



STB76NF75, STI76NF75 STP76NF75

N-channel 75 V, 0.0095 Ω , 80 A TO-220, D²PAK, I²PAK
STripFET™ II Power MOSFET

Features

| Type | V _{DSS} | R _{DS(on) max} | I _D |
|-----------|------------------|-------------------------|---------------------|
| STB76NF75 | 75 V | < 0.011 Ω | 80 A ⁽¹⁾ |
| STI76NF75 | 75 V | < 0.011 Ω | 80 A ⁽¹⁾ |
| STP76NF75 | 75 V | < 0.011 Ω | 80 A ⁽¹⁾ |

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.

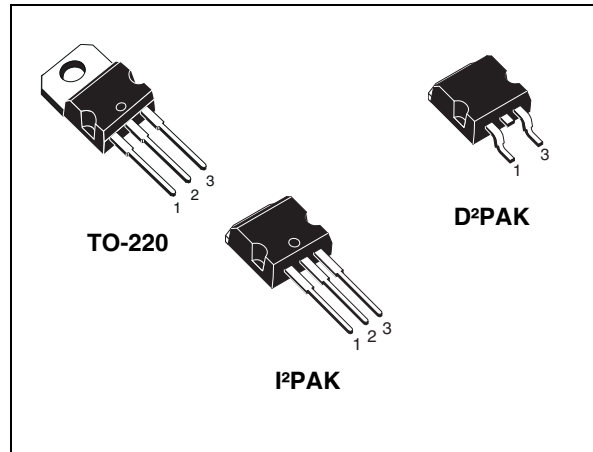


Figure 1. Internal schematic diagram

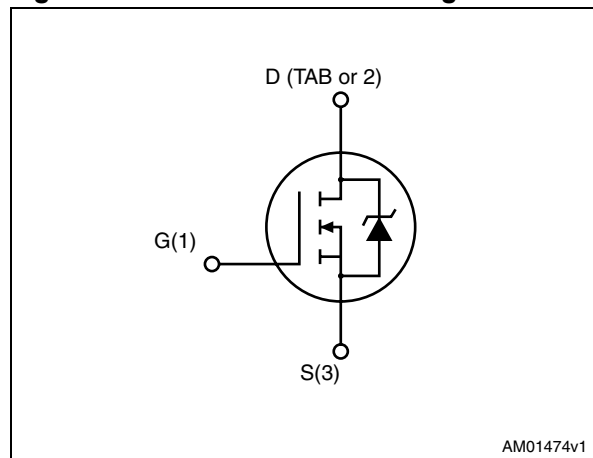


Table 1. Device summary

| Order codes | Marking | Package | Packaging |
|-------------|---------|--------------------|---------------|
| STB76NF75 | B76NF75 | D ² PAK | Tape and reel |
| STI76NF75 | I76NF75 | I ² 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 | ± 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 T_{stg} | Operating junction temperature 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 ⁽¹⁾ | 300 | $^\circ\text{C}$ |

1. 1.6mm from case for 10 sec

2 Electrical characteristics

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

Table 4. On/off states

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|---------------|--|---|------|--------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage | $I_D = 250\ \mu\text{A}$, $V_{GS} = 0$ | 75 | | | V |
| I_{DSS} | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS} = \text{Max rating}$, $V_{DS} = \text{Max rating @ } 125\text{ °C}$ | | | 1 10 | μA μA |
| I_{GSS} | Gate body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20\text{ V}$ | | | ± 100 | nA |
| $V_{GS(th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$ | 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} | Input capacitance | $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$ | - | 3700 | | pF |
| C_{oss} | Output capacitance | | | 730 | | pF |
| C_{rss} | Reverse transfer capacitance | | | 240 | | pF |
| Q_g | Total gate charge | $V_{DD} = 60\text{ V}$, $I_D = 80\text{ A}$ $V_{GS} = 10\text{ V}$ | - | 117 | 160 | nC |
| Q_{gs} | Gate-source charge | | | 27 | | nC |
| Q_{gd} | Gate-drain charge | | | 47 | | nC |

1. Pulsed: pulse duration = 300 μs , duty cycle 1.5%

Table 6. Switching times

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|--|------|------|------|------|
| $t_{d(on)}$ | Turn-on delay time | $V_{DD} = 37.5\text{ V}$, $I_D = 45\text{ A}$, $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ <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 | $I_{SD} = 80\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 25\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$ <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 μs , duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

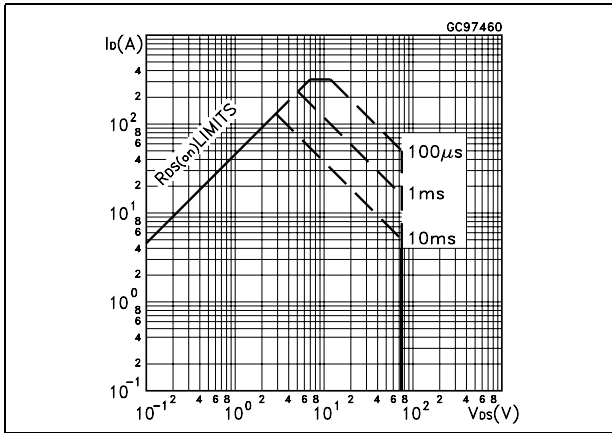


Figure 3. Thermal impedance

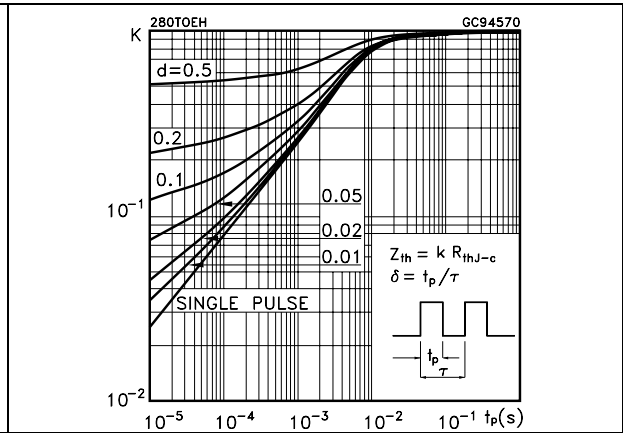


Figure 4. Output characteristics

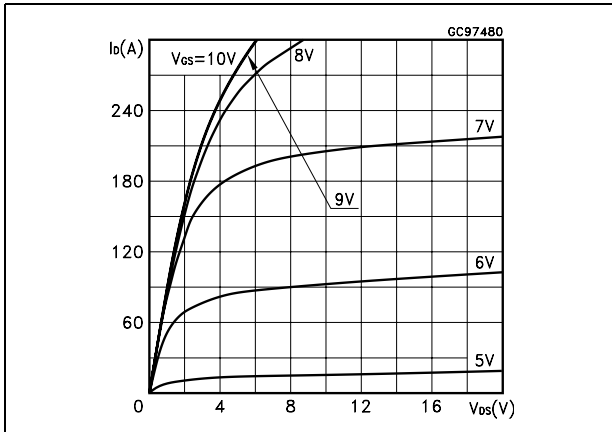


Figure 5. Transfer characteristics

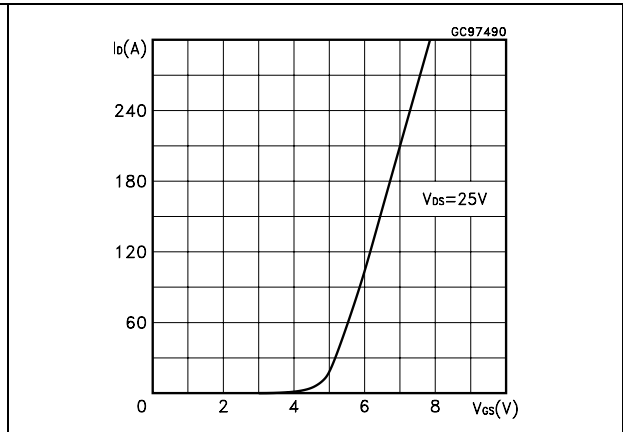


Figure 6. Transconductance

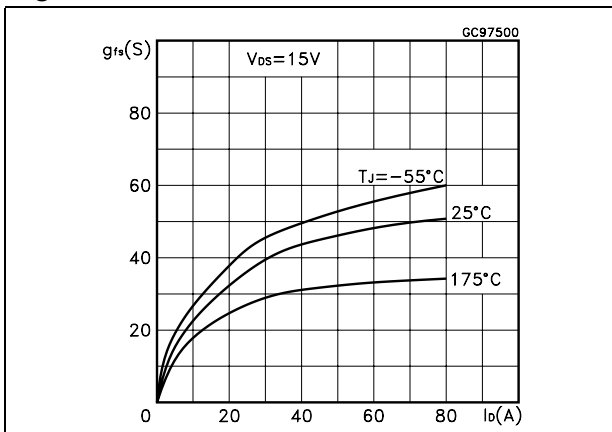


Figure 7. Static drain-source on resistance

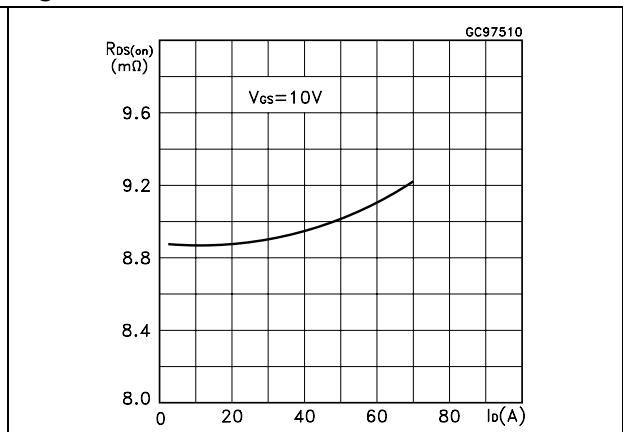


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

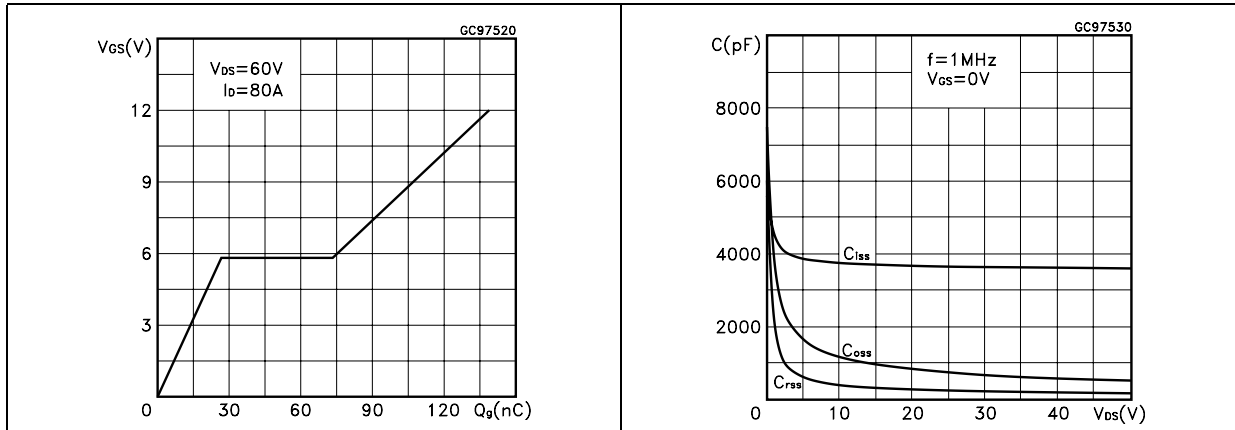


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

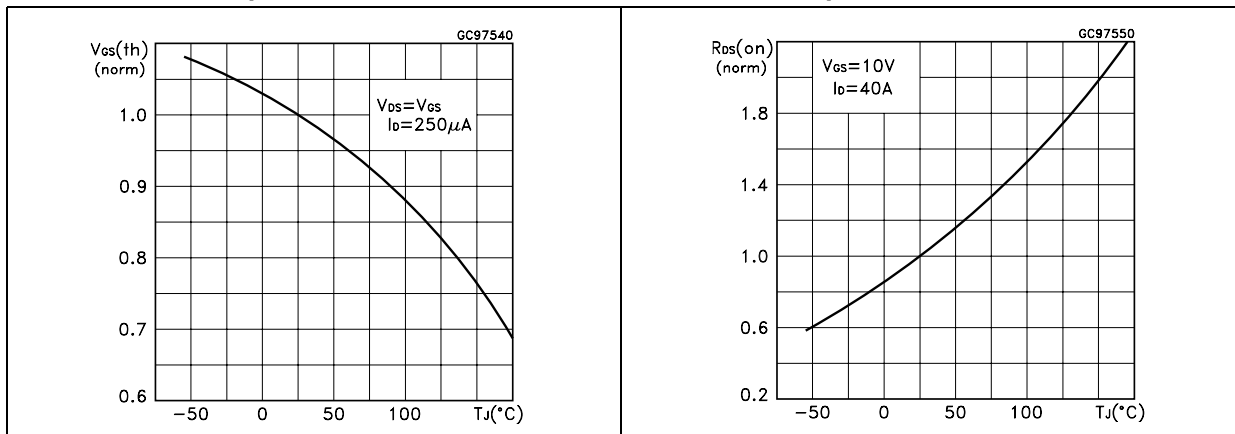
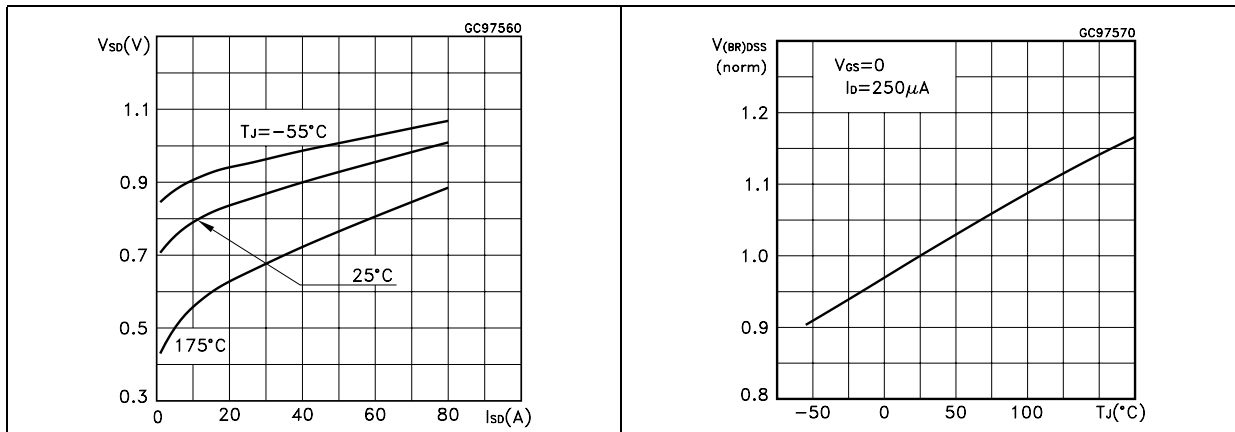
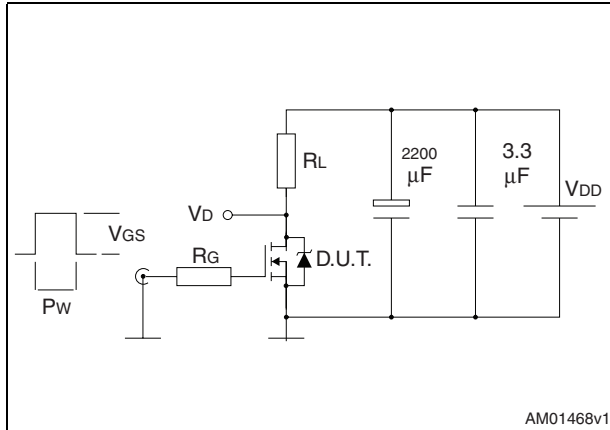


Figure 12. Source-drain diode forward characteristics Figure 13. Normalized $B_{V_{DSS}}$ vs temperature



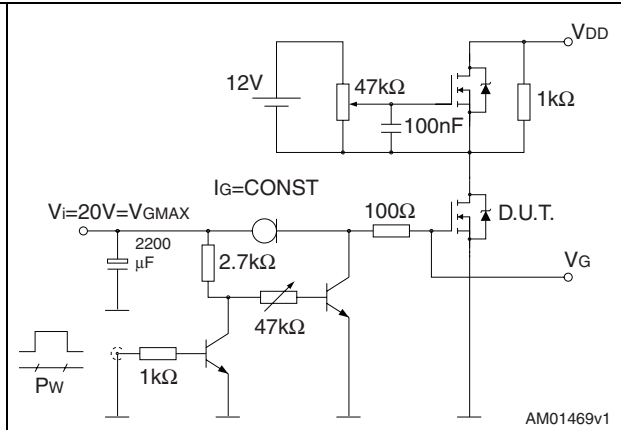
3 Test circuits

Figure 14. Switching times test circuit for resistive load



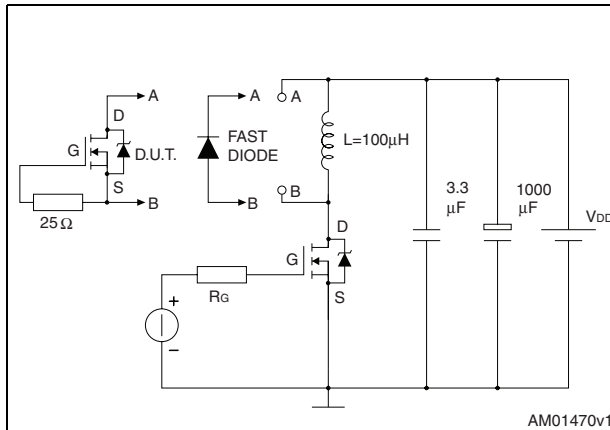
AM01468v1

Figure 15. Gate charge test circuit



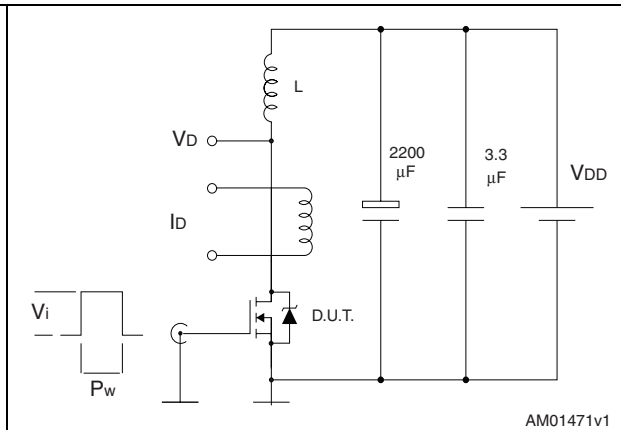
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Figure 16. Test circuit for inductive load switching and diode recovery times



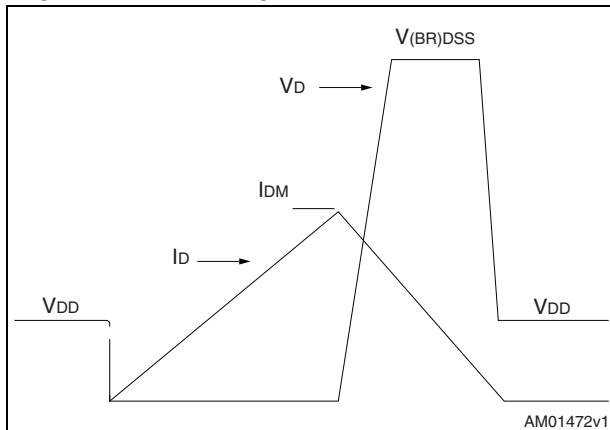
AM01470v1

Figure 17. Unclamped inductive load test circuit



AM01471v1

Figure 18. Unclamped inductive waveform



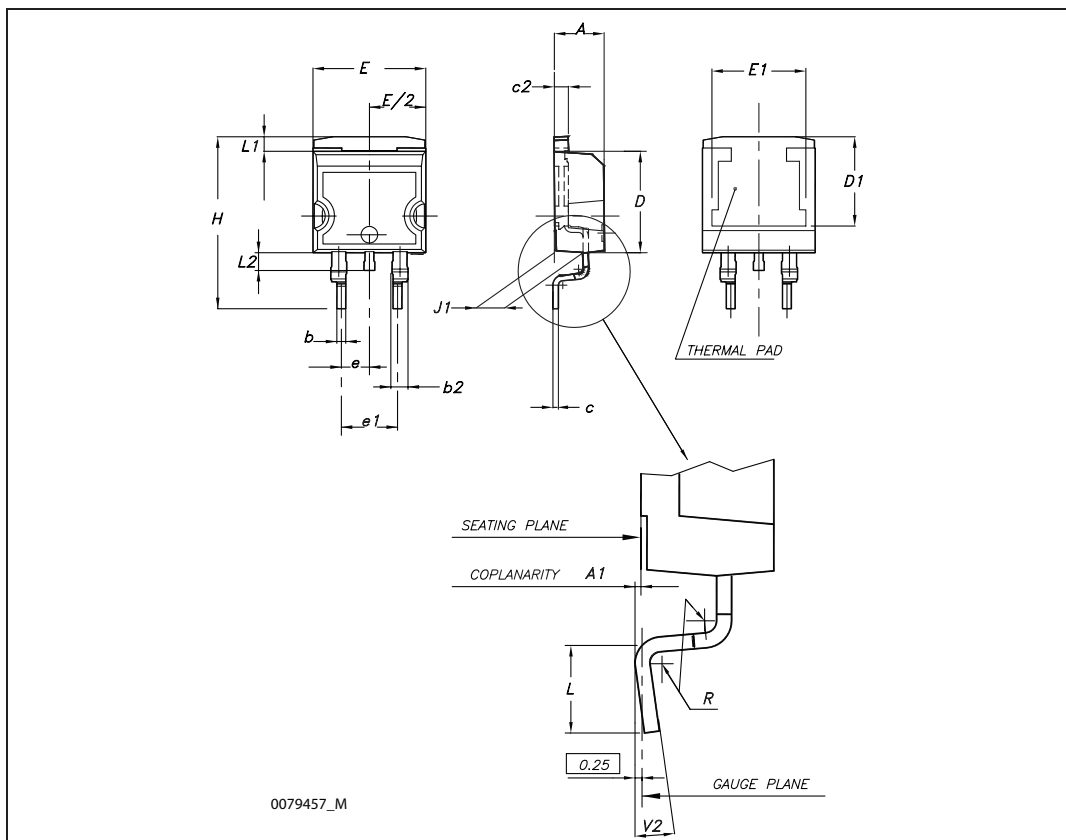
AM01472v1

4 Package mechanical data

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. ECOPACK is an ST trademark.

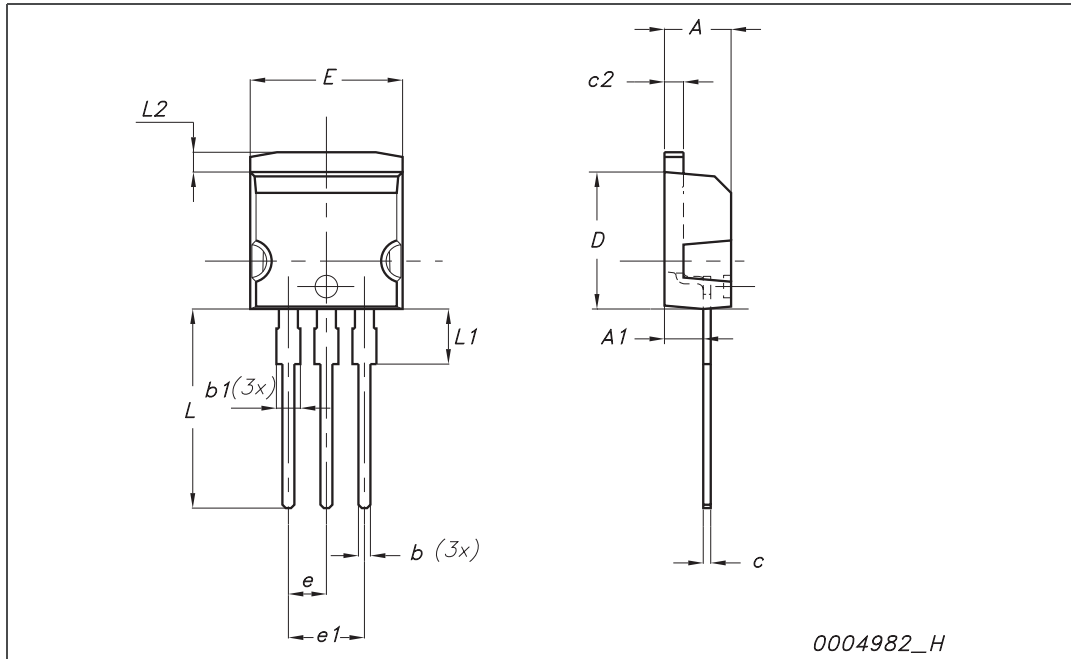
D²PAK (TO-263) mechanical data

| 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° |



I²PAK (TO-262) mechanical data

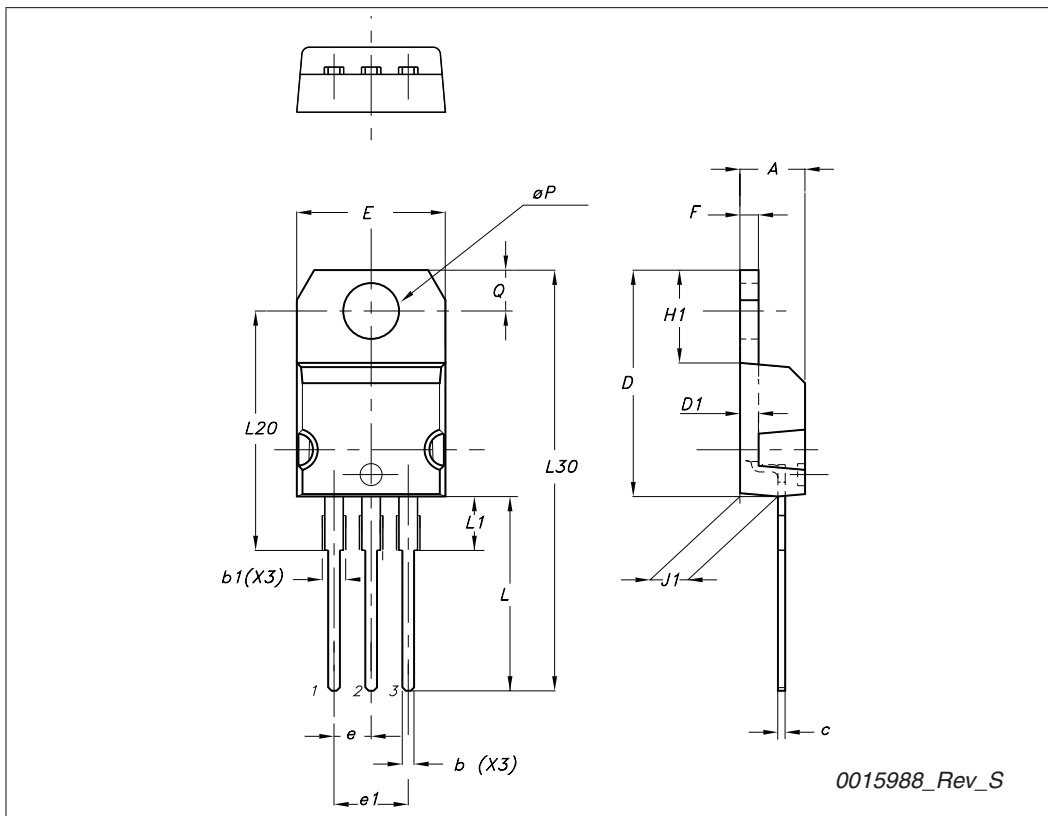
| Dim | mm | | | inch | | |
|-----|------|-----|-------|-------|-----|-------|
| | Min | Typ | Max | Min | Typ | Max |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| A1 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| b | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b1 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| c | 0.49 | | 0.70 | 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 |



0004982_H

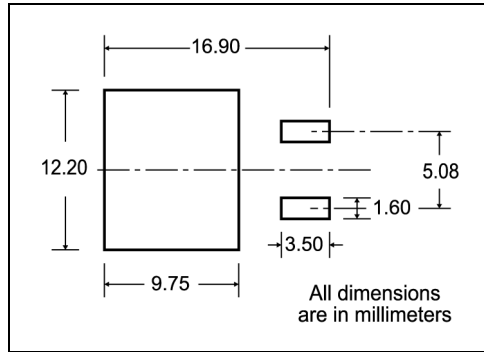
TO-220 type A mechanical data

| 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 | |
| ∅P | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |



5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT

TAPE MECHANICAL DATA

| DIM. | mm | | inch | |
|------|------|------|--------|--------|
| | MIN. | MAX. | MIN. | MAX. |
| A0 | 10.5 | 10.7 | 0.413 | 0.421 |
| B0 | 15.7 | 15.9 | 0.618 | 0.626 |
| D | 1.5 | 1.6 | 0.059 | 0.063 |
| D1 | 1.59 | 1.61 | 0.062 | 0.063 |
| E | 1.65 | 1.85 | 0.065 | 0.073 |
| F | 11.4 | 11.6 | 0.449 | 0.456 |
| K0 | 4.8 | 5.0 | 0.189 | 0.197 |
| P0 | 3.9 | 4.1 | 0.153 | 0.161 |
| P1 | 11.9 | 12.1 | 0.468 | 0.476 |
| P2 | 1.9 | 2.1 | 0.075 | 0.082 |
| R | 50 | | 1.574 | |
| T | 0.25 | 0.35 | 0.0098 | 0.0137 |
| W | 23.7 | 24.3 | 0.933 | 0.956 |

REEL MECHANICAL DATA

| DIM. | mm | | inch | |
|------|------|------|-------|--------|
| | MIN. | MAX. | MIN. | MAX. |
| A | | 330 | | 12.992 |
| B | 1.5 | | 0.059 | |
| C | 12.8 | 13.2 | 0.504 | 0.520 |
| D | 20.2 | | 0.795 | |
| G | 24.4 | 26.4 | 0.960 | 1.039 |
| N | 100 | | 3.937 | |
| T | | 30.4 | | 1.197 |

| BASE QTY | BULK QTY |
|----------|----------|
| 1000 | 1000 |

* on sales type

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 ² PAK |

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