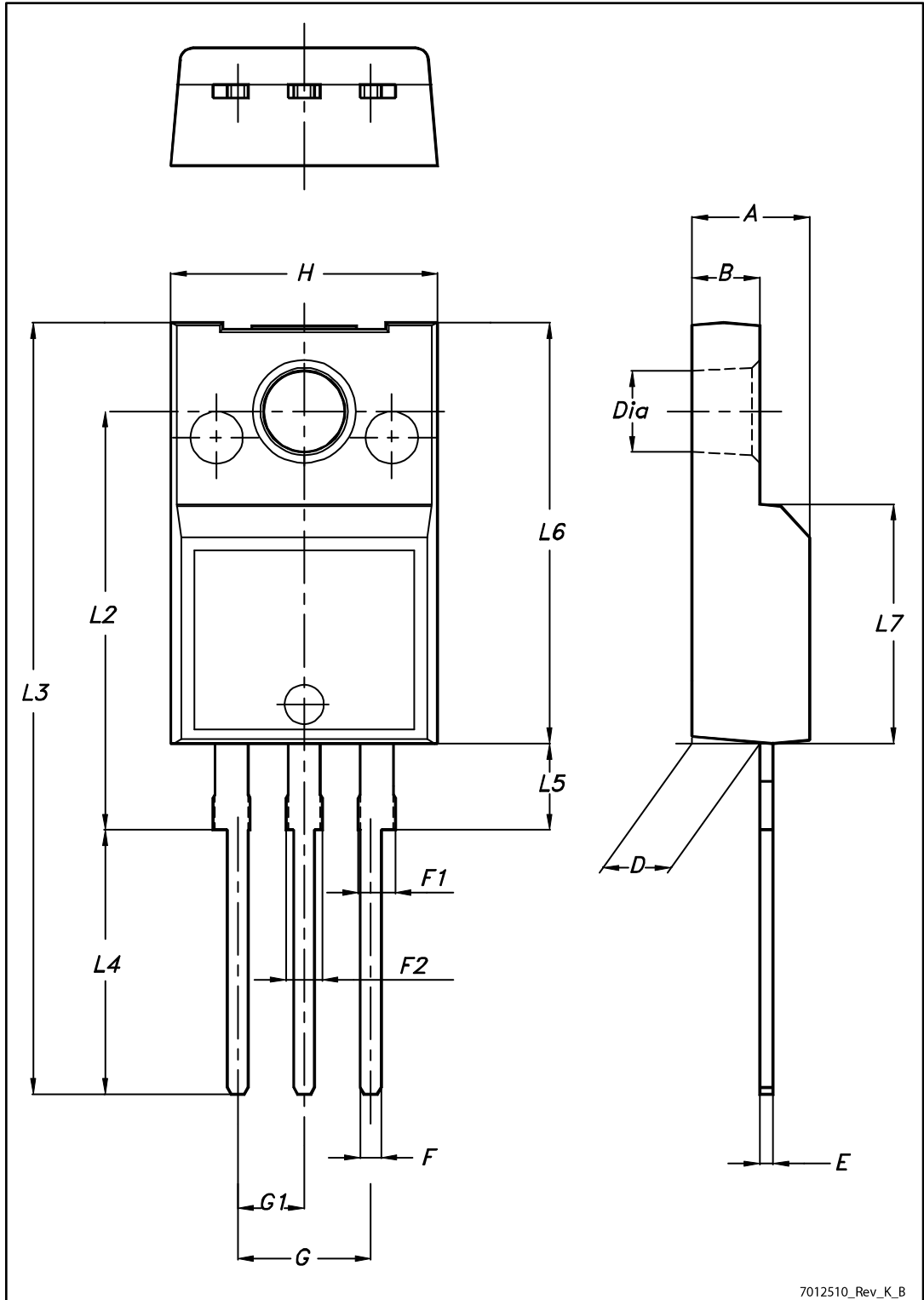


## 4 Package information

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.

### 4.1 TO-220FP package information

Figure 19: TO-220FP package outline



7012510\_Rev\_K\_B

Table 9: TO-220FP package mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    | 4.4  |      | 4.6  |
| B    | 2.5  |      | 2.7  |
| D    | 2.5  |      | 2.75 |
| E    | 0.45 |      | 0.7  |
| F    | 0.75 |      | 1    |
| F1   | 1.15 |      | 1.70 |
| F2   | 1.15 |      | 1.70 |
| G    | 4.95 |      | 5.2  |
| G1   | 2.4  |      | 2.7  |
| H    | 10   |      | 10.4 |
| L2   |      | 16   |      |
| L3   | 28.6 |      | 30.6 |
| L4   | 9.8  |      | 10.6 |
| L5   | 2.9  |      | 3.6  |
| L6   | 15.9 |      | 16.4 |
| L7   | 9    |      | 9.3  |
| Dia  | 3    |      | 3.2  |

## 5 Revision history

Table 10: Document revision history

| Date        | Revision | Changes  |
|-------------|----------|--|
| 13-Dec-2016 | 1        | First release. Part number previously included in datasheet DocID15642 |

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