



# STB76NF75, STI76NF75 STP76NF75

N-channel 75 V, 0.0095  $\Omega$ , 80 A TO-220, D<sup>2</sup>PAK, I<sup>2</sup>PAK  
STripFET™ II Power MOSFET

## Features

| Type      | V <sub>DSS</sub> | R <sub>DS(on)</sub><br>max | I <sub>D</sub>      |
|-----------|------------------|----------------------------|---------------------|
| STB76NF75 | 75 V             | < 0.011 $\Omega$           | 80 A <sup>(1)</sup> |
| STI76NF75 | 75 V             | < 0.011 $\Omega$           | 80 A <sup>(1)</sup> |
| STP76NF75 | 75 V             | < 0.011 $\Omega$           | 80 A <sup>(1)</sup> |

1. Current limited by package

- Exceptional dv/dt capability
- 100% avalanche tested

## Application

- Switching applications
  - Automotive

## Description

This Power MOSFET is the latest development of STMicroelectronics unique “single feature size” strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

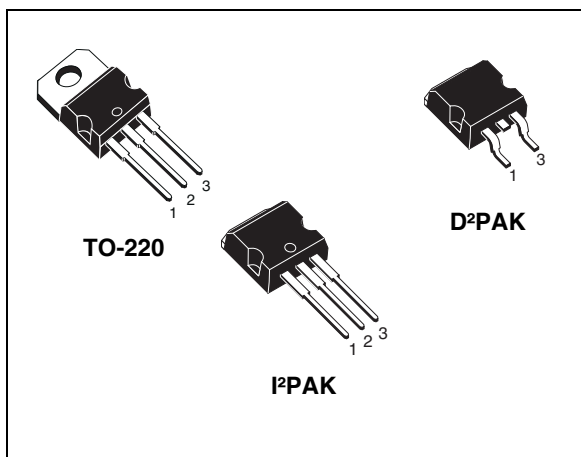


Figure 1. Internal schematic diagram

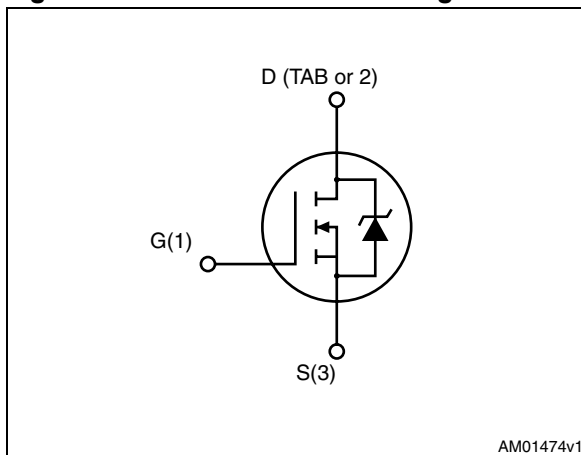


Table 1. Device summary

| Order codes | Marking | Package            | Packaging     |
|-------------|---------|--------------------|---------------|
| STB76NF75   | B76NF75 | D <sup>2</sup> PAK | Tape and reel |
| STI76NF75   | I76NF75 | I <sup>2</sup> PAK | Tube          |
| STP76NF75   | P76NF75 | TO-220             | Tube          |

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol             | Parameter                                                       | Value      | Unit                |
|--------------------|-----------------------------------------------------------------|------------|---------------------|
| $V_{DS}$           | Drain-source voltage ( $V_{GS} = 0$ )                           | 75         | V                   |
| $V_{DGR}$          | Drain-gate voltage ( $R_{GS} = 20\text{ k}\Omega$ )             | 75         | V                   |
| $V_{GS}$           | Gate-source voltage                                             | $\pm 20$   | V                   |
| $I_D^{(1)}$        | Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$  | 80         | A                   |
| $I_D^{(1)}$        | Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$ | 70         | A                   |
| $I_{DM}^{(2)}$     | Drain current (pulsed)                                          | 320        | A                   |
| $P_{TOT}$          | Total dissipation at $T_C = 25\text{ }^\circ\text{C}$           | 300        | W                   |
|                    | Derating factor                                                 | 2.0        | W/ $^\circ\text{C}$ |
| $dv/dt^{(3)}$      | Peak diode recovery voltage slope                               | 12         | V/ns                |
| $E_{AS}^{(4)}$     | Single pulse avalanche energy                                   | 700        | mJ                  |
| $T_J$<br>$T_{stg}$ | Operating junction temperature<br>Storage temperature           | -55 to 175 | $^\circ\text{C}$    |

1. Current limited by package

2. Pulse width limited by safe operating area

3.  $I_{SD} \leq 80\text{ A}$ ,  $di/dt \leq 300\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq T_{JMAX}$

4. Starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $I_D = 40\text{ A}$ ,  $V_{DD} = 37.5\text{ V}$

**Table 3. Thermal data**

| Symbol     | Parameter                                                     | Value | Unit                      |
|------------|---------------------------------------------------------------|-------|---------------------------|
| $R_{thJC}$ | Thermal resistance junction-case max                          | 0.5   | $^\circ\text{C}/\text{W}$ |
| $R_{thJA}$ | Thermal resistance junction-ambient max                       | 62.5  | $^\circ\text{C}/\text{W}$ |
| $T_l$      | Maximum lead temperature for soldering purpose <sup>(1)</sup> | 300   | $^\circ\text{C}$          |

1. 1.6mm from case for 10 sec

## 2 Electrical characteristics

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

**Table 4. On/off states**

| Symbol        | Parameter                                        | Test conditions                                                                               | Min. | Typ.   | Max.      | Unit                           |
|---------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------|------|--------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage                   | $I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0$                                                 | 75   |        |           | V                              |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max rating}$ ,<br>$V_{DS} = \text{Max rating @ } 125\text{ }^{\circ}\text{C}$ |      |        | 1<br>10   | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | 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                | $V_{GS} = 10\text{ V}$ , $I_D = 40\text{ A}$                                                  |      | 0.0095 | 0.011     | W                              |

**Table 5. Dynamic**

| Symbol                              | Parameter                                                               | Test conditions                                                        | Min. | Typ.               | Max. | Unit           |
|-------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------|------|--------------------|------|----------------|
| $g_{fs}^{(1)}$                      | Forward transconductance                                                | $V_{DS} = 15\text{ V}$ , $I_D = 40\text{ A}$                           | -    | 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>$V_{GS} = 0$          | -    | 3700<br>730<br>240 |      | pF<br>pF<br>pF |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$       | Total gate charge<br>Gate-source charge<br>Gate-drain charge            | $V_{DD} = 60\text{ V}$ , $I_D = 80\text{ A}$<br>$V_{GS} = 10\text{ V}$ | -    | 117<br>27<br>47    | 160  | nC<br>nC<br>nC |

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

**Table 6. Switching times**

| Symbol       | Parameter           | Test conditions                                                                                                                | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 37.5\text{ V}$ , $I_D = 45\text{ A}$ ,<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$<br><i>Figure 14 on page 8</i> | -    | 25   | -    | ns   |
| $t_r$        | Rise time           |                                                                                                                                |      | 100  |      | ns   |
| $t_{d(off)}$ | Turn-off delay time |                                                                                                                                |      | 66   |      | ns   |
| $t_f$        | Fall time           |                                                                                                                                |      | 30   |      | ns   |

**Table 7. Source drain diode**

| Symbol          | Parameter                     | Test conditions                                                                                                                                              | Min | Typ. | Max | Unit |
|-----------------|-------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|-----|------|
| $I_{SD}$        | Source-drain current          |                                                                                                                                                              | -   |      | 80  | A    |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) |                                                                                                                                                              | -   |      | 320 | A    |
| $V_{SD}^{(2)}$  | Forward on voltage            | $I_{SD} = 80\text{ A}$ , $V_{GS} = 0$                                                                                                                        | -   |      | 1.5 | V    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 80\text{ A}$ ,<br>$di/dt = 100\text{ A}/\mu\text{s}$ ,<br>$V_{DD} = 25\text{ V}$ , $T_J = 150\text{ }^\circ\text{C}$<br><i>Figure 16 on page 8</i> | -   | 132  |     | ns   |
| $Q_{rr}$        | Reverse recovery charge       |                                                                                                                                                              |     | 660  |     | nC   |
| $I_{RRM}$       | Reverse recovery current      |                                                                                                                                                              |     | 10   |     | 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

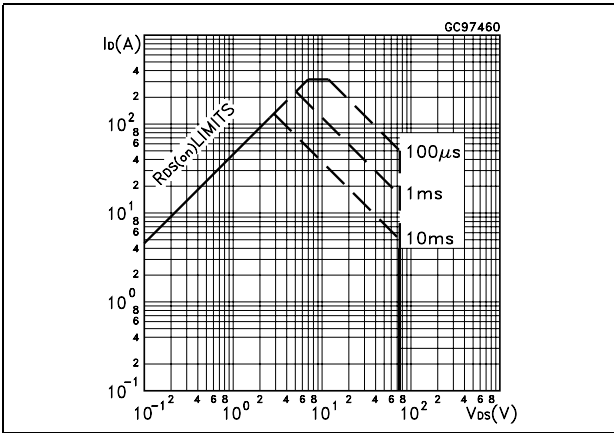


Figure 3. Thermal impedance

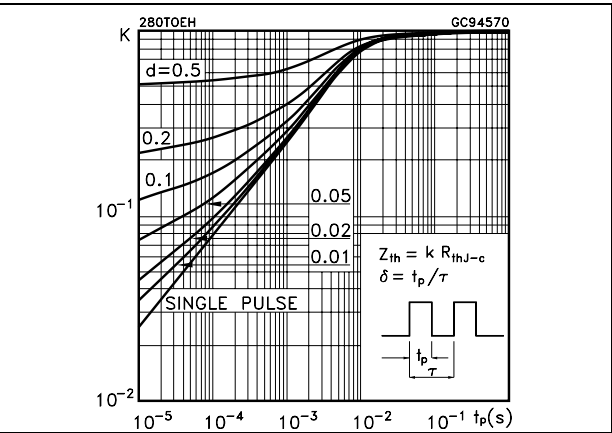


Figure 4. Output characteristics

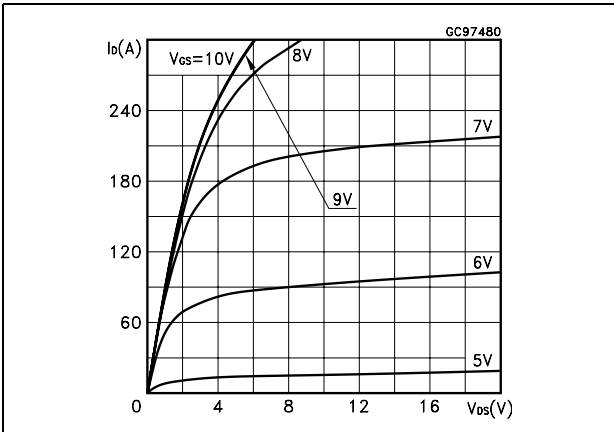


Figure 5. Transfer characteristics

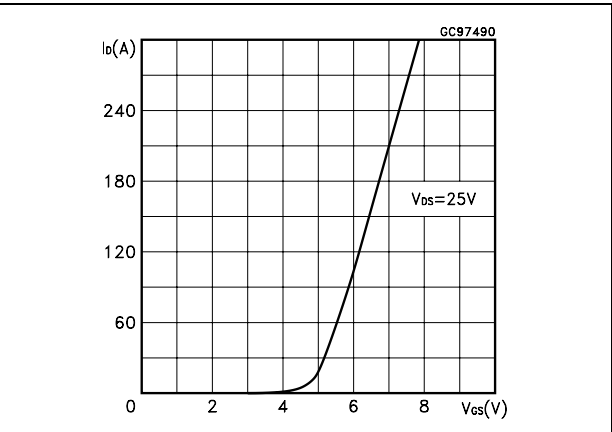


Figure 6. Transconductance

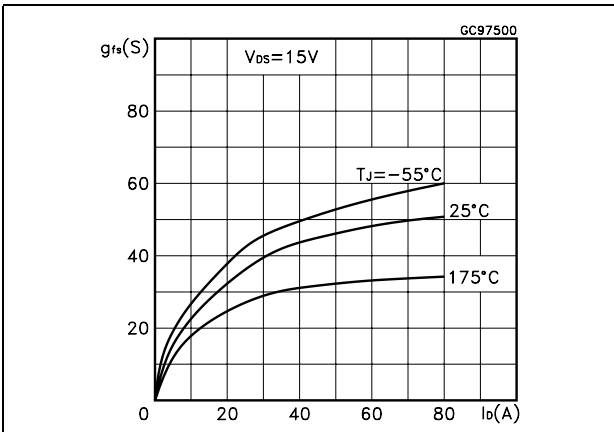
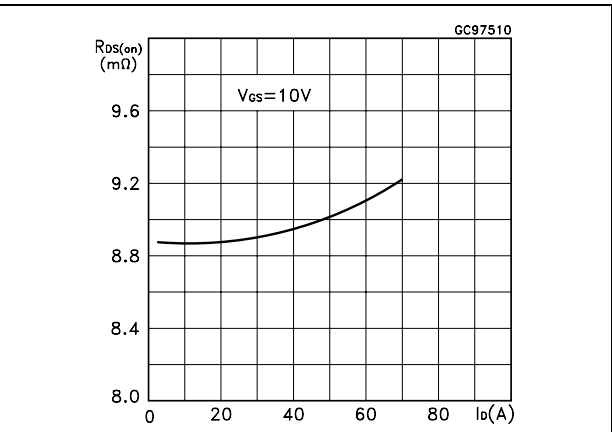
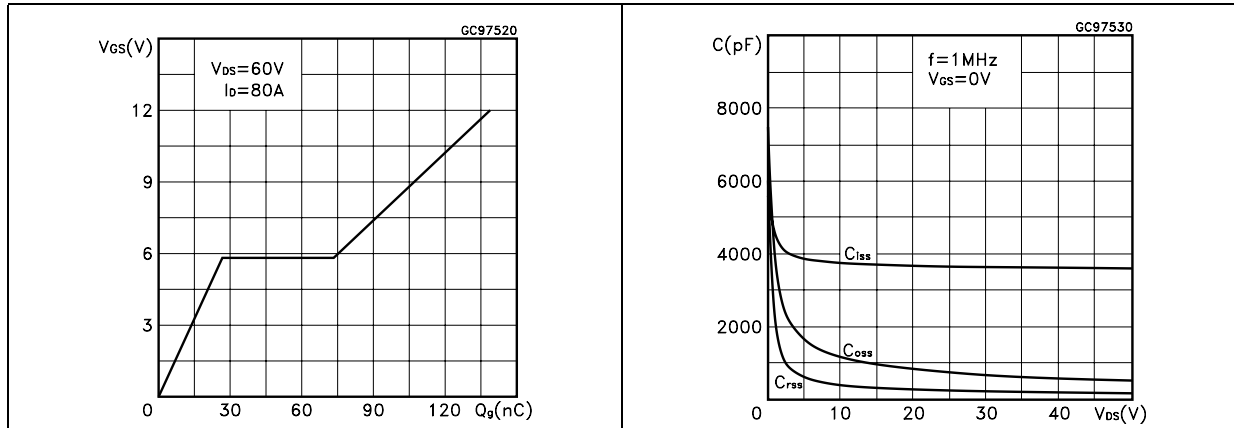
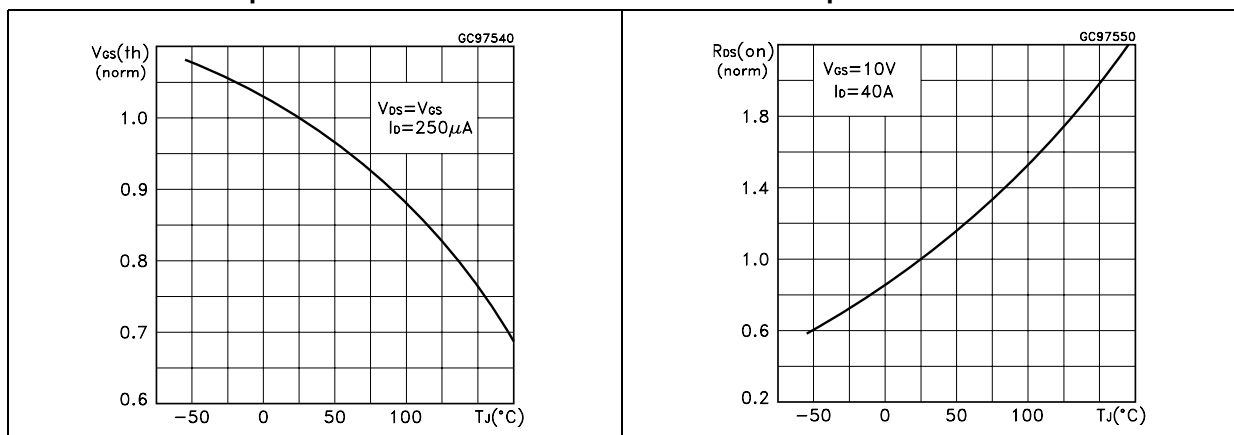
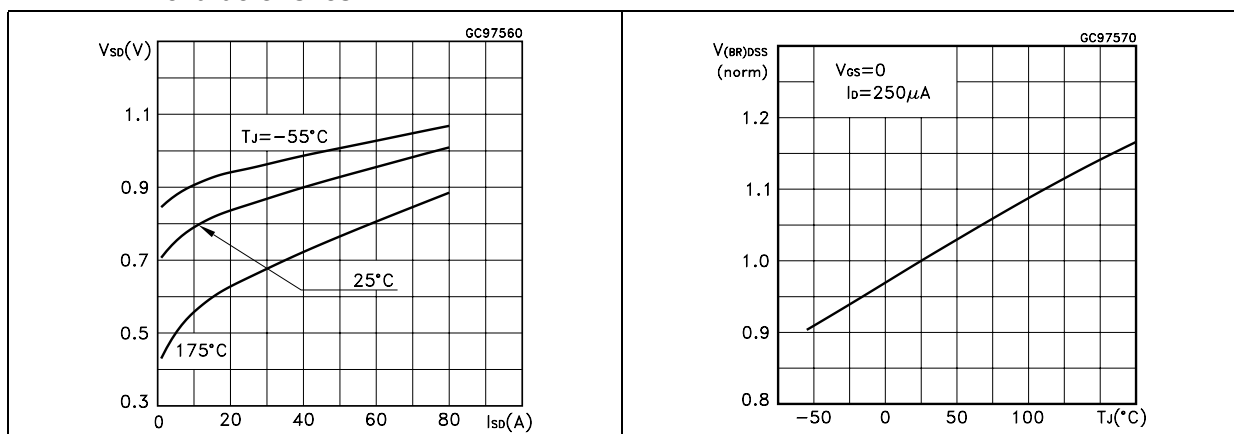


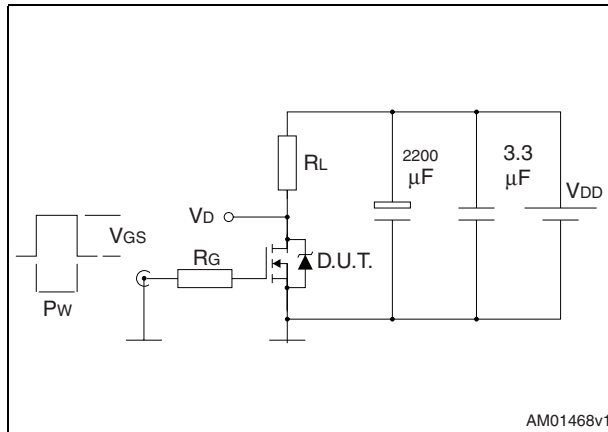
Figure 7. Static drain-source on resistance



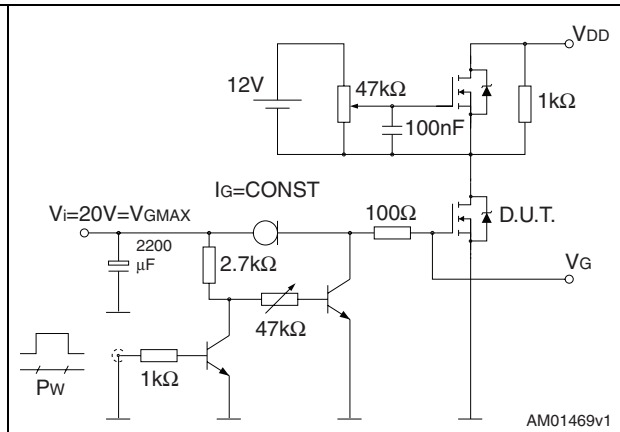
**Figure 8. Gate charge vs gate-source voltage** **Figure 9. Capacitance variations****Figure 10. Normalized gate threshold voltage vs temperature** **Figure 11. Normalized on resistance vs temperature****Figure 12. Source-drain diode forward characteristics** **Figure 13. Normalized  $B_{V_{DS}}$  vs temperature**

### 3 Test circuits

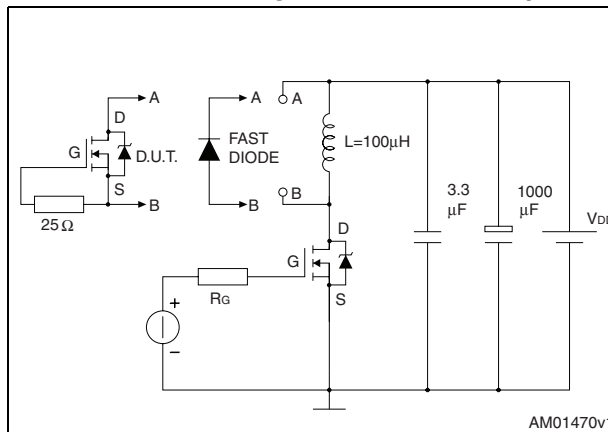
**Figure 14. Switching times test circuit for resistive load**



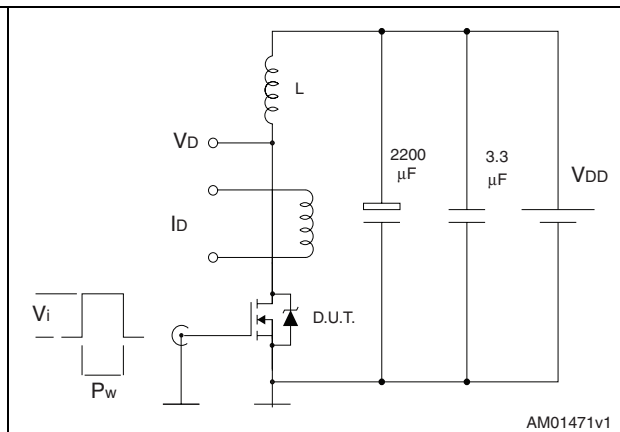
**Figure 15. Gate charge test circuit**



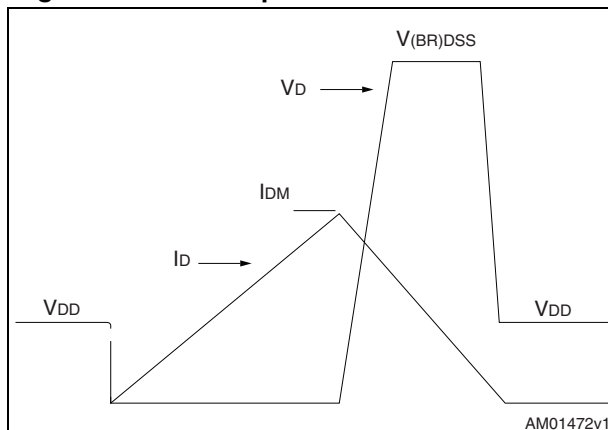
**Figure 16. Test circuit for inductive load switching and diode recovery times**



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



**Figure 18. Unclamped inductive waveform**

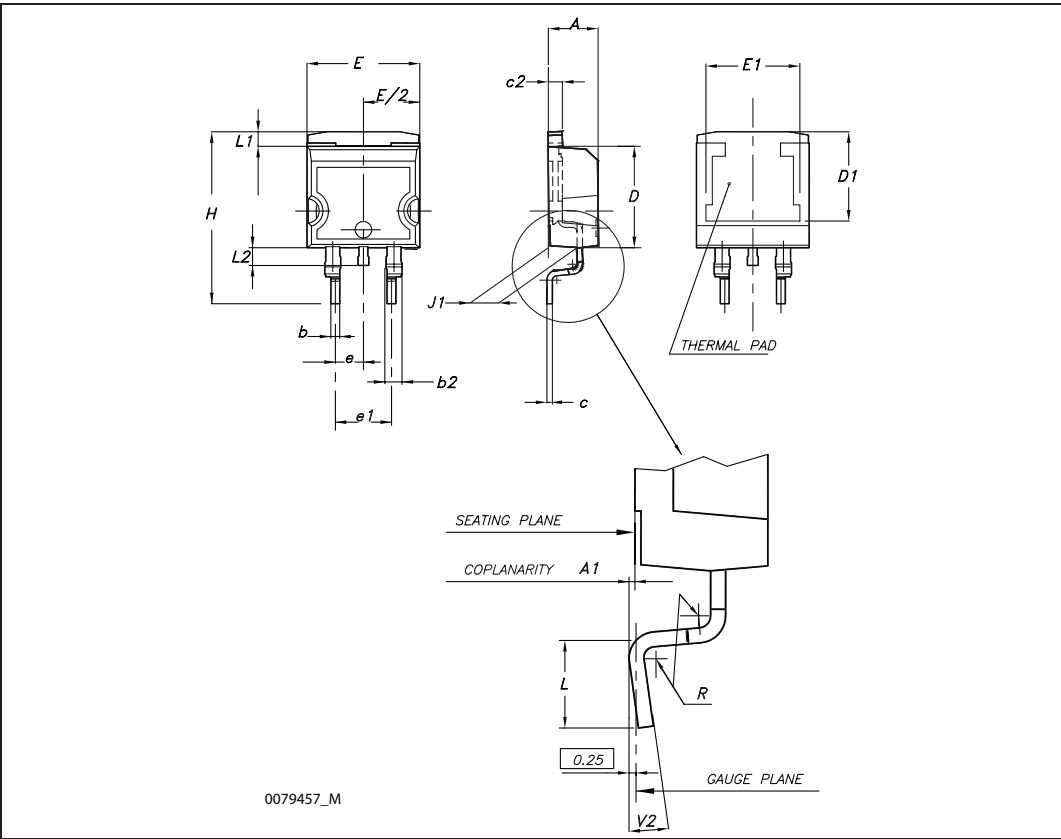


## 4 Package mechanical data

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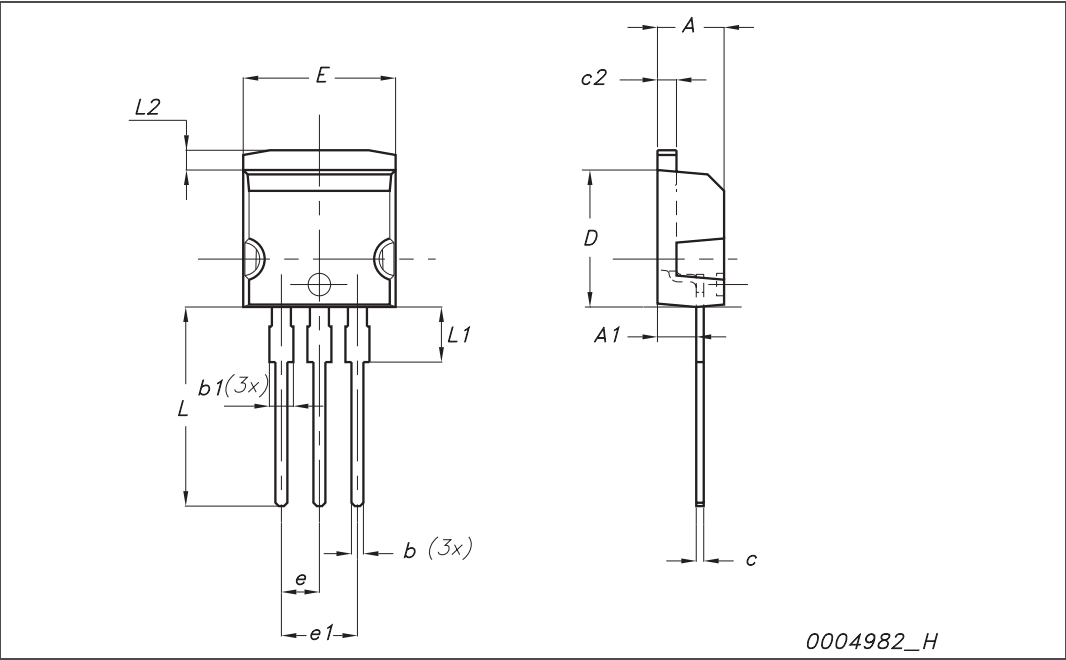
D<sup>2</sup>PAK (TO-263) mechanical data

| Dim | mm   |      |       | inch  |       |       |
|-----|------|------|-------|-------|-------|-------|
|     | Min  | Typ  | Max   | Min   | Typ   | Max   |
| A   | 4.40 |      | 4.60  | 0.173 |       | 0.181 |
| A1  | 0.03 |      | 0.23  | 0.001 |       | 0.009 |
| b   | 0.70 |      | 0.93  | 0.027 |       | 0.037 |
| b2  | 1.14 |      | 1.70  | 0.045 |       | 0.067 |
| c   | 0.45 |      | 0.60  | 0.017 |       | 0.024 |
| c2  | 1.23 |      | 1.36  | 0.048 |       | 0.053 |
| D   | 8.95 |      | 9.35  | 0.352 |       | 0.368 |
| D1  | 7.50 |      |       | 0.295 |       |       |
| E   | 10   |      | 10.40 | 0.394 |       | 0.409 |
| E1  | 8.50 |      |       | 0.334 |       |       |
| e   |      | 2.54 |       |       | 0.1   |       |
| e1  | 4.88 |      | 5.28  | 0.192 |       | 0.208 |
| H   | 15   |      | 15.85 | 0.590 |       | 0.624 |
| J1  | 2.49 |      | 2.69  | 0.099 |       | 0.106 |
| L   | 2.29 |      | 2.79  | 0.090 |       | 0.110 |
| L1  | 1.27 |      | 1.40  | 0.05  |       | 0.055 |
| L2  | 1.30 |      | 1.75  | 0.051 |       | 0.069 |
| R   |      | 0.4  |       |       | 0.016 |       |
| V2  | 0°   |      | 8°    | 0°    |       | 8°    |



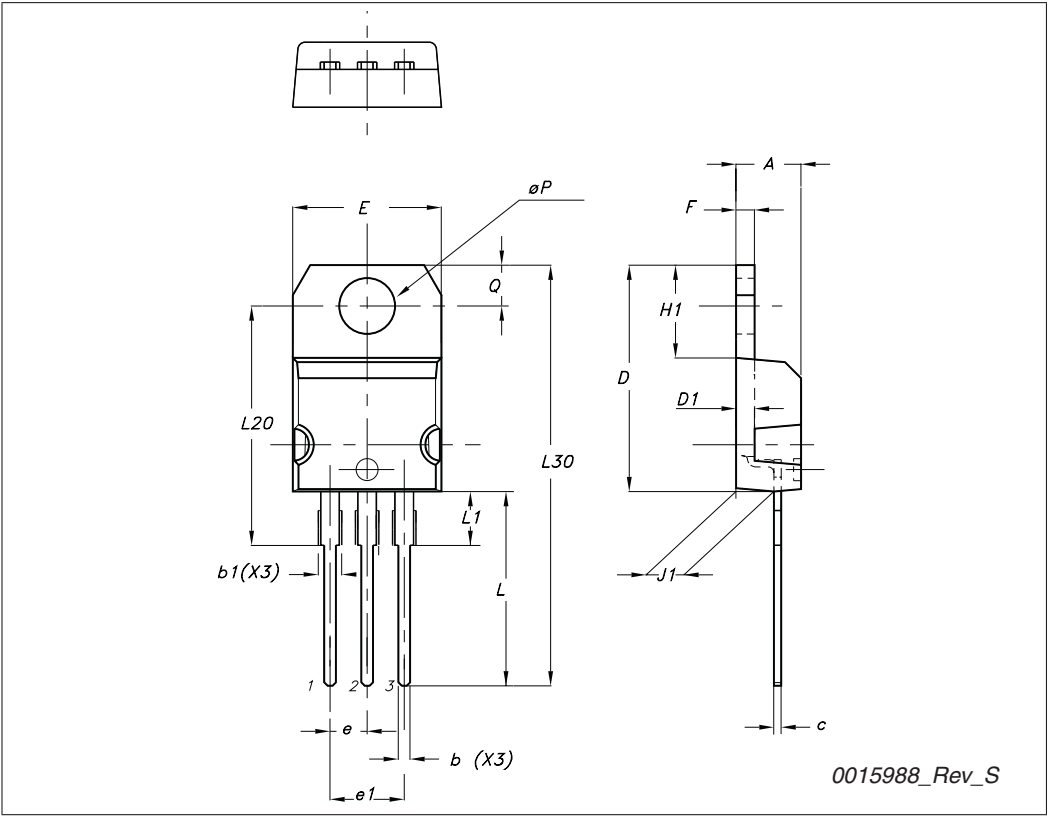
I<sup>2</sup>PAK (TO-262) mechanical data

| Dim | mm   |     |       | inch  |     |       |
|-----|------|-----|-------|-------|-----|-------|
|     | Min  | Typ | Max   | Min   | Typ | Max   |
| A   | 4.40 |     | 4.60  | 0.173 |     | 0.181 |
| A1  | 2.40 |     | 2.72  | 0.094 |     | 0.107 |
| b   | 0.61 |     | 0.88  | 0.024 |     | 0.034 |
| b1  | 1.14 |     | 1.70  | 0.044 |     | 0.066 |
| c   | 0.49 |     | 0.70  | 0.019 |     | 0.027 |
| c2  | 1.23 |     | 1.32  | 0.048 |     | 0.052 |
| D   | 8.95 |     | 9.35  | 0.352 |     | 0.368 |
| e   | 2.40 |     | 2.70  | 0.094 |     | 0.106 |
| e1  | 4.95 |     | 5.15  | 0.194 |     | 0.202 |
| E   | 10   |     | 10.40 | 0.393 |     | 0.410 |
| L   | 13   |     | 14    | 0.511 |     | 0.551 |
| L1  | 3.50 |     | 3.93  | 0.137 |     | 0.154 |
| L2  | 1.27 |     | 1.40  | 0.050 |     | 0.055 |



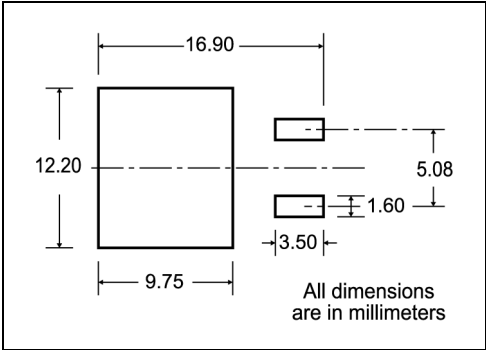
TO-220 type A mechanical data

| 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  |

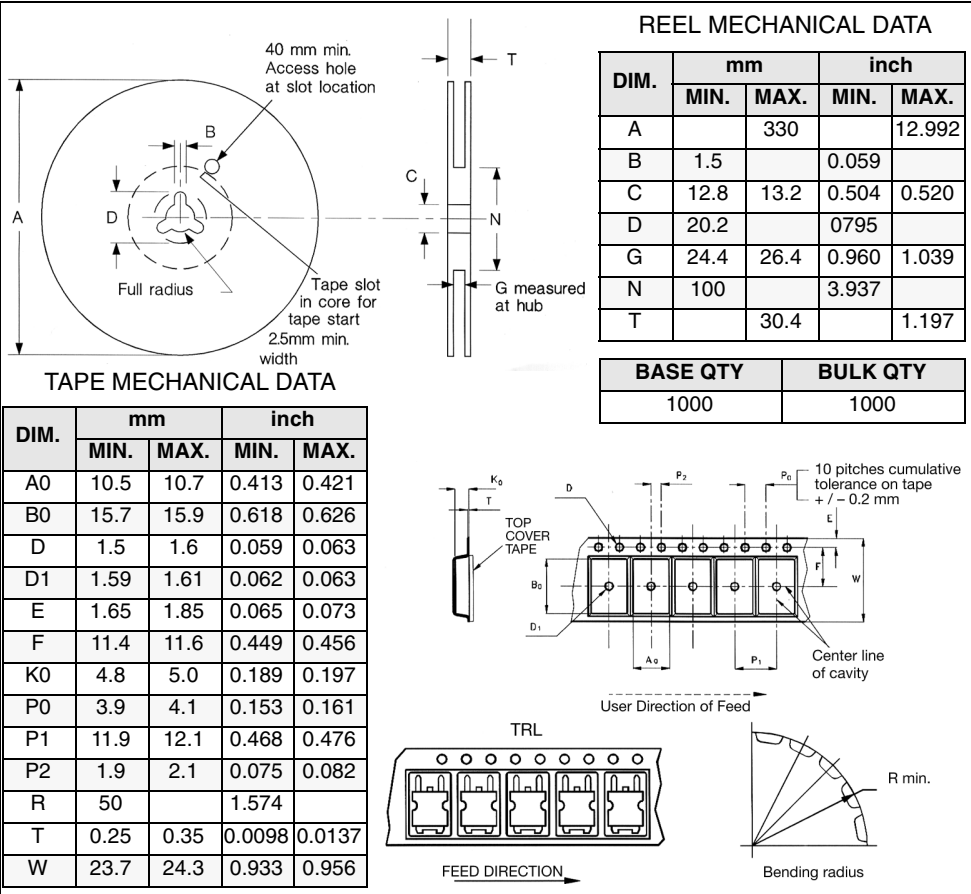


# 5 Packaging mechanical data

## D<sup>2</sup>PAK FOOTPRINT



## TAPE AND REEL SHIPMENT



## 6 Revision history

**Table 8. Document revision history**

| Date        | Revision | Changes                                                |
|-------------|----------|--------------------------------------------------------|
| 25-Jul-2007 | 1        | Initial release                                        |
| 14-Dec-2009 | 2        | Added new package, mechanical data: I <sup>2</sup> PAK |

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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

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