



# STB80NF10 STP80NF10

N-channel 100 V, 0.012  $\Omega$ , 80 A, TO-220, D<sup>2</sup>PAK  
low gate charge STripFET™ II Power MOSFET

## Features

| Type      | V <sub>DSS</sub> | R <sub>DS(on) max</sub> | I <sub>D</sub> |
|-----------|------------------|-------------------------|----------------|
| STP80NF10 | 100 V            | < 0.015 $\Omega$        | 80 A           |
| STB80NF10 | 100 V            | < 0.015 $\Omega$        | 80 A           |

- Exceptional dv/dt capability
- 100% Avalanche tested
- Application oriented characterization

## Applications

- Switching applications

## Description

This Power MOSFET series realized with STMicroelectronics unique STripFET process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters for telecom and computer application. It is also intended for any application with low gate charge drive requirements.

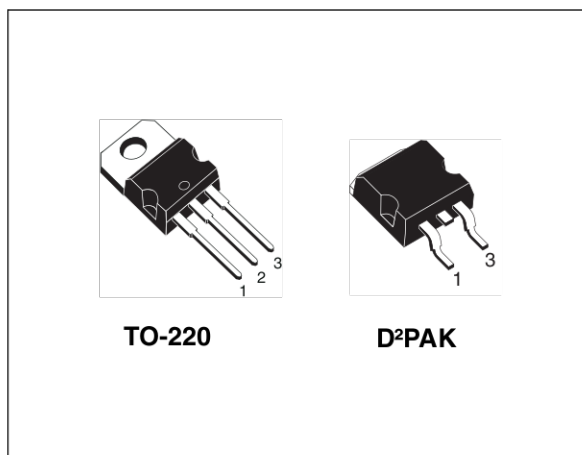


Figure 1. Internal schematic diagram

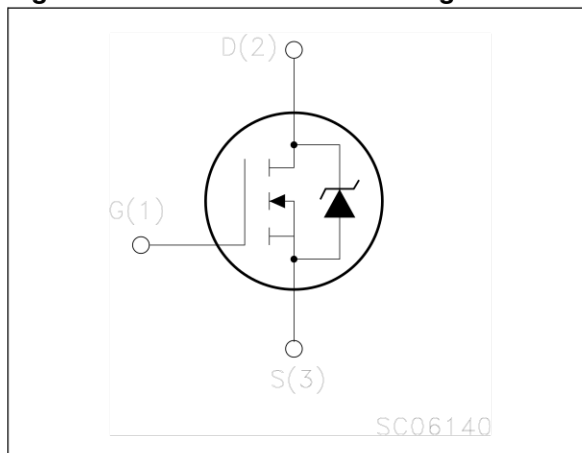


Table 1. Device summary

| Order codes | Marking  | Package            | Packaging     |
|-------------|----------|--------------------|---------------|
| STP80NF10   | P80NF10@ | TO-220             | Tube          |
| STB80NF10T4 | B80NF10@ | D <sup>2</sup> PAK | Tape and reel |

# Contents

|          |   |           |
|----------|---|-----------|
| <b>1</b> | <b>Electrical ratings</b> .....           | <b>3</b>  |
| <b>2</b> | <b>Electrical characteristics</b> .....   | <b>4</b>  |
| 2.1      | Electrical characteristics (curves) ..... | 5         |
| <b>3</b> | <b>Test circuit</b> .....                 | <b>8</b>  |
| <b>4</b> | <b>Package mechanical data</b> .....      | <b>9</b>  |
| <b>5</b> | <b>Packaging mechanical data</b> .....    | <b>13</b> |
| <b>6</b> | <b>Revision history</b> .....             | <b>14</b> |

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol             | Parameter   | Value      | Unit                |
|--------------------|---|------------|---------------------|
| $V_{DS}$           | Drain-source voltage ( $V_{GS} = 0$ )                           | 100        | 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 $T_C = 100\text{ }^\circ\text{C}$ | 80         | 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          | W/ $^\circ\text{C}$ |
| $dv/dt^{(3)}$      | Peak diode recovery voltage slope                               | 7          | V/ns                |
| $E_{AS}^{(4)}$     | Single pulse avalanche energy                                   | 350        | mJ                  |
| $T_{stg}$<br>$T_j$ | Storage temperature<br>Operating junction temperature           | -55 to 175 | $^\circ\text{C}$    |

- Limited by package
- Pulse width limited by safe operating area
- $I_{SD} < 80\text{ A}$ ,  $di/dt < 300\text{ A}/\mu\text{s}$ ,  $V_{DD} = 80\% V_{(BR)DSS}$
- Starting  $T_j = 25\text{ }^\circ\text{C}$ ,  $I_D = 40\text{ A}$ ,  $V_{DD} = 50\text{ V}$

**Table 3. Thermal resistance**

| Symbol    | Parameter                                      | Value | Unit                      |
|-----------|--|-------|---------------------------|
| Rthj-case | Thermal resistance junction-case max           | 0.5   | $^\circ\text{C}/\text{W}$ |
| Rthj-amb  | Thermal resistance junction-ambient max        | 62.5  | $^\circ\text{C}/\text{W}$ |
| $T_l$     | Maximum lead temperature for soldering purpose | 300   | $^\circ\text{C}$          |

## 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                   | $I_D = 250\ \mu\text{A}$ , $V_{GS} = 0$                                      | 100  |       |           | V                   |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max rating}$<br>$V_{DS} = \text{Max rating @ } 125\text{°C}$ |      |       | 500<br>10 | nA<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                           | $V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$                                 | 2    | 3     | 4         | V                   |
| $R_{DS(on)}$  | Static drain-source on resistance                | $V_{GS} = 10\ \text{V}$ , $I_D = 40\ \text{A}$                               |      | 0.012 | 0.015     | $\Omega$            |

**Table 5. Dynamic**

| Symbol         | Parameter                    | Test conditions   | Min. | Typ. | Max. | Unit |
|----------------|------------------------------|---|------|------|------|------|
| $g_{fs}^{(1)}$ | Forward transconductance     | $V_{DS} = 25\ \text{V}$ , $I_D = 40\ \text{A}$                              | -    | 50   |      | S    |
| $C_{iss}$      | Input capacitance            | $V_{DS} = 25\ \text{V}$ , $f = 1\ \text{MHz}$ ,<br>$V_{GS} = 0$             | -    | 5500 |      | pF   |
| $C_{oss}$      | Output capacitance           |   |      | 700  |      | pF   |
| $C_{rss}$      | Reverse transfer capacitance |   |      | 175  |      | pF   |
| $Q_g$          | Total gate charge            | $V_{DD} = 50\ \text{V}$ , $I_D = 80\ \text{A}$ ,<br>$V_{GS} = 10\ \text{V}$ | -    | 135  | 182  | nC   |
| $Q_{gs}$       | Gate-source charge           |   |      | 23   |      | nC   |
| $Q_{gd}$       | Gate-drain charge            |   |      | 51.3 |      | 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  | $V_{DD} = 50\ \text{V}$ , $I_D = 40\ \text{A}$ ,<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 10\ \text{V}$<br><i>(see Figure 15)</i> | -    | 26   |      | ns   |
| $t_r$        | Rise time           |   |      | 80   |      | ns   |
| $t_{d(off)}$ | Turn-off-delay time |   |      | 116  | -    | ns   |
| $t_f$        | Fall time           |   |      | 60   |      | 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            | $I_{SD} = 80 \text{ A}, V_{GS} = 0$          | -    |      | 1.3 | V    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD}=80 \text{ A}, V_{DD} = 50 \text{ V}$ |      | 106  |     | ns   |
| $Q_{rr}$        | Reverse recovery charge       | $di/dt = 100 \text{ A}/\mu\text{s},$         | -    | 450  |     | nC   |
| $I_{RRM}$       | Reverse recovery current      | $T_j=150 \text{ }^\circ\text{C}$             |      | 8.5  |     | A    |

1. Pulse width limited by safe operating area

2. Pulse duration=300 $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

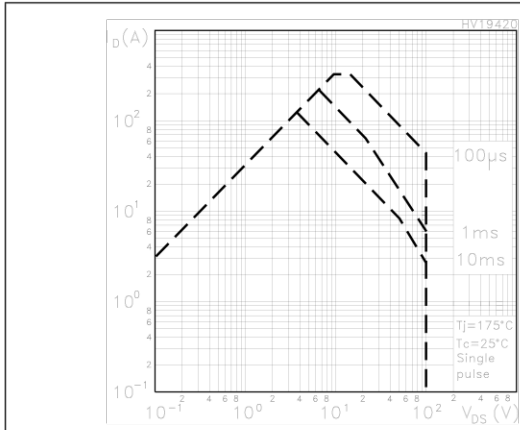


Figure 3. Thermal impedance

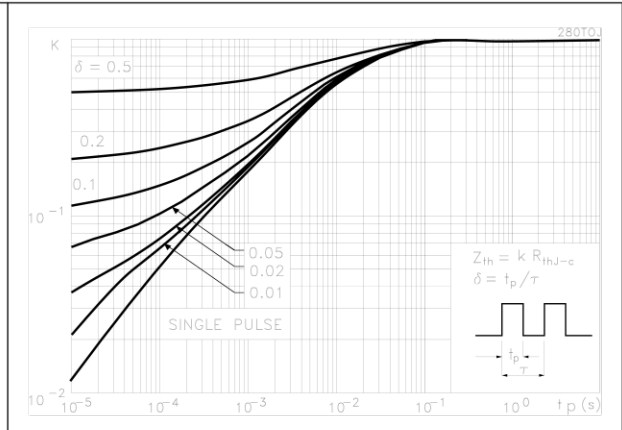


Figure 4. Output characteristics

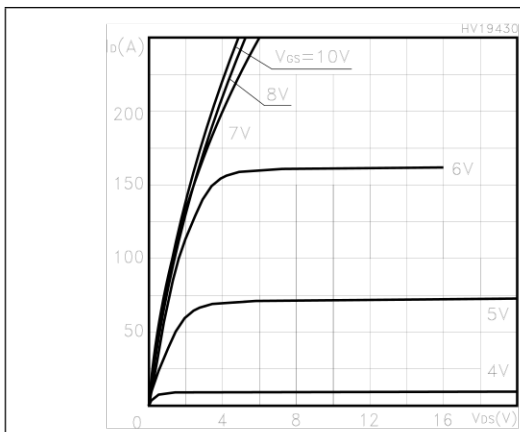


Figure 5. Transfer characteristics

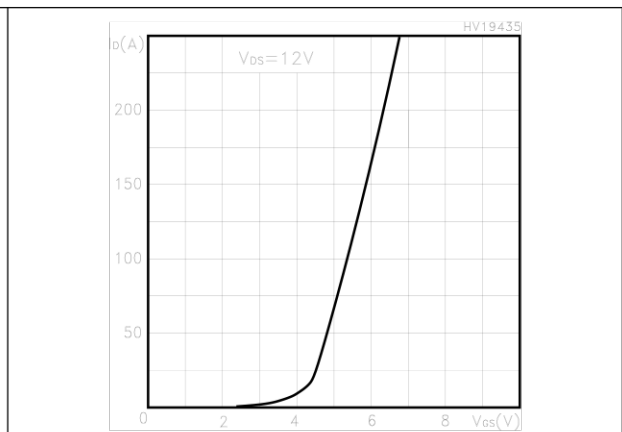


Figure 6. Transconductance

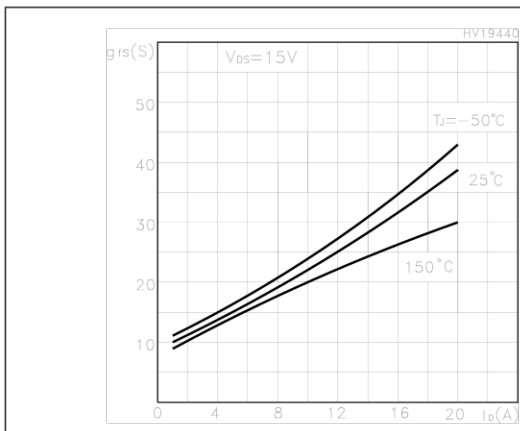


Figure 7. Static drain-source on resistance

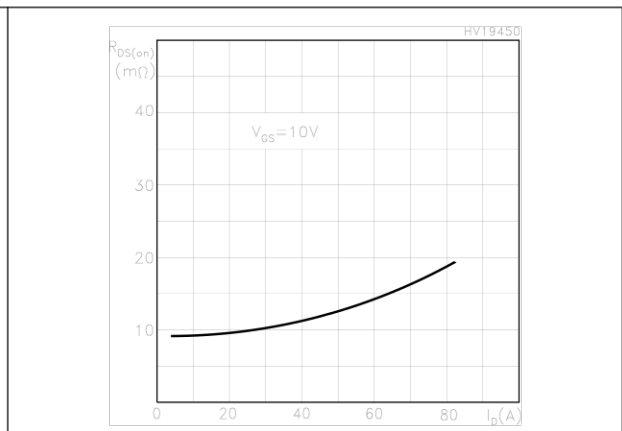


Figure 8. Gate charge vs. gate-source voltage Figure 9. Capacitance variations

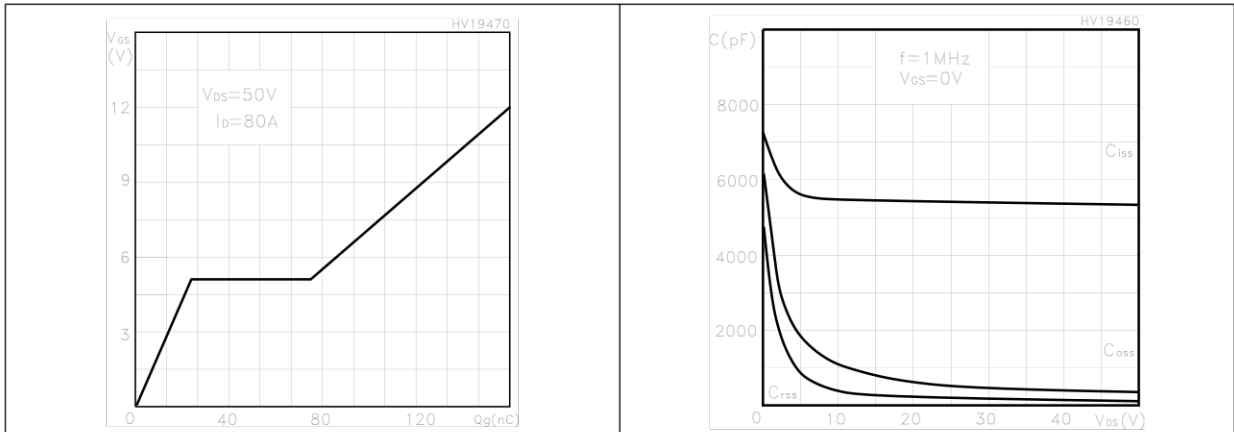


Figure 10. Normalized gate threshold voltage vs. temperature

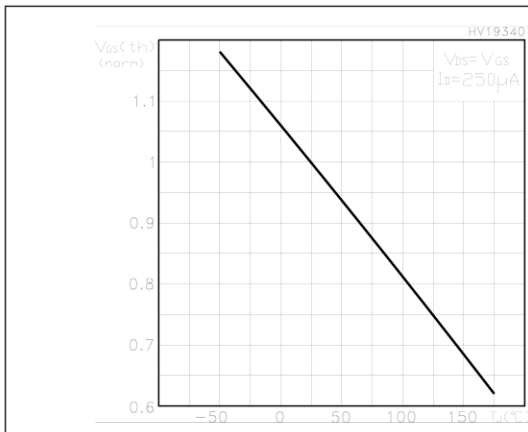


Figure 11. Normalized on resistance vs. temperature

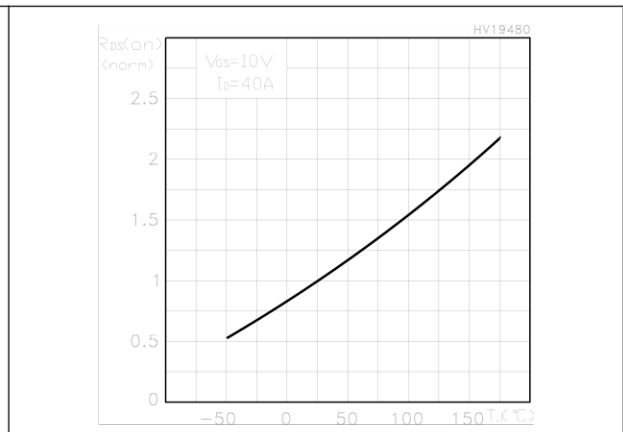
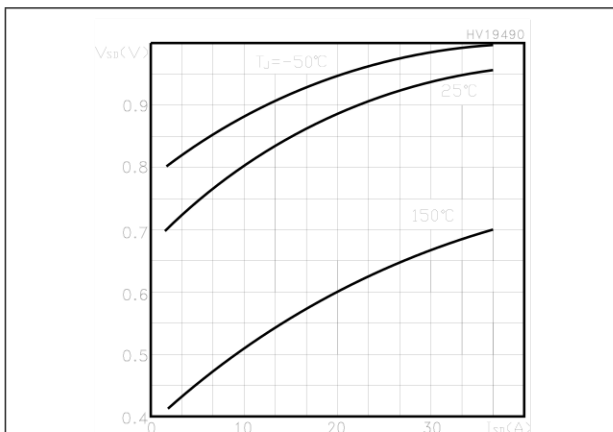
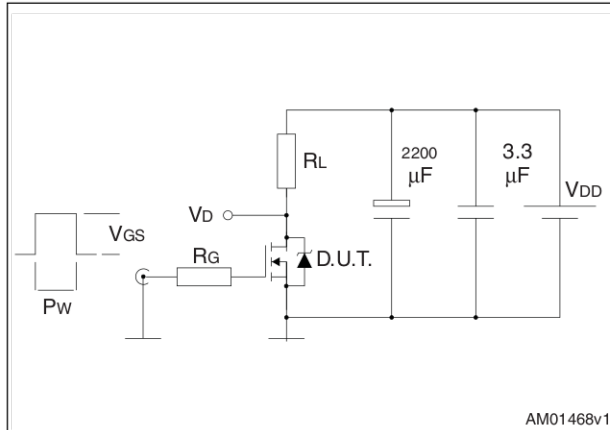


Figure 12. Source-drain diode forward characteristics



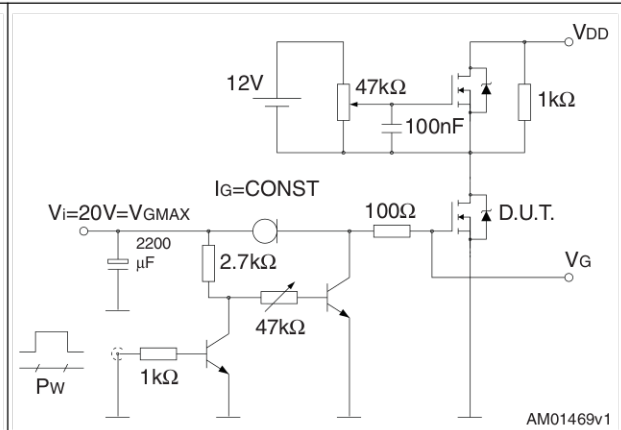
### 3 Test circuits

**Figure 13. Switching times test circuit for resistive load**



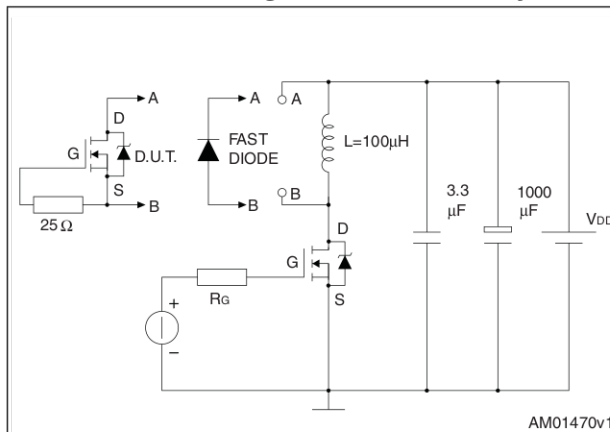
AM01468v1

**Figure 14. Gate charge test circuit**



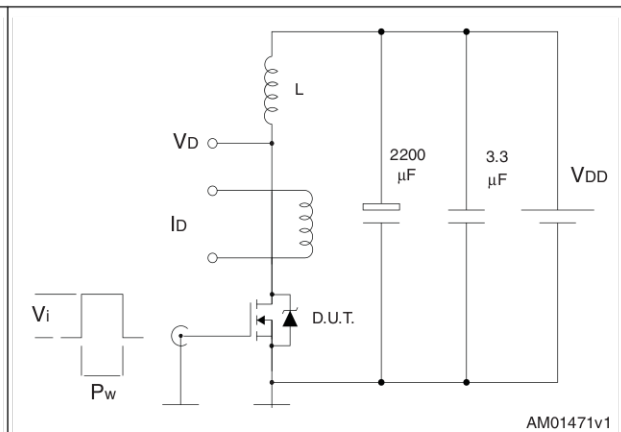
AM01469v1

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



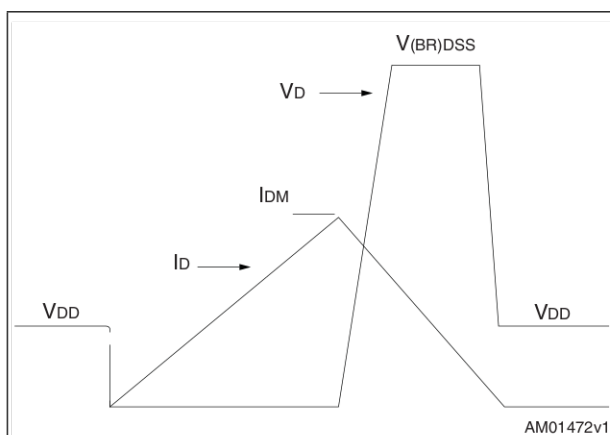
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**Figure 16. Unclamped inductive load test circuit**



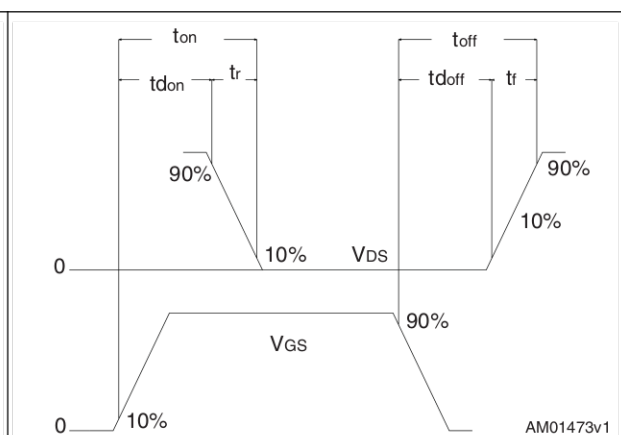
AM01471v1

**Figure 17. Unclamped inductive waveform**



AM01472v1

**Figure 18. Switching time waveform**



AM01473v1

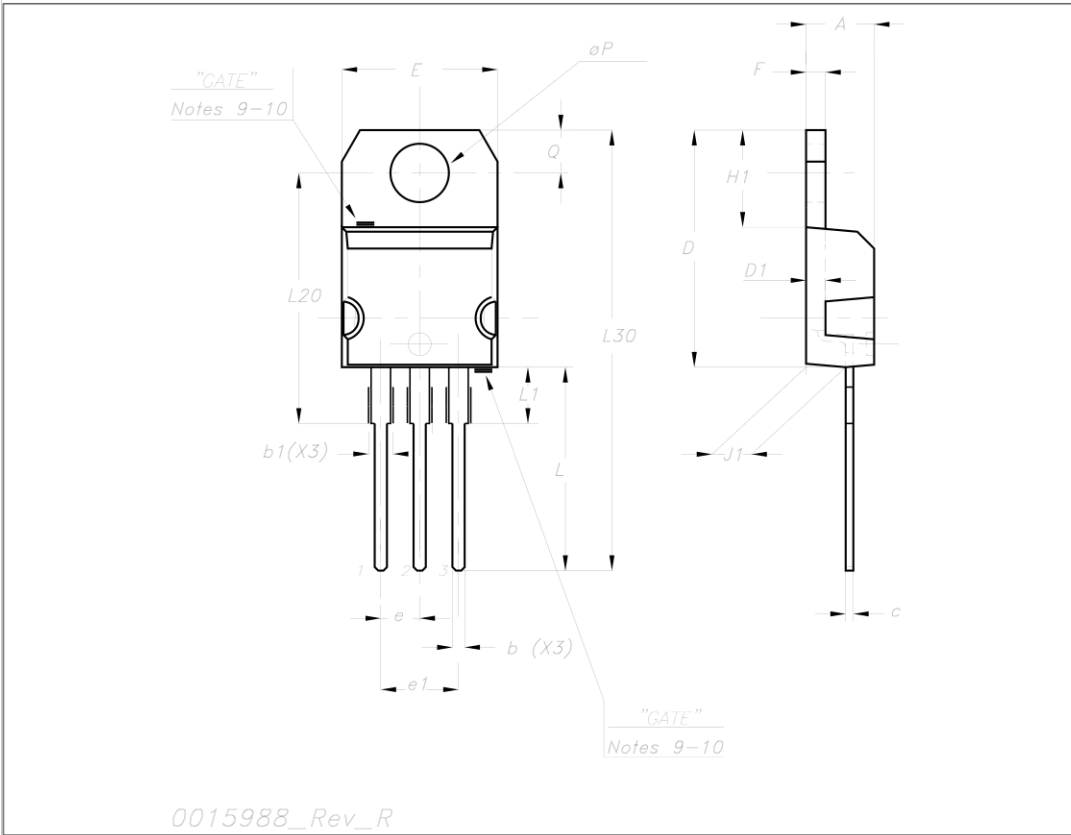


## 4 Package mechanical data

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.

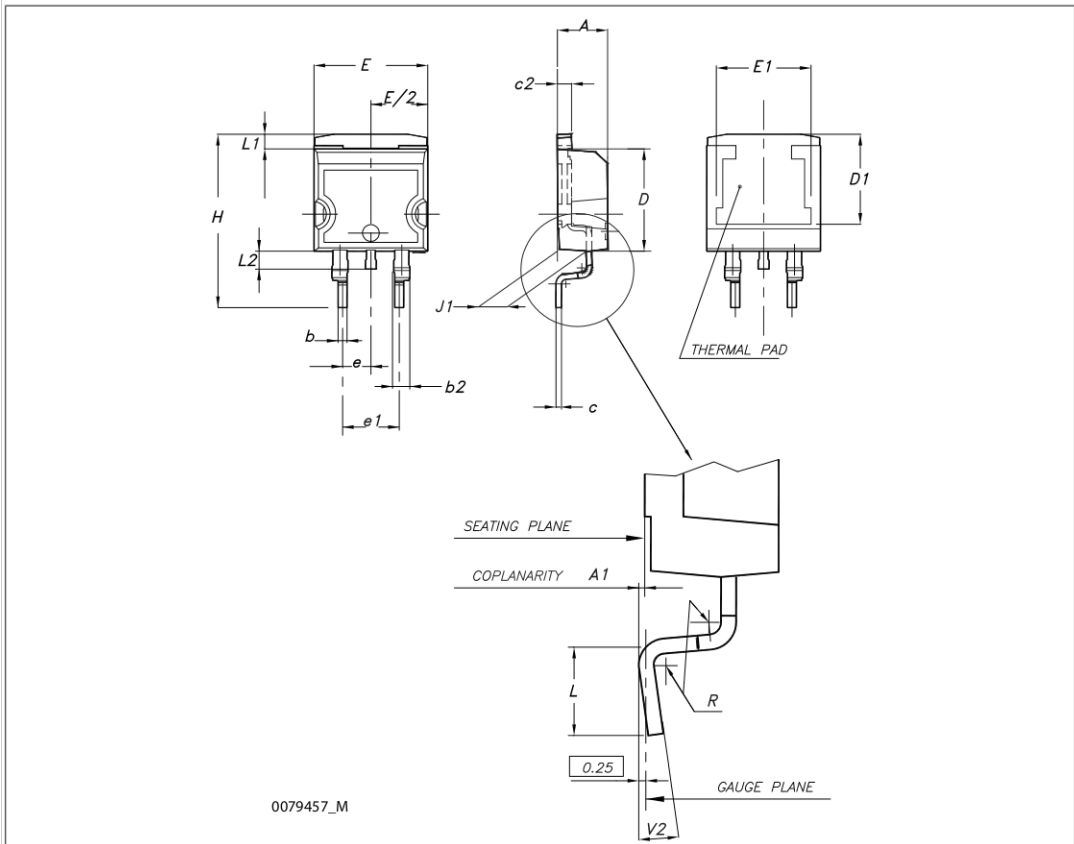
**TO-220 mechanical data**

| Dim | mm    |       |       | inch  |       |       |
|-----|-------|-------|-------|-------|-------|-------|
|     | Min   | Typ   | Max   | Min   | Typ   | Max   |
| A   | 4.40  |       | 4.60  | 0.173 |       | 0.181 |
| b   | 0.61  |       | 0.88  | 0.024 |       | 0.034 |
| b1  | 1.14  |       | 1.70  | 0.044 |       | 0.066 |
| c   | 0.48  |       | 0.70  | 0.019 |       | 0.027 |
| D   | 15.25 |       | 15.75 | 0.6   |       | 0.62  |
| D1  |       | 1.27  |       |       | 0.050 |       |
| E   | 10    |       | 10.40 | 0.393 |       | 0.409 |
| e   | 2.40  |       | 2.70  | 0.094 |       | 0.106 |
| e1  | 4.95  |       | 5.15  | 0.194 |       | 0.202 |
| F   | 1.23  |       | 1.32  | 0.048 |       | 0.051 |
| H1  | 6.20  |       | 6.60  | 0.244 |       | 0.256 |
| J1  | 2.40  |       | 2.72  | 0.094 |       | 0.107 |
| L   | 13    |       | 14    | 0.511 |       | 0.551 |
| L1  | 3.50  |       | 3.93  | 0.137 |       | 0.154 |
| L20 |       | 16.40 |       |       | 0.645 |       |
| L30 |       | 28.90 |       |       | 1.137 |       |
| ∅P  | 3.75  |       | 3.85  | 0.147 |       | 0.151 |
| Q   | 2.65  |       | 2.95  | 0.104 |       | 0.116 |



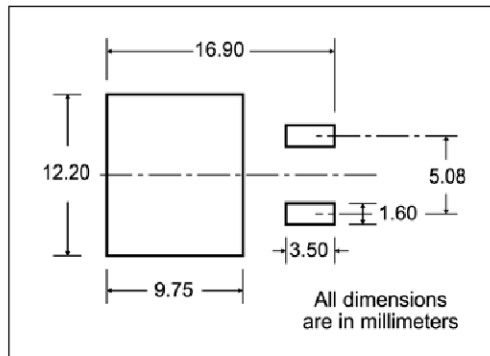
**D<sup>2</sup>PAK (TO-263) mechanical data**

| 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°    |



## 5 Packaging mechanical data

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

10 pitches cumulative tolerance on tape +/- 0.2 mm

\* on sales type

## 6 Revision history

**Table 8. Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 04-Nov-2003 | 8        | New datasheet according to PCN DSG-TRA/03/382                            |
| 13-Dec-2004 | 9        | D <sup>2</sup> PAK inserted  |
| 16-Dec-2004 | 10       | @ inserted in table 2 for TO-220 marking                                 |
| 27-Jan-2005 | 11       | New value in table 3   |
| 22-Feb-2005 | 12       | Id value changed   |
| 28-Feb-2005 | 13       | New value in table 3   |
| 01-Mar-2005 | 14       | Vgs value changed  |
| 06-Apr-2006 | 15       | The document has been reformatted  |
| 25-Jan-2007 | 16       | Typo mistake on page 1 (order codes)                                     |
| 17-Nov-2008 | 17       | E <sub>AS</sub> value has been updated                                   |
| 15-Apr-2009 | 18       | I <sub>DSS</sub> value changed in <a href="#">Table 4: On/off states</a> |

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