



# STB18NM80, STF18NM80, STP18NM80, STW18NM80

N-channel 800 V, 0.25  $\Omega$ , 17 A, MDmesh™ Power MOSFET  
in D<sup>2</sup>PAK, TO-220FP, TO-220 and TO-247 packages

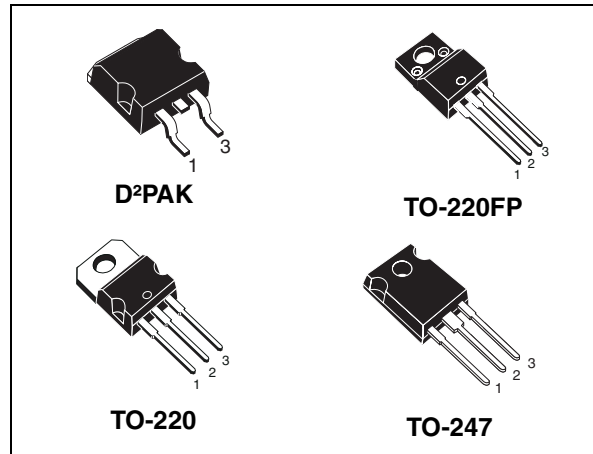
Datasheet — production data

## Features

| Order codes | V <sub>DSS</sub> | R <sub>DS(on) max</sub> | I <sub>D</sub>      |
|-------------|------------------|-------------------------|---------------------|
| STB18NM80   | 800 V            | < 0.295 $\Omega$        | 17 A                |
| STF18NM80   | 800 V            | < 0.295 $\Omega$        | 17 A <sup>(1)</sup> |
| STP18NM80   | 800 V            | < 0.295 $\Omega$        | 17 A                |
| STW18NM80   | 800 V            | < 0.295 $\Omega$        | 17 A                |

1. Limited only by maximum temperature allowed

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



## Application

- Switching applications

## Description

These N-channel Power MOSFETs are developed using STMicroelectronics' revolutionary MDmesh™ technology, which associates the multiple drain process with the company's PowerMESH™ horizontal layout. These devices offer extremely low on-resistance, high dv/dt and excellent avalanche characteristics. Utilizing ST's proprietary strip technique, these Power MOSFETs boast an overall dynamic performance which is superior to similar products on the market.

Figure 1. Internal schematic diagram

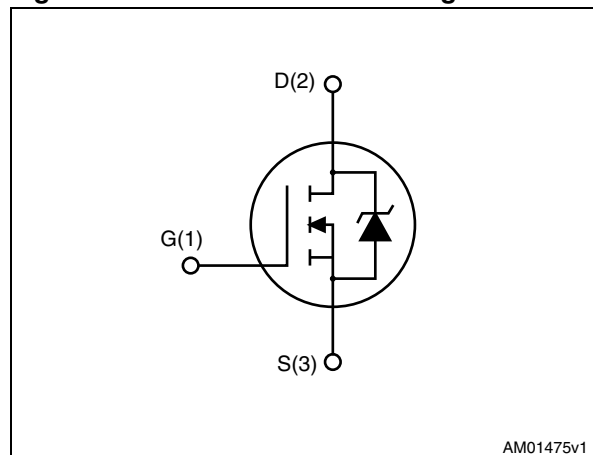


Table 1. Device summary

| Order codes | Marking | Package            | Packaging     |
|-------------|---------|--------------------|---------------|
| STB18NM80   | 18NM80  | D <sup>2</sup> PAK | Tape and reel |
| STF18NM80   |         | TO-220FP           | Tube          |
| STP18NM80   |         | TO-220             |               |
| STW18NM80   |         | TO-247             |               |

## Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol                         | Parameter   | Value      |                    |                      |          | Unit |
|--------------------------------|---|------------|--------------------|----------------------|----------|------|
|                                |   | TO-220     | D <sup>2</sup> PAK | TO-247               | TO-220FP |      |
| V <sub>DS</sub>                | Drain-source voltage  | 800        |                    |                      |          | V    |
| V <sub>GS</sub>                | Gate-source voltage   | ± 30       |                    |                      |          | V    |
| I <sub>D</sub>                 | Drain current (continuous) at T <sub>C</sub> = 25 °C  | 17         |                    | 17 <sup>(1)</sup>    |          | A    |
| I <sub>D</sub>                 | Drain current (continuous) at T <sub>C</sub> = 100 °C   | 10.71      |                    | 10.71 <sup>(1)</sup> |          | A    |
| I <sub>DM</sub> <sup>(2)</sup> | Drain current (pulsed)  | 68         |                    | 68 <sup>(1)</sup>    |          | A    |
| P <sub>TOT</sub>               | Total dissipation at T <sub>C</sub> = 25 °C   | 190        |                    | 40                   |          | W    |
| V <sub>ISO</sub>               | Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T <sub>C</sub> = 25 °C) | 2500       |                    |                      |          | V    |
| T <sub>stg</sub>               | Storage temperature   | -65 to 150 |                    |                      |          | °C   |
| T <sub>j</sub>                 | Max. operating junction temperature   | 150        |                    |                      |          | °C   |

1. Limited only by maximum temperature allowed
2. Pulse width limited by safe operating area

**Table 3. Thermal data**

| Symbol                | Parameter                                      | Value  |                    |        |          | Unit |
|-----------------------|--|--------|--------------------|--------|----------|------|
|                       |  | TO-220 | D <sup>2</sup> PAK | TO-247 | TO-220FP |      |
| R <sub>thj-case</sub> | Thermal resistance junction-case               | 0.66   |                    | 3.13   |          | °C/W |
| R <sub>thj-amb</sub>  | Thermal resistance junction-amb                | 62.5   |                    | 50     | 62.5     | °C/W |
| R <sub>thj-pcb</sub>  | Thermal resistance junction-pcb                |        | 30                 |        |          | °C/W |
| T <sub>l</sub>        | Maximum lead temperature for soldering purpose | 300    |                    |        |          | °C   |

**Table 4. Avalanche characteristics**

| Symbol          | Parameter  | Max value | Unit |
|-----------------|--|-----------|------|
| I <sub>AS</sub> | Avalanche current, repetitive or not-repetitive (pulse width limited by T <sub>j</sub> max)                                | 4         | A    |
| E <sub>AS</sub> | Single pulse avalanche energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AS</sub> , V <sub>DD</sub> = 50 V) | 600       | 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                   | $I_D = 1\text{ mA}$ , $V_{GS} = 0$   | 800  |      |           | V                              |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = 800\text{ V}$ ,<br>$V_{DS} = 800\text{ V}$ , $T_C = 125\text{ °C}$ |      |      | 10<br>100 | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 30\text{ V}$   |      |      | $\pm 100$ | nA                             |
| $V_{GS(th)}$  | 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                | $V_{GS} = 10\text{ V}$ , $I_D = 8.5\text{ A}$                                |      | 0.25 | 0.295     | $\Omega$                       |

**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 | $V_{DS} = 50\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$  | -    | 2070<br>210<br>29 | -    | pF<br>pF<br>pF |
| $C_{oss\text{ eq.}}^{(2)}$          | Equivalent output capacitance   | $V_{GS} = 0$ , $V_{DS} = 0\text{ to }640\text{ V}$  | -    | 316               | -    | pF             |
| $R_G$                               | Gate input resistance   | $f = 1\text{ MHz}$ Gate DC Bias = 0<br>Test Signal Level = 20 mV<br>Open Drain                              | -    | 4                 | -    | $\Omega$       |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$       | Total gate charge<br>Gate-source charge<br>Gate-drain charge            | $V_{DD} = 640\text{ V}$ , $I_D = 17\text{ A}$<br>$V_{GS} = 10\text{ V}$<br>(see <a href="#">Figure 17</a> ) | -    | 70<br>13<br>40    | -    | 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%  $V_{DSS}$

**Table 7. Switching times**

| Symbol       | Parameter           | Test conditions   | Min. | Typ. | Max. | Unit |    |
|--------------|---------------------|---|------|------|------|------|----|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 400\text{ V}$ , $I_D = 8.5\text{ A}$ ,<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$<br>(see <a href="#">Figure 16</a> and<br><a href="#">Figure 21</a> ) |      | 18   |      | ns   |    |
| $t_r$        | Rise time           |   |      | 28   |      | ns   |    |
| $t_{d(off)}$ | Turn-off delay time |   |      |      | 96   |      | ns |
| $t_f$        | Fall time           |   |      |      | 50   |      | ns |

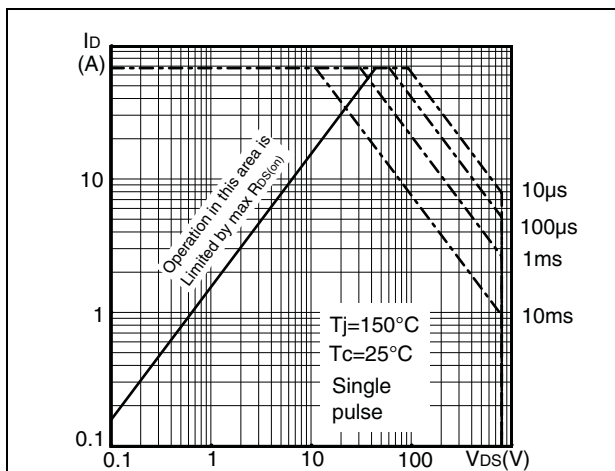
**Table 8. Source drain diode**

| Symbol          | Parameter                     | Test conditions   | Min. | Typ. | Max. | Unit          |
|-----------------|-------------------------------|---|------|------|------|---------------|
| $I_{SD}$        | Source-drain current          |   | -    |      | 17   | A             |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) |   |      |      | 68   | A             |
| $V_{SD}^{(2)}$  | Forward on voltage            | $I_{SD} = 17\text{ A}$ , $V_{GS} = 0$   | -    |      | 1.6  | V             |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 17\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 100\text{ V}$ ,<br>(see <a href="#">Figure 18</a> )                              | -    | 618  |      | ns            |
| $Q_{rr}$        | Reverse recovery charge       |   |      | 9.6  |      | $\mu\text{C}$ |
| $I_{RRM}$       | Reverse recovery current      |   |      | 31.2 |      | A             |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 17\text{ A}$ ,<br>$di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 100\text{ V}$ , $T_j = 150^\circ\text{C}$<br>(see <a href="#">Figure 18</a> ) | -    | 822  |      | ns            |
| $Q_{rr}$        | Reverse recovery charge       |   |      | 13   |      | $\mu\text{C}$ |
| $I_{RRM}$       | Reverse recovery current      |   |      | 31.8 |      | A             |

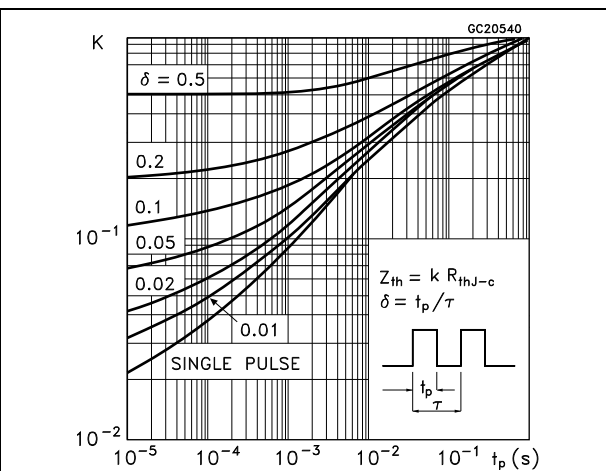
1. Pulse width limited by safe operating area
2. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

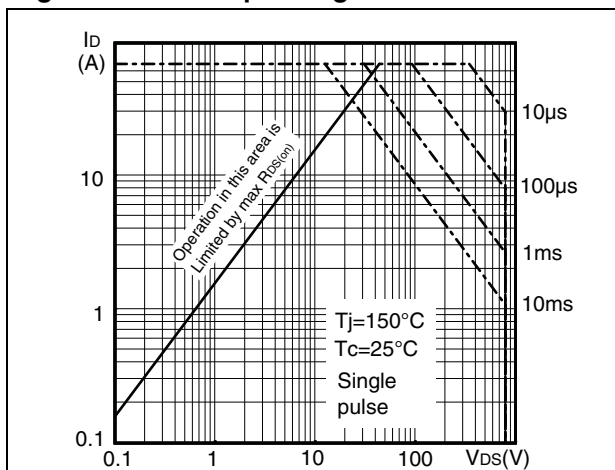
**Figure 2. Safe operating area for TO-220, D<sup>2</sup>PAK**



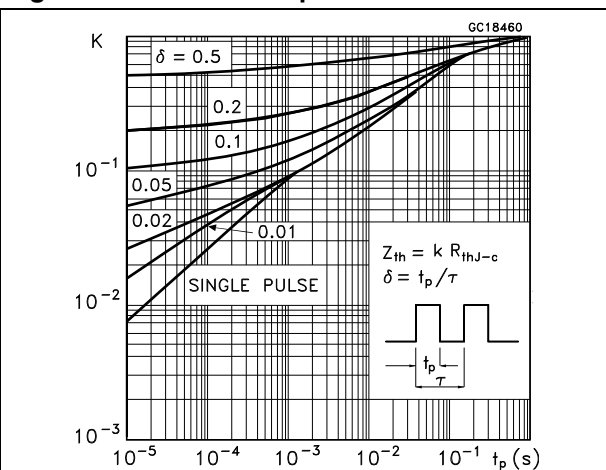
**Figure 3. Thermal impedance for TO-220, D<sup>2</sup>PAK**



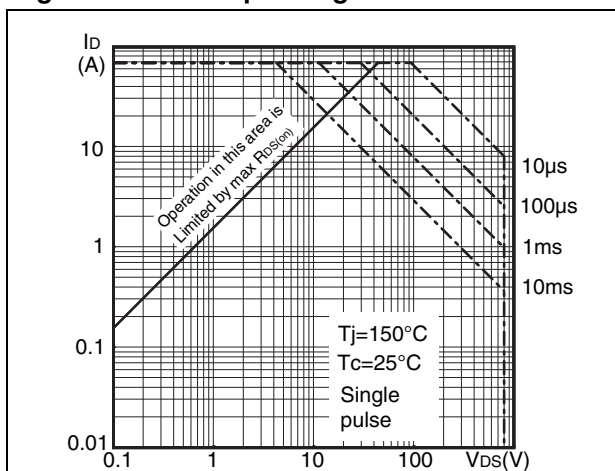
**Figure 4. Safe operating area for TO-247**



**Figure 5. Thermal impedance for TO-247**



**Figure 6. Safe operating area for TO-220FP**



**Figure 7. Thermal impedance for TO-220FP**

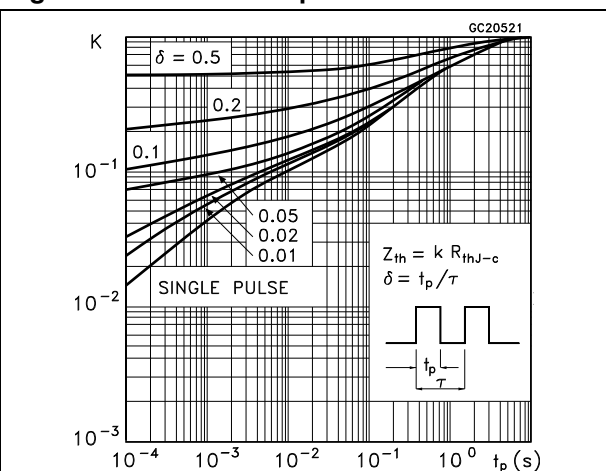


Figure 8. Output characteristics

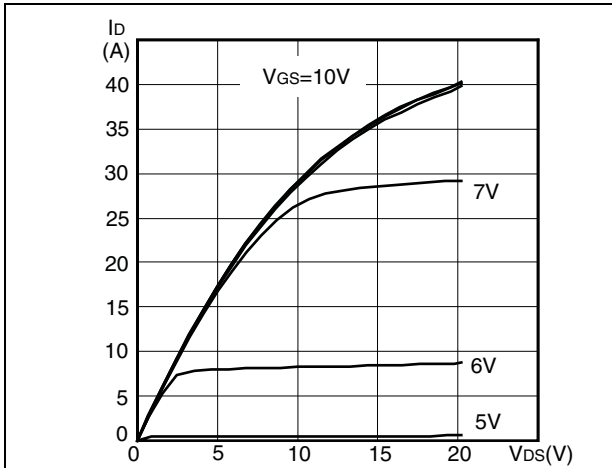


Figure 9. Transfer characteristics

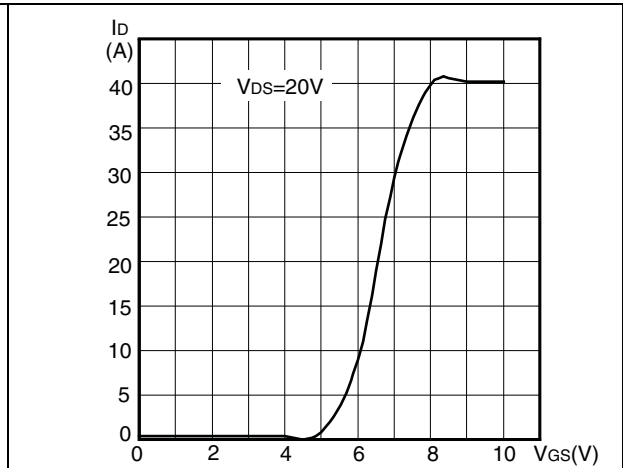


Figure 10. Normalized  $B_{V_{DSS}}$  vs temperature

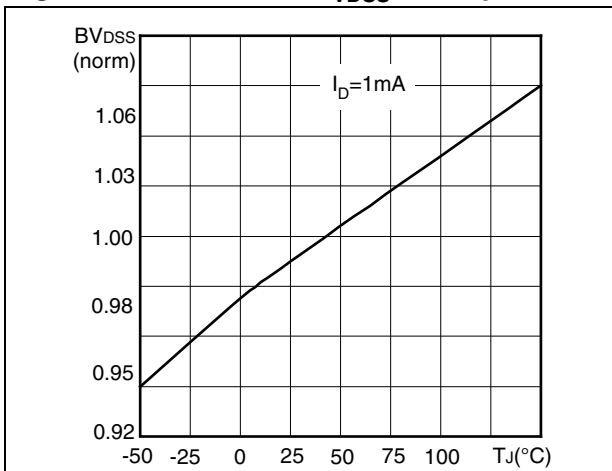


Figure 11. Static drain-source on-resistance

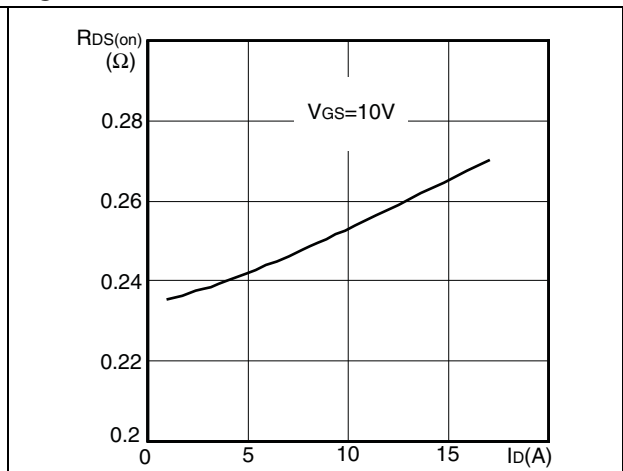


Figure 12. Gate charge vs gate-source voltage

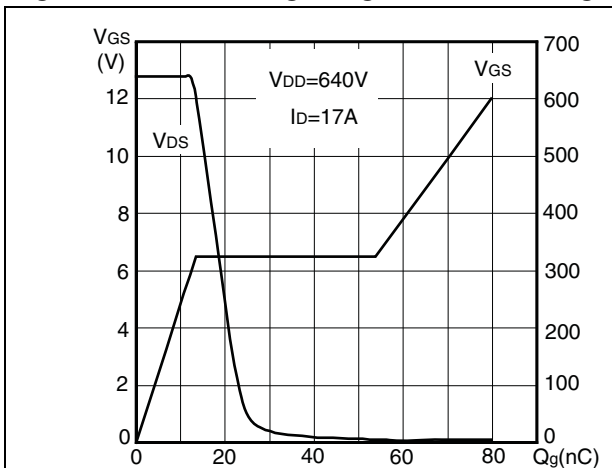


Figure 13. Capacitance variations

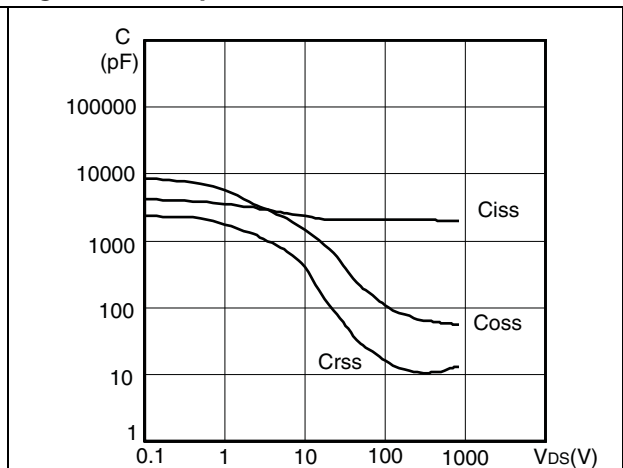


Figure 14. Normalized gate threshold voltage vs temperature

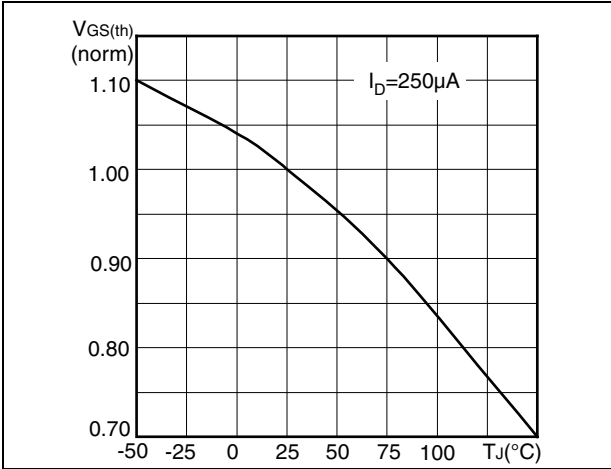
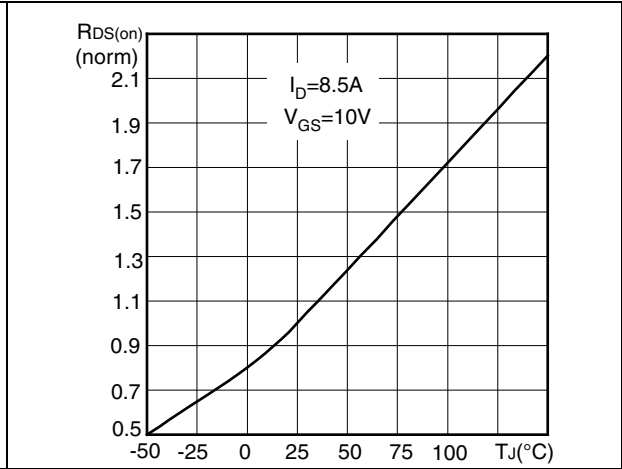


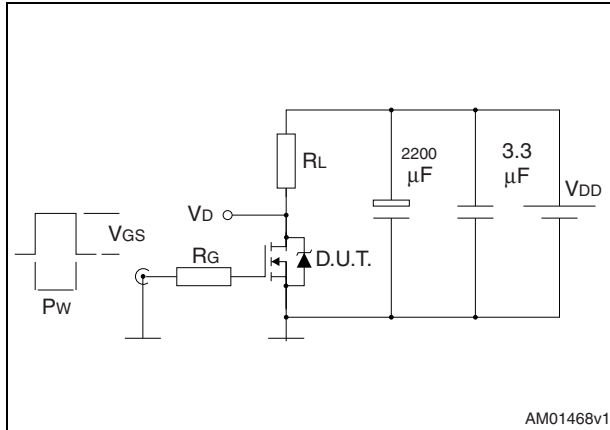
Figure 15. Normalized on-resistance vs temperature



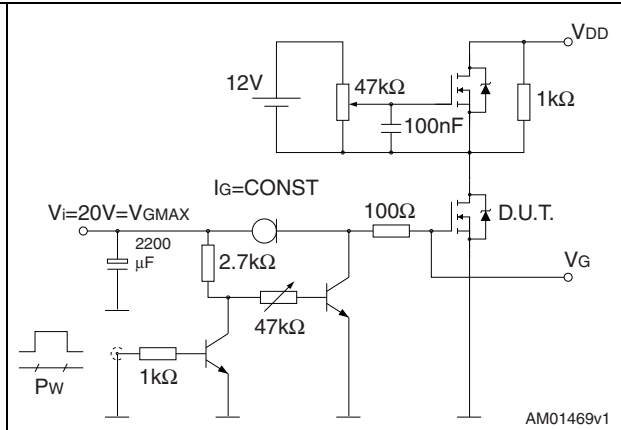


### 3 Test circuits

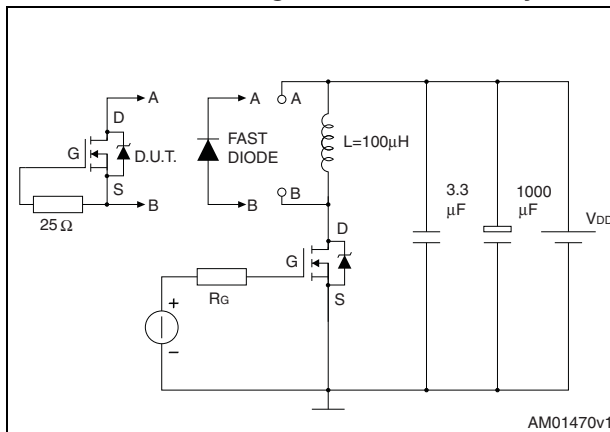
**Figure 16. Switching times test circuit for resistive load**



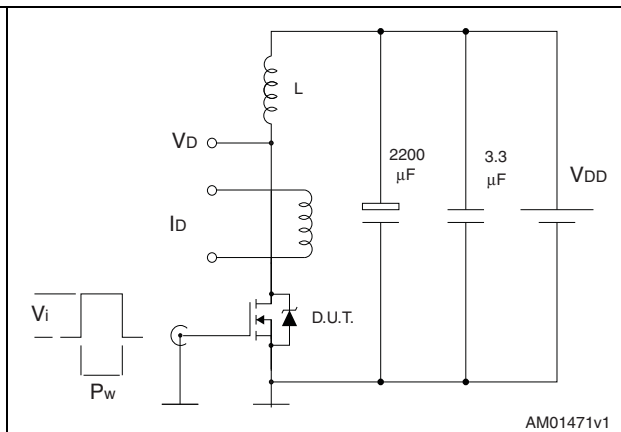
**Figure 17. Gate charge test circuit**



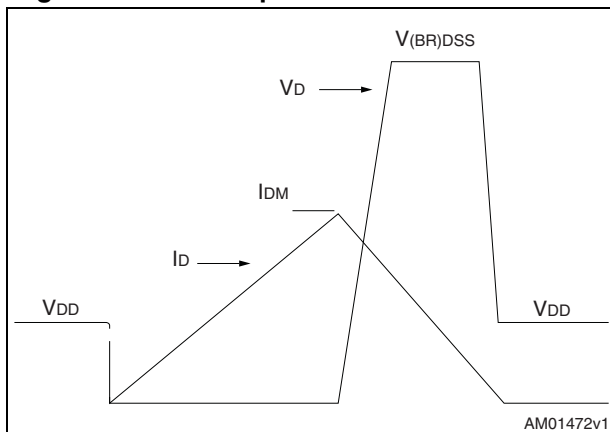
**Figure 18. Test circuit for inductive load switching and diode recovery times**



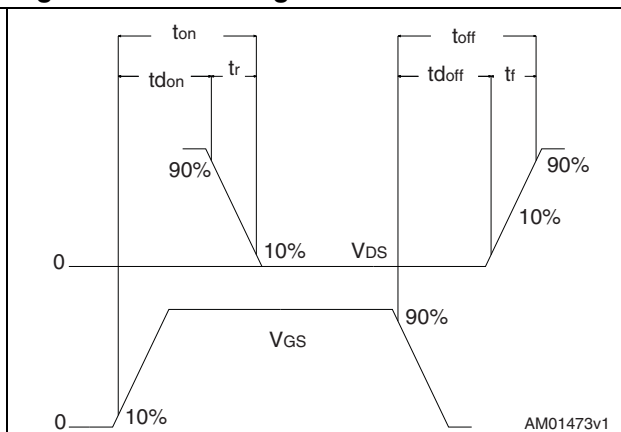
**Figure 19. Unclamped inductive load test circuit**



**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<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.

**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

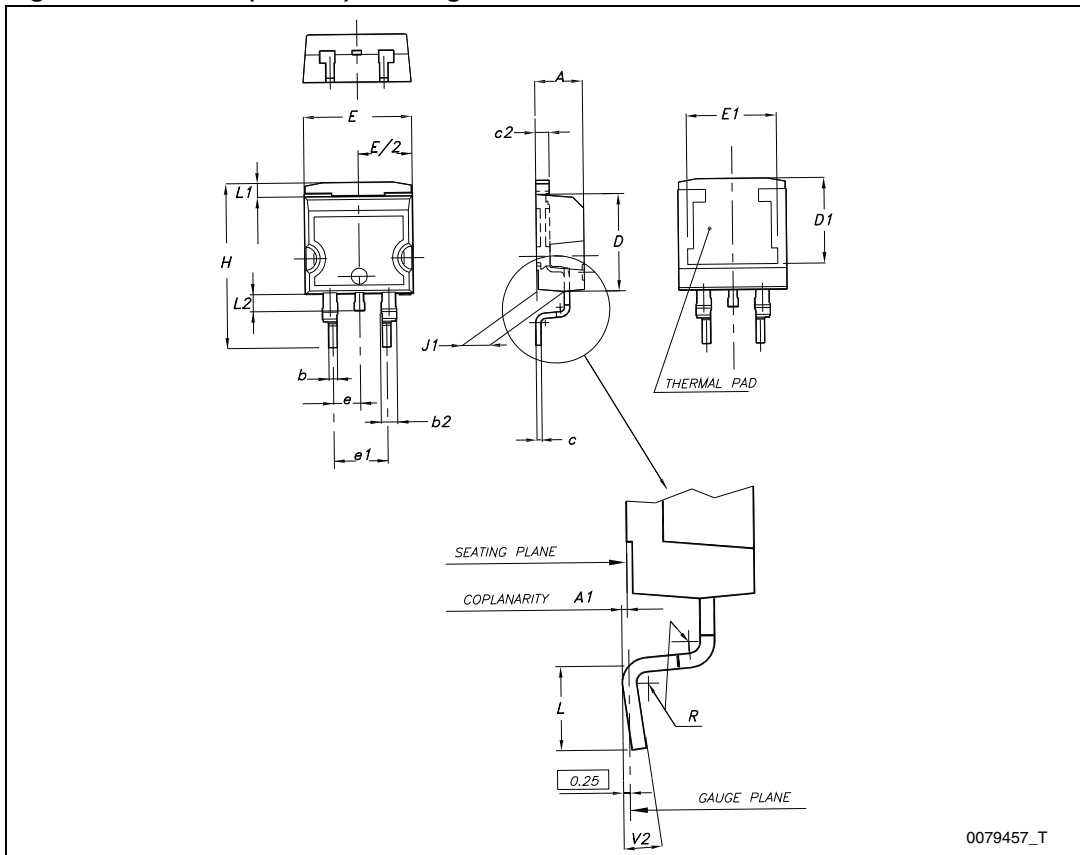
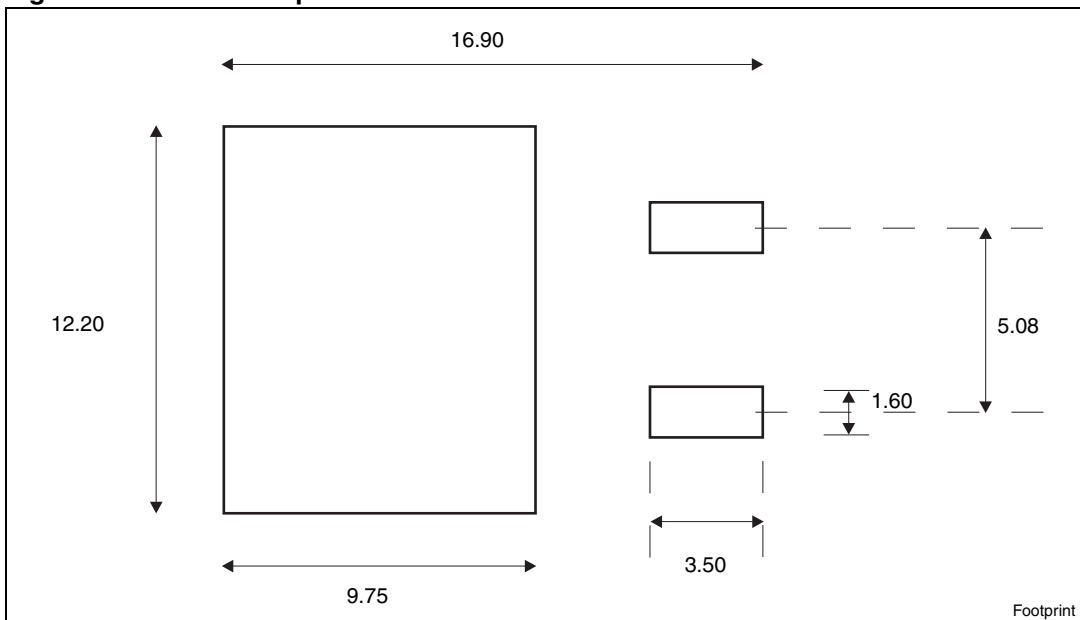


Figure 23. D<sup>2</sup>PAK footprint<sup>(a)</sup>



a. All dimensions are in millimeters

Table 10. TO-220FP 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  |

Figure 24. TO-220FP drawing

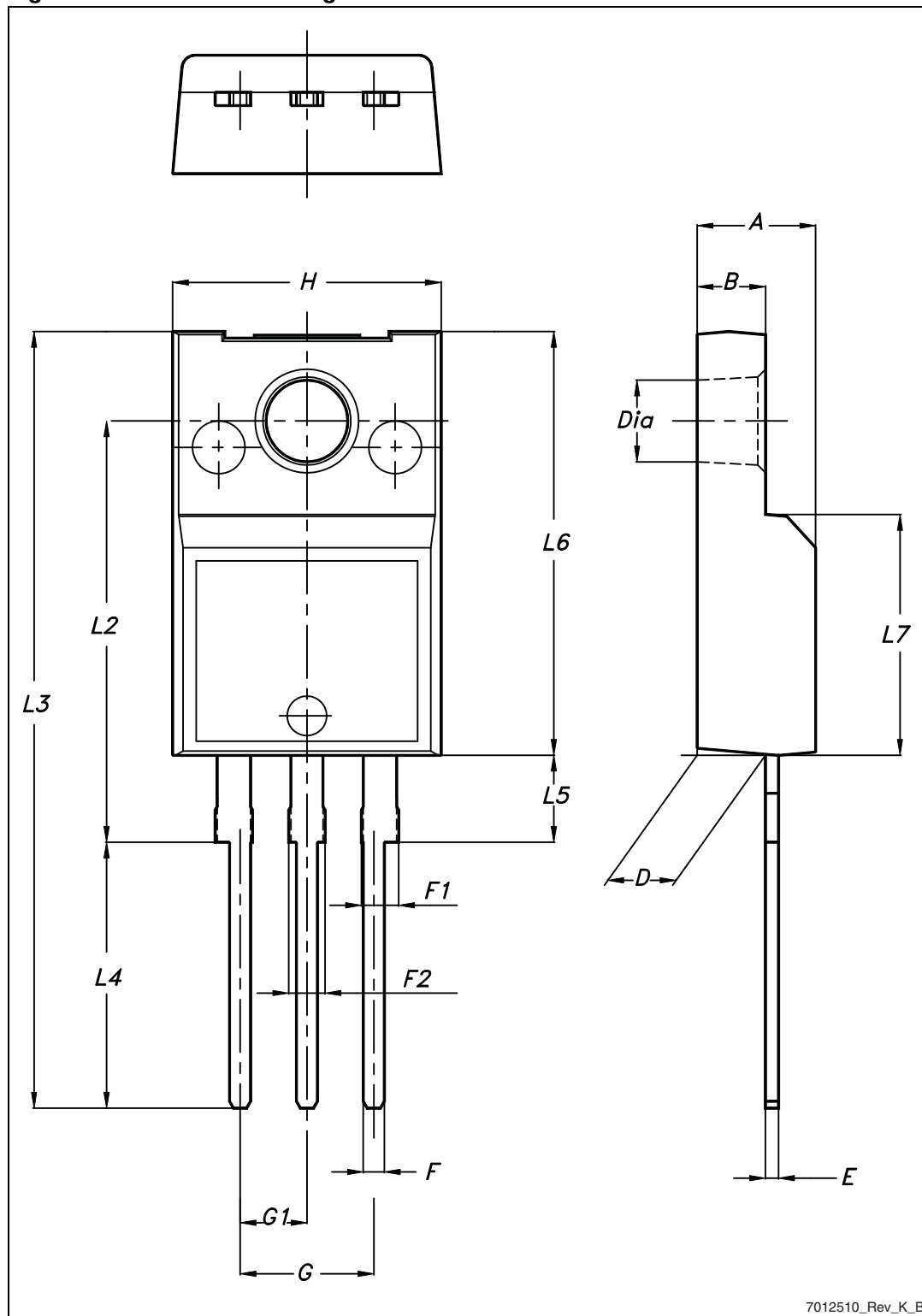


Table 11. TO-220 type A mechanical data

| Dim. | mm    |       |       |
|------|-------|-------|-------|
|      | Min.  | Typ.  | Max.  |
| A    | 4.40  |       | 4.60  |
| b    | 0.61  |       | 0.88  |
| b1   | 1.14  |       | 1.70  |
| c    | 0.48  |       | 0.70  |
| D    | 15.25 |       | 15.75 |
| D1   |       | 1.27  |       |
| E    | 10    |       | 10.40 |
| e    | 2.40  |       | 2.70  |
| e1   | 4.95  |       | 5.15  |
| F    | 1.23  |       | 1.32  |
| H1   | 6.20  |       | 6.60  |
| J1   | 2.40  |       | 2.72  |
| L    | 13    |       | 14    |
| L1   | 3.50  |       | 3.93  |
| L20  |       | 16.40 |       |
| L30  |       | 28.90 |       |
| ØP   | 3.75  |       | 3.85  |
| Q    | 2.65  |       | 2.95  |

Figure 25. TO-220 type A drawing

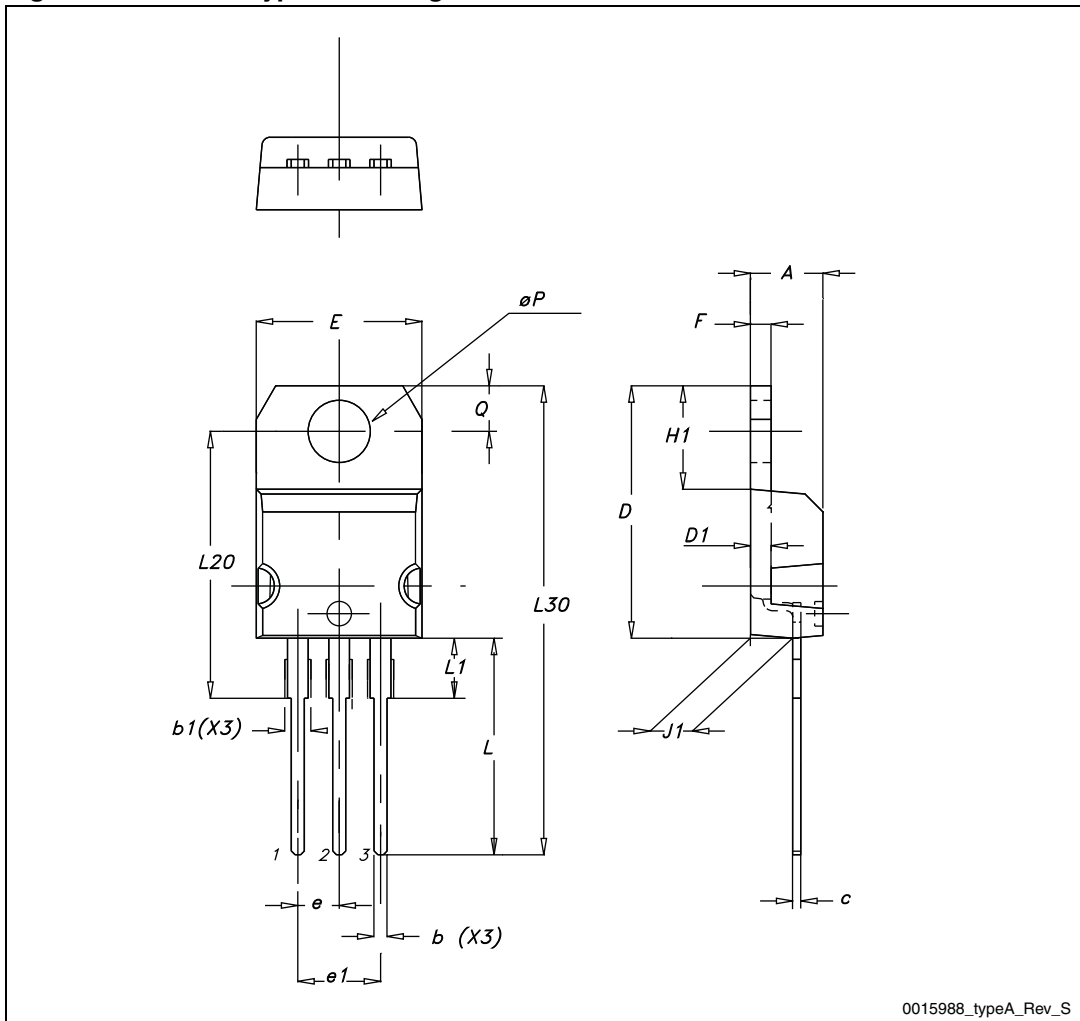
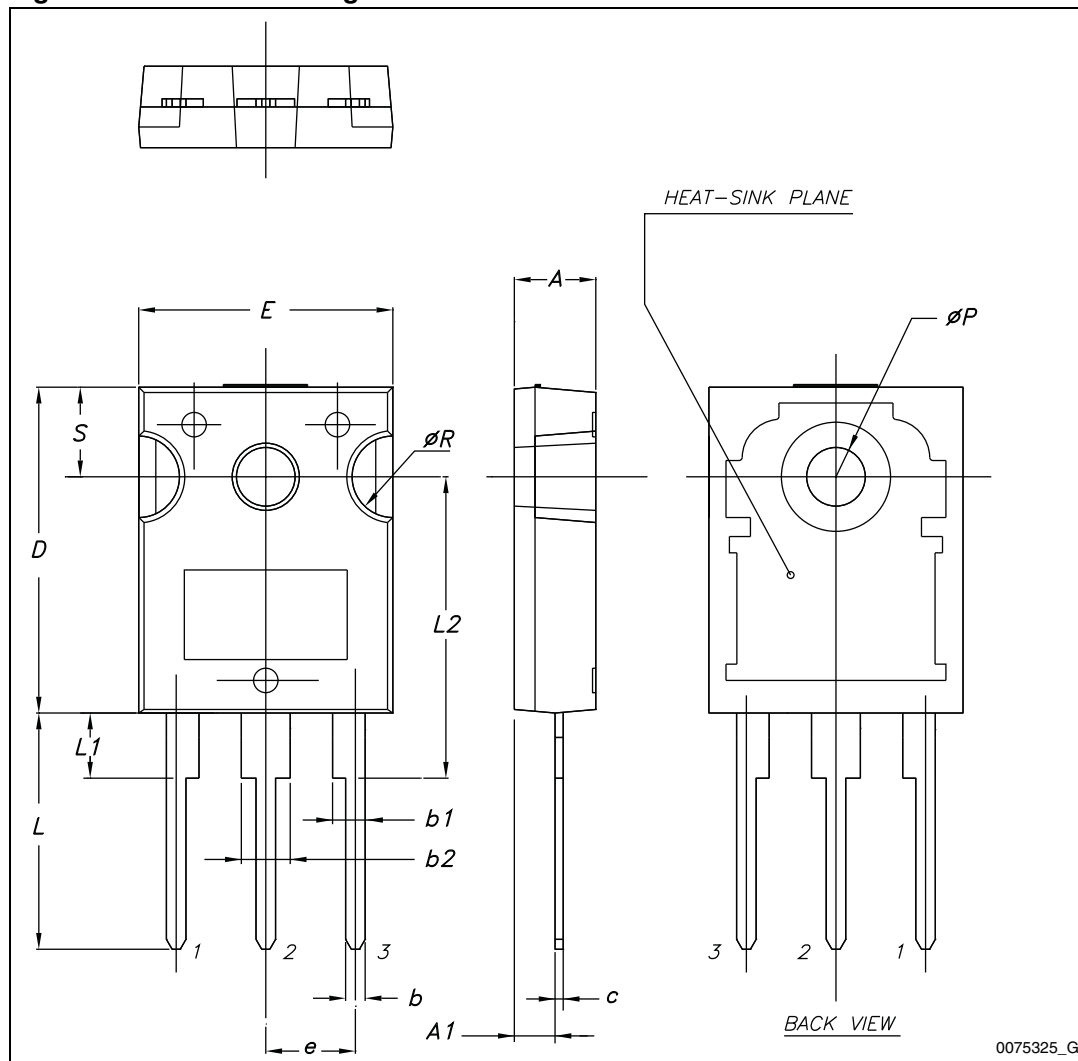


Table 12. TO-247 mechanical data

| 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    | 5.30  | 5.45  | 5.60  |
| L    | 14.20 |       | 14.80 |
| L1   | 3.70  |       | 4.30  |
| L2   |       | 18.50 |       |
| ØP   | 3.55  |       | 3.65  |
| ØR   | 4.50  |       | 5.50  |
| S    | 5.30  | 5.50  | 5.70  |



Figure 26. TO-247 drawing

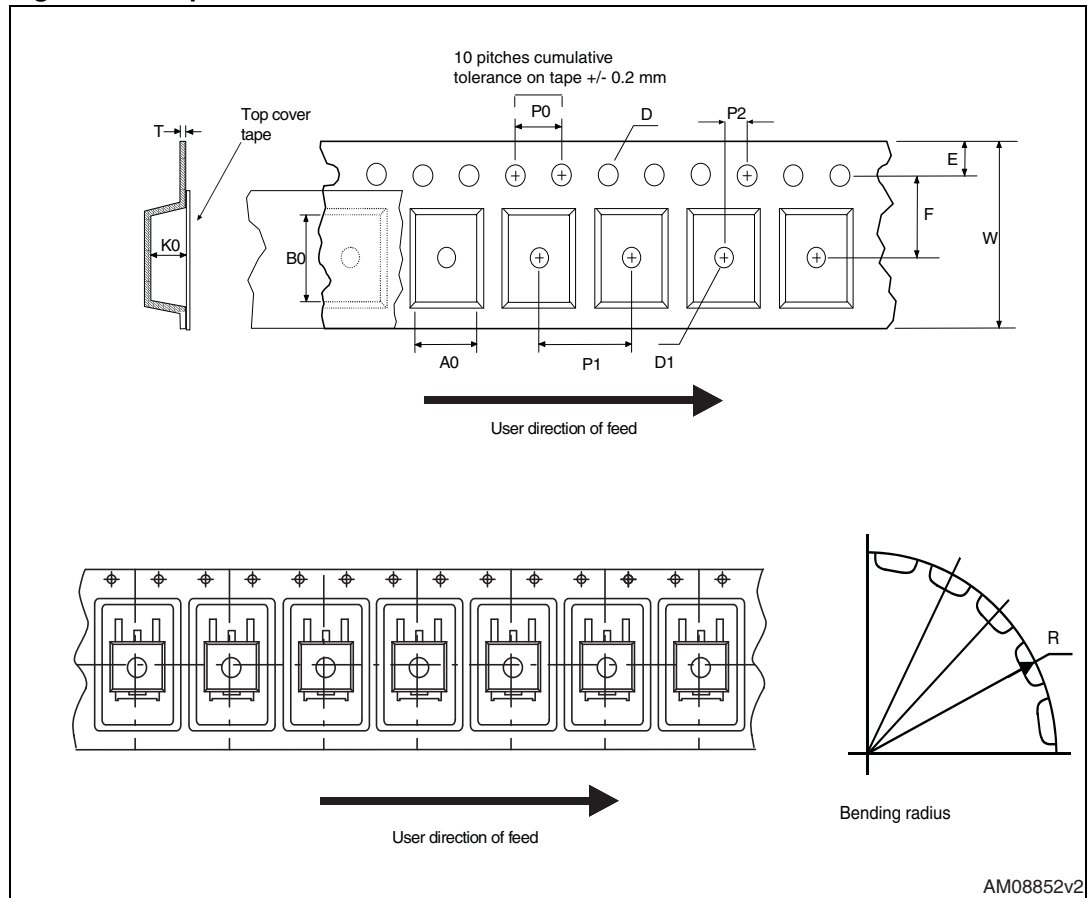


## 5 Packaging mechanical data

Table 13. D<sup>2</sup>PAK (TO-263) tape and reel mechanical data

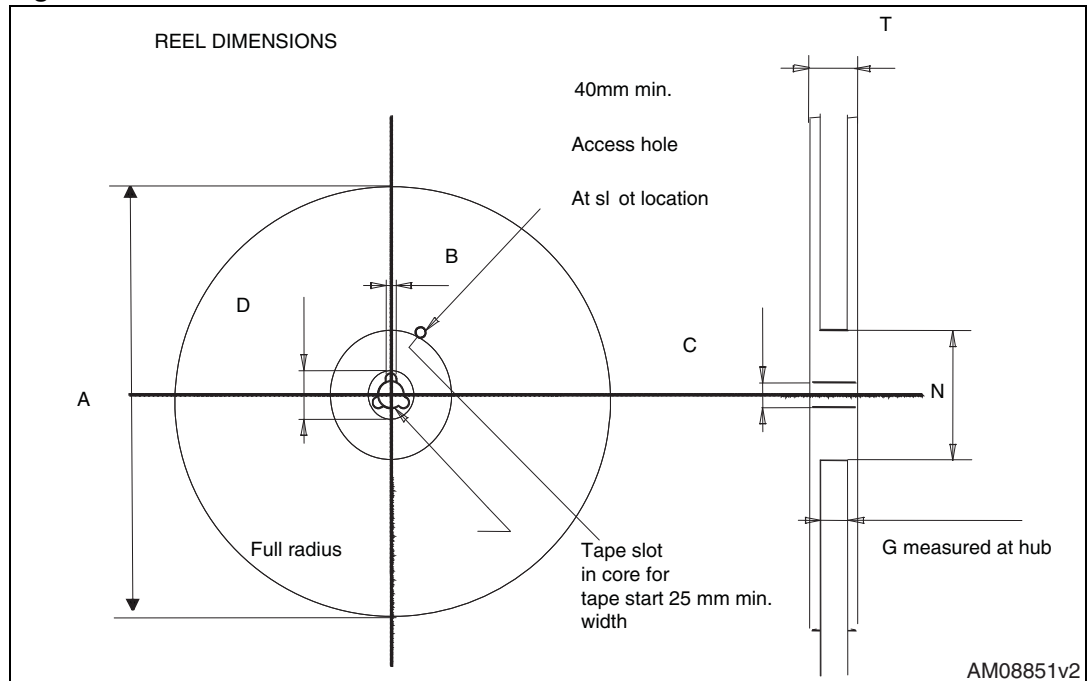
| Tape |      |      | Reel |          |      |
|------|------|------|------|----------|------|
| Dim. | mm   |      | Dim. | mm       |      |
|      | Min. | Max. |      | Min.     | Max. |
| A0   | 10.5 | 10.7 | A    |          | 330  |
| B0   | 15.7 | 15.9 | B    | 1.5      |      |
| D    | 1.5  | 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 |      |          |      |

Figure 27. Tape



AM08852v2

Figure 28. Reel



AM08851v2

## 6 Revision history

Table 14. Document revision history

| Date        | Revision | Changes  |
|-------------|----------|--|
| 25-Feb-2009 | 1        | First release.   |
| 07-Apr-2009 | 2        | <a href="#">Section 4: Package mechanical data</a> has been modified.                                  |
| 20-Apr-2009 | 3        | $R_{DS(on)}$ max value has been corrected.   |
| 09-Sep-2009 | 4        | Document status promoted from preliminary data to datasheet.   |
| 25-May-2012 | 5        | <a href="#">Figure 12: Gate charge vs gate-source voltage</a> has been updated.<br>Minor text changes. |

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