

## N-channel 600 V, 550 mΩ typ., 8 A MDmesh™ DM2 Power MOSFET in a TO-220FP package

Datasheet - production data

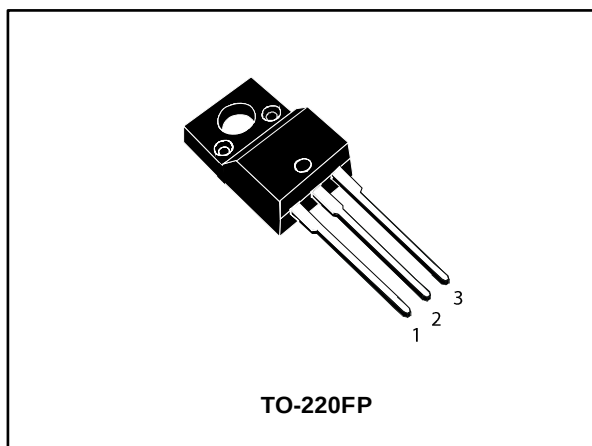
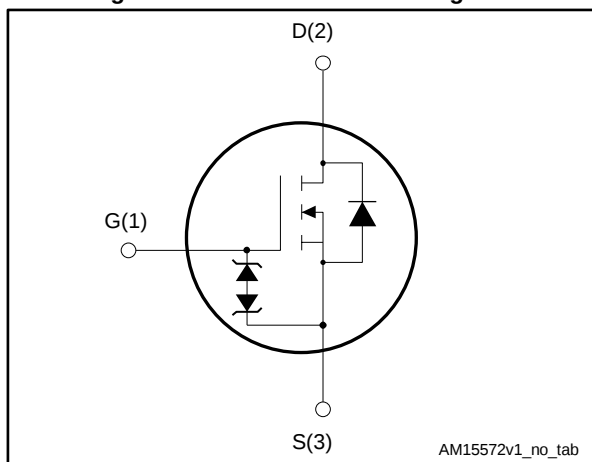


Figure 1: Internal schematic diagram



### Features

| Order code | V <sub>DS</sub> | R <sub>DS(on)</sub> max. | I <sub>D</sub> | P <sub>TOT</sub> |
|------------|-----------------|--------------------------|----------------|------------------|
| STF8N60DM2 | 600 V           | 600 mΩ                   | 8 A            | 25 W             |

- Fast-recovery body diode
- Extremely low gate charge and input capacitance
- Low on-resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness
- Zener-protected

### Applications

- Switching applications

### Description

This high voltage N-channel Power MOSFET is part of the MDmesh™ DM2 fast recovery diode series. It offers very low recovery charge ( $Q_{rr}$ ) and time ( $t_{rr}$ ) combined with low  $R_{DS(on)}$ , rendering it suitable for the most demanding high efficiency converters and ideal for bridge topologies and ZVS phase-shift converters.

Table 1: Device summary

| Order code | Marking | Package  | Packing |
|------------|---------|----------|---------|
| STF8N60DM2 | 8N60DM2 | TO-220FP | Tube    |

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## Contents

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# 1 Electrical ratings

Table 2: Absolute maximum ratings

| Symbol         | Parameter                                                                                                                               | Value      | Unit               |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------|------------|--------------------|
| $V_{GS}$       | Gate-source voltage                                                                                                                     | $\pm 25$   | V                  |
| $I_D^{(1)}$    | Drain current (continuous) at $T_{case} = 25\text{ }^{\circ}\text{C}$                                                                   | 8          | A                  |
|                | Drain current (continuous) at $T_{case} = 100\text{ }^{\circ}\text{C}$                                                                  | 5          |                    |
| $I_{DM}^{(2)}$ | Drain current (pulsed)                                                                                                                  | 32         | A                  |
| $P_{TOT}$      | Total dissipation at $T_{case} = 25\text{ }^{\circ}\text{C}$                                                                            | 25         | W                  |
| $dv/dt^{(3)}$  | Peak diode recovery voltage slope                                                                                                       | 50         | V/ns               |
| $dv/dt^{(4)}$  | MOSFET $dv/dt$ ruggedness                                                                                                               | 50         |                    |
| $V_{ISO}$      | Insulation withstand voltage (RMS) from all three leads to external heat sink ( $t = 1\text{ s}$ ; $T_c = 25\text{ }^{\circ}\text{C}$ ) | 2.5        | kV                 |
| $T_{stg}$      | Storage temperature range                                                                                                               | -55 to 150 | $^{\circ}\text{C}$ |
| $T_j$          | Operating junction temperature range                                                                                                    |            |                    |

**Notes:**

- (1) Current is limited by package.  
 (2) Pulse width is limited by safe operating area.  
 (3)  $I_{SD} \leq 8\text{ A}$ ,  $di/dt = 900\text{ A}/\mu\text{s}$ ;  $V_{DS}\text{ peak} < V_{(BR)DSS}$ ,  $V_{DD} = 400\text{ V}$ .  
 (4)  $V_{DS} \leq 480\text{ V}$ .

Table 3: Thermal data

| Symbol         | Parameter                           | Value | Unit                        |
|----------------|-------------------------------------|-------|-----------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case    | 5     | $^{\circ}\text{C}/\text{W}$ |
| $R_{thj-amb}$  | Thermal resistance junction-ambient | 62.5  |                             |

Table 4: Avalanche characteristics

| Symbol         | Parameter                                       | Value | Unit |
|----------------|-------------------------------------------------|-------|------|
| $I_{AR}^{(1)}$ | Avalanche current, repetitive or not repetitive | 2.5   | A    |
| $E_{AS}^{(2)}$ | Single pulse avalanche energy                   | 430   | mJ   |

**Notes:**

- (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

( $T_{\text{case}} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified)

**Table 5: Static**

| Symbol                      | Parameter                         | Test conditions                                                                                                          | Min. | Typ. | Max.    | Unit          |
|-----------------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------|------|------|---------|---------------|
| $V_{(\text{BR})\text{DSS}}$ | Drain-source breakdown voltage    | $V_{\text{GS}} = 0\text{ V}$ , $I_{\text{D}} = 1\text{ mA}$                                                              | 600  |      |         | V             |
| $I_{\text{DSS}}$            | Zero gate voltage drain current   | $V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 600\text{ V}$                                                            |      |      | 1       | $\mu\text{A}$ |
|                             |                                   | $V_{\text{GS}} = 0\text{ V}$ , $V_{\text{DS}} = 600\text{ V}$ ,<br>$T_{\text{case}} = 125\text{ }^{\circ}\text{C}^{(1)}$ |      |      | 100     |               |
| $I_{\text{GSS}}$            | Gate-body leakage current         | $V_{\text{DS}} = 0\text{ V}$ , $V_{\text{GS}} = \pm 25\text{ V}$                                                         |      |      | $\pm 5$ | $\mu\text{A}$ |
| $V_{\text{GS(th)}}$         | Gate threshold voltage            | $V_{\text{DS}} = V_{\text{GS}}$ , $I_{\text{D}} = 250\text{ }\mu\text{A}$                                                | 3    | 4    | 5       | V             |
| $R_{\text{DS(on)}}$         | Static drain-source on-resistance | $V_{\text{GS}} = 10\text{ V}$ , $I_{\text{D}} = 4\text{ A}$                                                              |      | 550  | 600     | m $\Omega$    |

**Notes:**

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

**Table 6: Dynamic**

| Symbol                     | Parameter                     | Test conditions                                                                                                                                                           | Min. | Typ. | Max. | Unit     |
|----------------------------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|----------|
| $C_{\text{iss}}$           | Input capacitance             | $V_{\text{DS}} = 100\text{ V}$ , $f = 1\text{ MHz}$ ,<br>$V_{\text{GS}} = 0\text{ V}$                                                                                     | -    | 449  | -    | pF       |
| $C_{\text{oss}}$           | Output capacitance            |                                                                                                                                                                           | -    | 24   | -    |          |
| $C_{\text{rss}}$           | Reverse transfer capacitance  |                                                                                                                                                                           | -    | 0.89 | -    |          |
| $C_{\text{oss eq.}}^{(1)}$ | Equivalent output capacitance | $V_{\text{DS}} = 0\text{ to }480\text{ V}$ , $V_{\text{GS}} = 0\text{ V}$                                                                                                 | -    | 42   | -    | pF       |
| $R_{\text{G}}$             | Intrinsic gate resistance     | $f = 1\text{ MHz}$ , $I_{\text{D}} = 0\text{ A}$                                                                                                                          | -    | 6.5  | -    | $\Omega$ |
| $Q_{\text{g}}$             | Total gate charge             | $V_{\text{DD}} = 480\text{ V}$ , $I_{\text{D}} = 8\text{ A}$ ,<br>$V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 15: "Test circuit for gate charge behavior"</a> ) | -    | 13.5 | -    | nC       |
| $Q_{\text{gs}}$            | Gate-source charge            |                                                                                                                                                                           | -    | 3    | -    |          |
| $Q_{\text{gd}}$            | Gate-drain charge             |                                                                                                                                                                           | -    | 7.7  | -    |          |

**Notes:**

<sup>(1)</sup>  $C_{\text{oss eq.}}$  is defined as a constant equivalent capacitance giving the same charging time as  $C_{\text{oss}}$  when  $V_{\text{DS}}$  increases from 0 to 80%  $V_{\text{DSS}}$ .

**Table 7: Switching times**

| Symbol              | Parameter           | Test conditions                                                                                                                                                                                                                                                                 | Min. | Typ. | Max. | Unit |
|---------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{\text{d(on)}}$  | Turn-on delay time  | $V_{\text{DD}} = 300\text{ V}$ , $I_{\text{D}} = 4\text{ A}$<br>$R_{\text{G}} = 4.7\text{ }\Omega$ , $V_{\text{GS}} = 10\text{ V}$ (see <a href="#">Figure 14: "Test circuit for resistive load switching times"</a> and <a href="#">Figure 19: "Switching time waveform"</a> ) | -    | 10   | -    | ns   |
| $t_{\text{r}}$      | Rise time           |                                                                                                                                                                                                                                                                                 | -    | 6    | -    |      |
| $t_{\text{d(off)}}$ | Turn-off delay time |                                                                                                                                                                                                                                                                                 | -    | 25.4 | -    |      |
| $t_{\text{f}}$      | Fall time           |                                                                                                                                                                                                                                                                                 | -    | 9.5  | -    |      |

Table 8: Source-drain diode

| Symbol          | Parameter                     | Test conditions                                                                                                                                                                                                                | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $I_{SD}$        | Source-drain current          |                                                                                                                                                                                                                                | -    |      | 8    | A    |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) |                                                                                                                                                                                                                                | -    |      | 32   | A    |
| $V_{SD}^{(2)}$  | Forward on voltage            | $V_{GS} = 0\text{ V}$ , $I_{SD} = 8\text{ A}$                                                                                                                                                                                  | -    |      | 1.6  | V    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 8\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 60\text{ V}$ (see <a href="#">Figure 16</a> :<br>"Test circuit for inductive load<br>switching and diode recovery<br>times")                         | -    | 80   |      | ns   |
| $Q_{rr}$        | Reverse recovery charge       |                                                                                                                                                                                                                                | -    | 188  |      | nC   |
| $I_{RRM}$       | Reverse recovery current      |                                                                                                                                                                                                                                | -    | 4.7  |      | A    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 8\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 60\text{ V}$ , $T_j = 150\text{ °C}$ (see<br><a href="#">Figure 16</a> : "Test circuit for<br>inductive load switching and<br>diode recovery times") | -    | 160  |      | ns   |
| $Q_{rr}$        | Reverse recovery charge       |                                                                                                                                                                                                                                | -    | 640  |      | nC   |
| $I_{RRM}$       | Reverse recovery current      |                                                                                                                                                                                                                                | -    | 8    |      | A    |

**Notes:**

<sup>(1)</sup> Pulse width is limited by safe operating area.

<sup>(2)</sup> Pulse test: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%.

## 2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

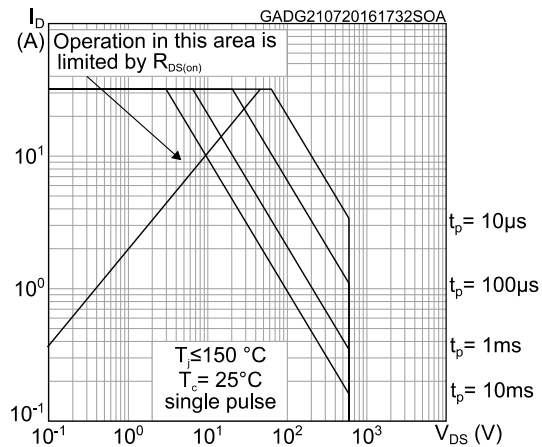


Figure 3: Thermal impedance

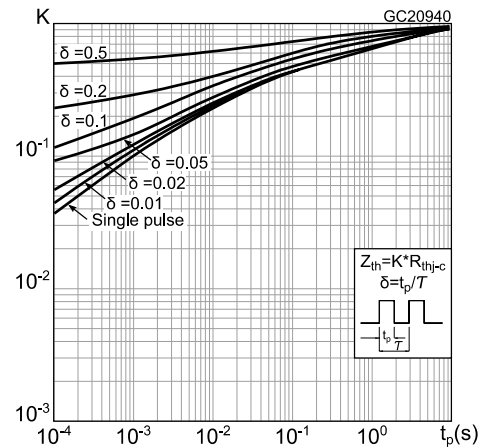


Figure 4: Output characteristics

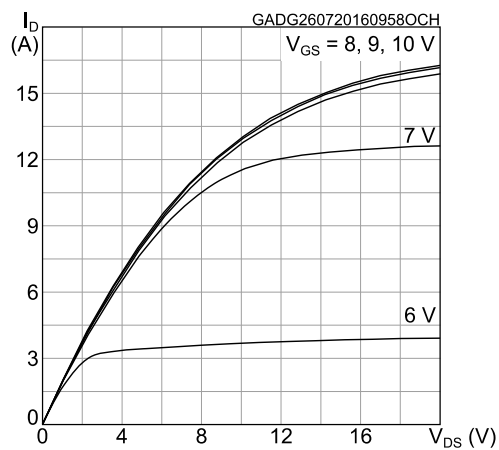


Figure 5: Transfer characteristics

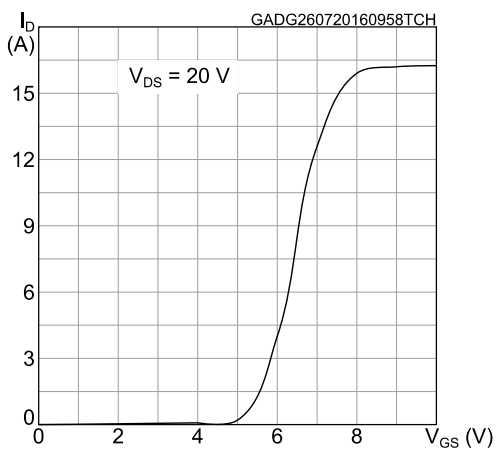


Figure 6: Gate charge vs gate-source voltage

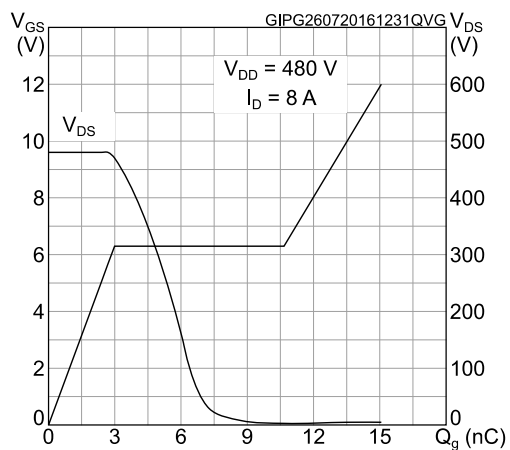


Figure 7: Static drain-source on resistance

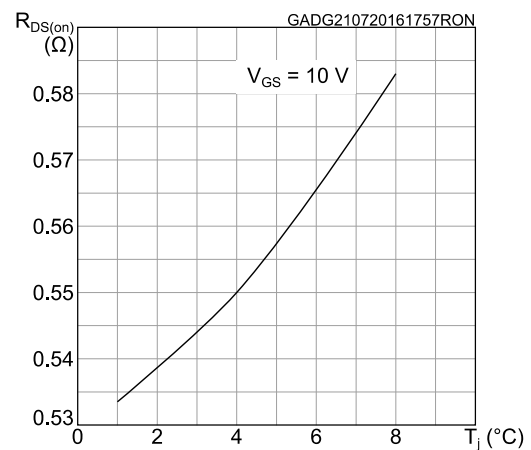


Figure 8: Capacitance variations

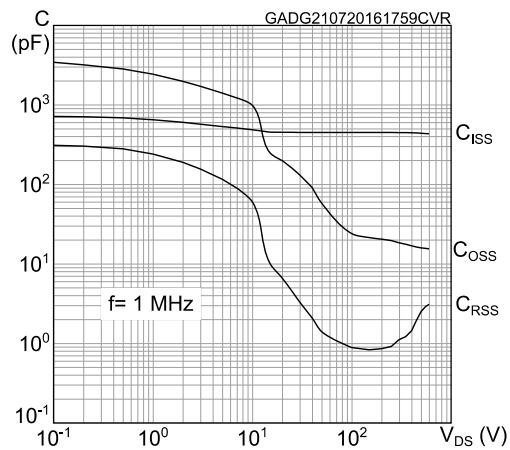


Figure 9: Normalized gate threshold voltage vs temperature

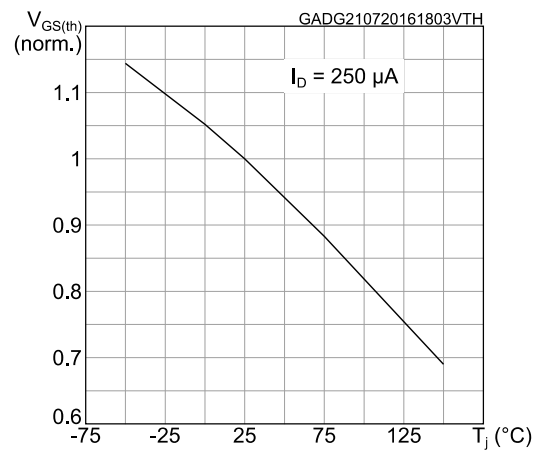


Figure 10: Normalized on-resistance vs temperature

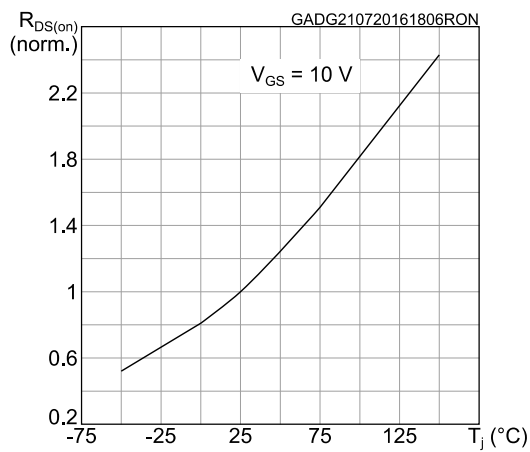


Figure 11: Normalized V(BR)DSS vs temperature

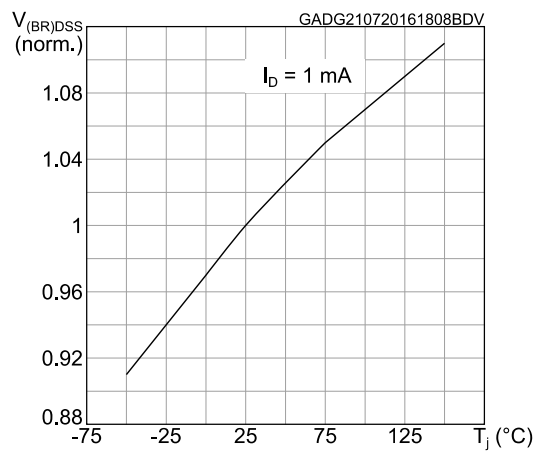


Figure 12: Source-drain diode forward characteristics

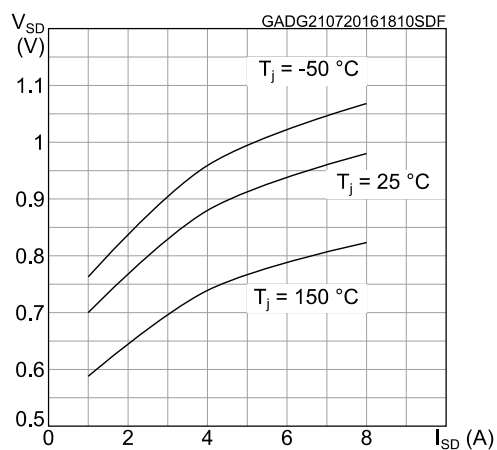
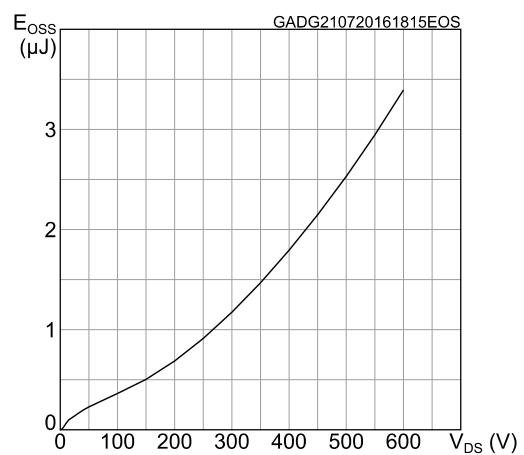


Figure 13: Output capacitance stored energy



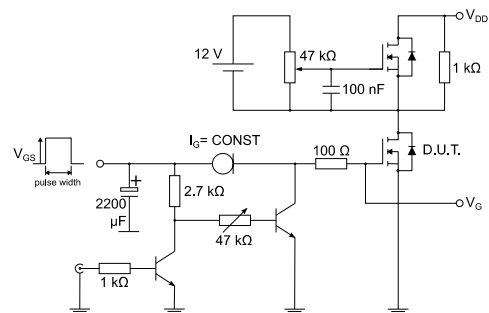
### 3 Test circuits

**Figure 14: Test circuit for resistive load switching times**



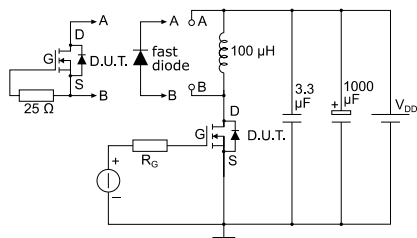
AM01468v1

**Figure 15: Test circuit for gate charge behavior**



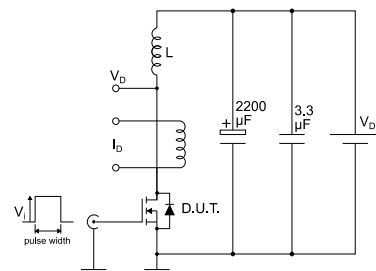
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**Figure 16: Test circuit for inductive load switching and diode recovery times**



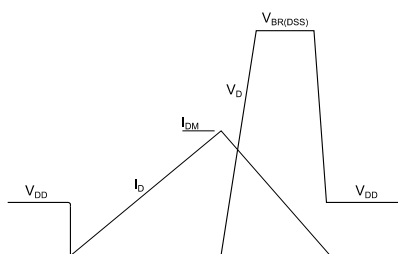
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**Figure 17: Unclamped inductive load test circuit**



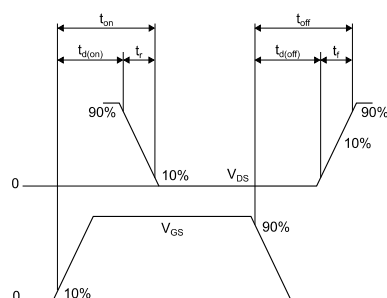
AM01471v1

**Figure 18: Unclamped inductive waveform**



AM01472v1

**Figure 19: Switching time waveform**



AM01473v1

## 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 20: TO-220FP package outline**

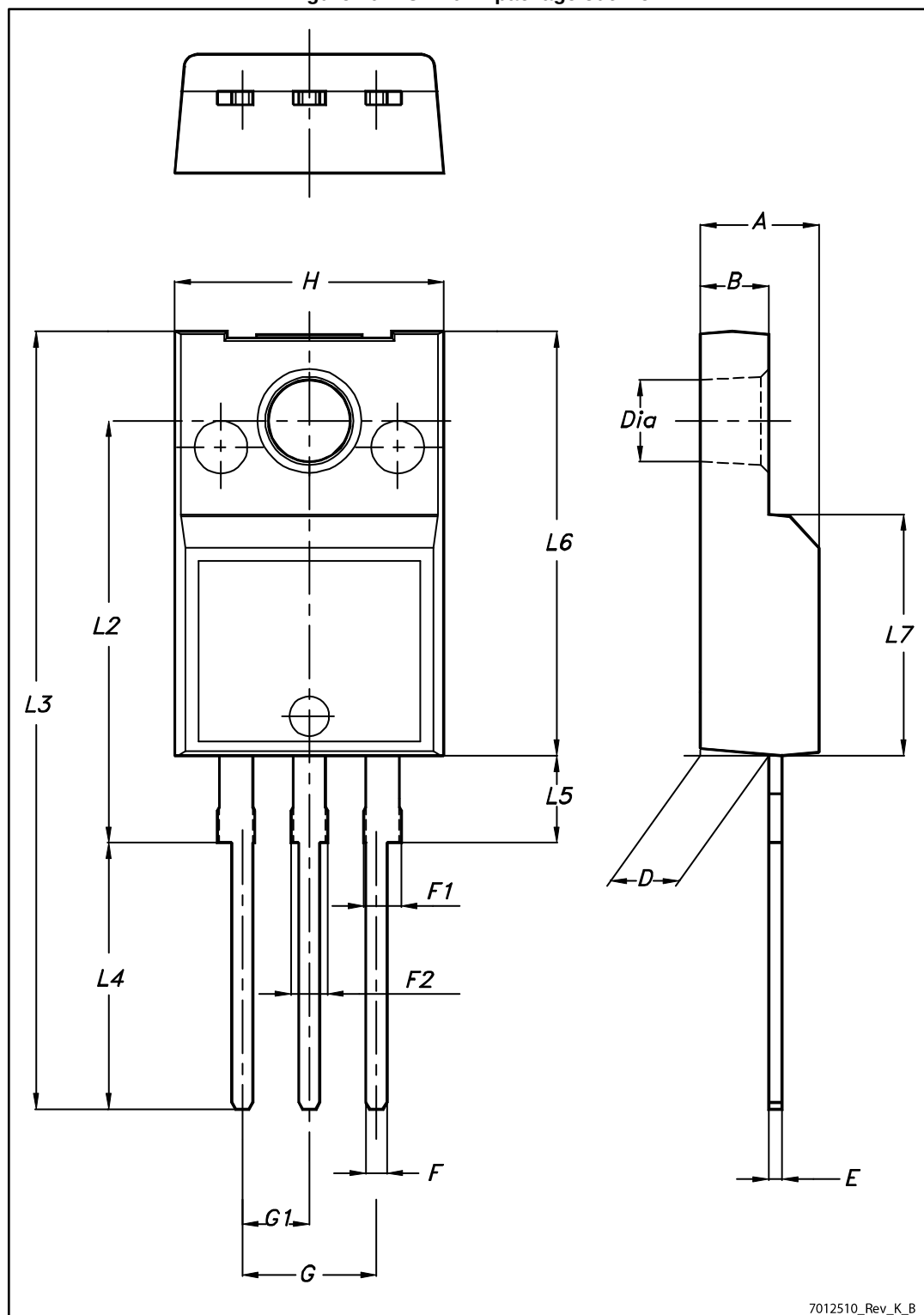


Table 9: TO-220FP package mechanical data

| 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                                                                                                                                                                                                                                                                                 |
|-------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12-May-2015 | 1        | First release.                                                                                                                                                                                                                                                                          |
| 24-Nov-2016 | 2        | Document status promoted from preliminary to production data.<br>Updated title in cover page, <a href="#">Section 1: "Electrical ratings"</a> , <a href="#">Section 2: "Electrical characteristics"</a> .<br>Added <a href="#">Section 2.1: "Electrical characteristics (curves)"</a> . |

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