



# STP22NF03L

N-channel 30V - 0.0038Ω - 22A - TO-220  
STripFET™ II Power MOSFET

## Features

| Type       | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|------------|------------------|---------------------|----------------|
| STP22NF03L | 30V              | <0.05Ω              | 22A            |

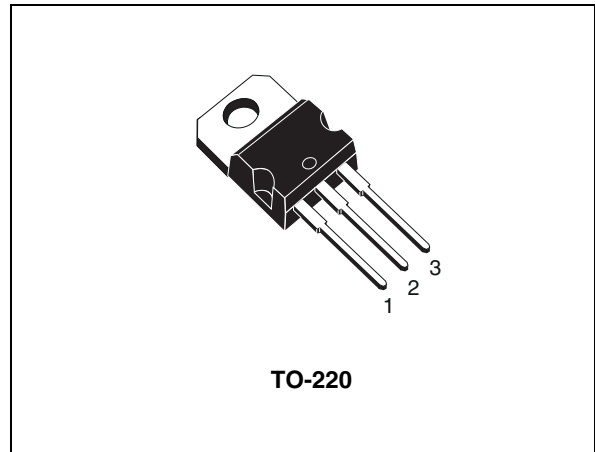
- Exceptional dv/dt capability
- Low gate charge at 100°C
- Application oriented characterization
- 100% avalanche tested

## Application

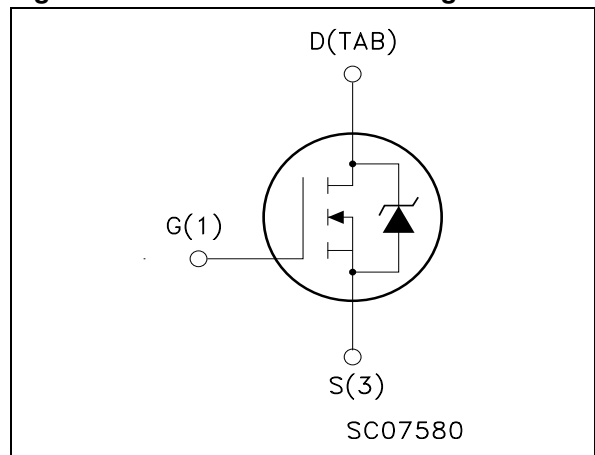
- Switching applications

## 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 code | Marking   | Package | Packaging |
|------------|-----------|---------|-----------|
| STP22NF03L | P22NF03L@ | TO-220  | Tube      |

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol         | Parameter                                               | Value      | Unit                |
|----------------|---------------------------------------------------------|------------|---------------------|
| $V_{DS}$       | Drain-source voltage ( $V_{GS} = 0$ )                   | 30         | V                   |
| $V_{DGR}$      | Drain-gate voltage ( $R_{GS} = 20\text{ k}\Omega$ )     | 30         | V                   |
| $V_{GS}$       | Gate- source voltage                                    | $\pm 15$   | V                   |
| $I_D$          | Drain current (continuous) at $T_C = 25^\circ\text{C}$  | 22         | A                   |
| $I_D^{(1)}$    | Drain current (continuous) at $T_C = 100^\circ\text{C}$ | 16         | A                   |
| $I_{DM}^{(1)}$ | Drain current (pulsed)                                  | 88         | A                   |
| $P_{tot}$      | Total dissipation at $T_C = 25^\circ\text{C}$           | 45         | W                   |
|                | Derating factor                                         | 0.3        | W/ $^\circ\text{C}$ |
| $dv/dt^{(2)}$  | Peak diode recovery voltage slope                       | 6          | V/ns                |
| $E_{AS}^{(3)}$ | Single pulse avalanche energy                           | 200        | mJ                  |
| $T_{stg}$      | Storage temperature                                     | -55 to 175 | $^\circ\text{C}$    |
| $T_j$          | Max. operating junction temperature                     |            |                     |

1. Pulse width limited by safe operating area.
2.  $I_{SD} \leq 22\text{A}$ ,  $di/dt \leq 300\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_j \leq T_{JMAX}$
3. Starting  $T_j = 25^\circ\text{C}$ ,  $I_D = 11\text{A}$ ,  $V_{DD} = 15\text{V}$

**Table 3. Thermal data**

| Symbol         | Parameter                                      | Value | Unit                      |
|----------------|------------------------------------------------|-------|---------------------------|
| $R_{thj-case}$ | Thermal resistance junction-case max           | 3.33  | $^\circ\text{C}/\text{W}$ |
| $R_{thj-amb}$  | Thermal resistance junction-ambient max        | 62.5  | $^\circ\text{C}/\text{W}$ |
| $T_J$          | Maximum lead temperature for soldering purpose | 300   | $^\circ\text{C}$          |

## 2 Electrical characteristics

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

**Table 4. On/off states**

| Symbol        | Parameter                                        | Test conditions                                                                                 | Min. | Typ.           | Max.         | Unit                           |
|---------------|--------------------------------------------------|-------------------------------------------------------------------------------------------------|------|----------------|--------------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage                   | $I_D = 250\mu\text{A}$ , $V_{GS} = 0$                                                           | 30   |                |              | V                              |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = \text{max ratings}$<br>$V_{DS} = \text{max ratings}$ ,<br>$T_C = 125^{\circ}\text{C}$ |      |                | 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                           | $V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$                                                      | 1    |                |              | V                              |
| $R_{DS(on)}$  | Static drain-source on resistance                | $V_{GS} = 10\text{V}$ , $I_D = 11\text{A}$<br>$V_{GS} = 5\text{V}$ , $I_D = 11\text{A}$         |      | 0.038<br>0.045 | 0.05<br>0.06 | $\Omega$<br>$\Omega$           |

**Table 5. Dynamic**

| Symbol                                        | Parameter                                                               | Test conditions                                                                                                            | Min. | Typ.               | Max. | Unit                 |
|-----------------------------------------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------|--------------------|------|----------------------|
| $g_{fs}^{(1)}$                                | Forward transconductance                                                | $V_{DS} = 15\text{V}$ , $I_D = 11\text{A}$                                                                                 |      | 7                  |      | 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>$V_{GS} = 0$                                                                |      | 330<br>90<br>40    |      | pF<br>pF<br>pF       |
| $t_{d(on)}$<br>$t_r$<br>$t_{d(off)}$<br>$t_f$ | Turn-on delay time<br>Rise time<br>Turn-off delay time<br>Fall time     | $V_{DD} = 15\text{V}$ , $I_D = 11\text{A}$<br>$R_G = 4.7\Omega$ , $V_{GS} = 5\text{V}$<br>(see <a href="#">Figure 13</a> ) |      | 13<br>4<br>12<br>5 |      | ns<br>ns<br>ns<br>ns |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$                 | Total gate charge<br>Gate-source charge<br>Gate-drain charge            | $V_{DD} = 24\text{V}$ , $I_D = 22\text{A}$ ,<br>$V_{GS} = 5\text{V}$<br>(see <a href="#">Figure 14</a> )                   |      | 6.5<br>3.6<br>2    | 9    | nC<br>nC<br>nC       |

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

**Table 6. Source drain diode**

| Symbol                            | Parameter                                                                    | Test conditions                                                                                                        | Min. | Typ.            | Max.     | Unit          |
|-----------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|------|-----------------|----------|---------------|
| $I_{SD}$<br>$I_{SDM}^{(1)}$       | Source-drain current<br>Source-drain current<br>(pulsed)                     |                                                                                                                        |      |                 | 22<br>88 | A<br>A        |
| $V_{SD}^{(2)}$                    | Forward on voltage                                                           | $I_{SD} = 22A$ , $V_{GS} = 0$                                                                                          |      |                 | 1.5      | V             |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD} = 22A$ ,<br>$di/dt = 100A/\mu s$ ,<br>$V_{DD} = 15V$ , $T_j = 150^\circ C$<br>(see <a href="#">Figure 15</a> ) |      | 30<br>18<br>1.2 |          | ns<br>nC<br>A |

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

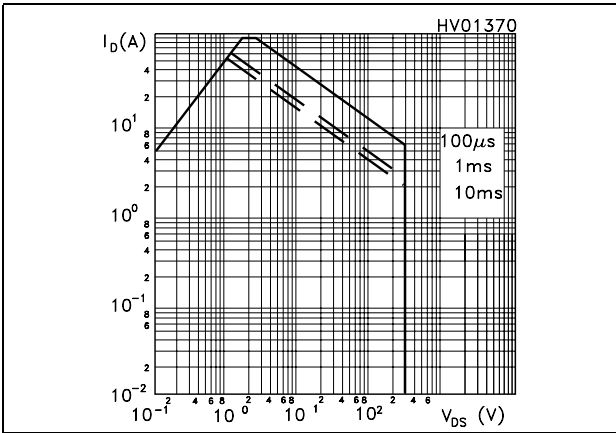


Figure 3. Thermal impedance

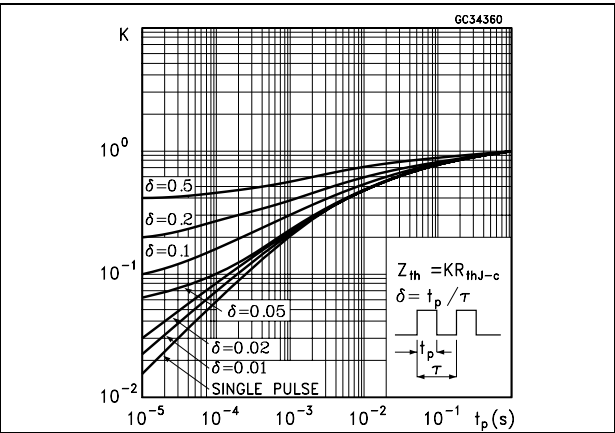


Figure 4. Output characteristics

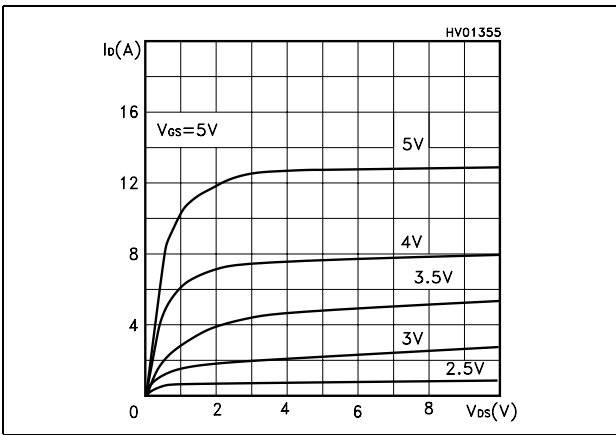


Figure 5. Transfer characteristics

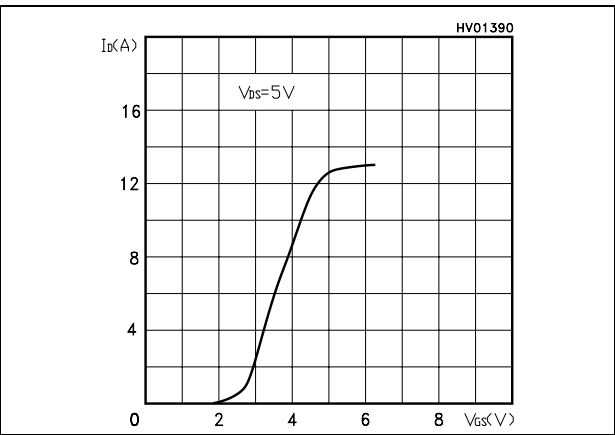


Figure 6. Transconductance

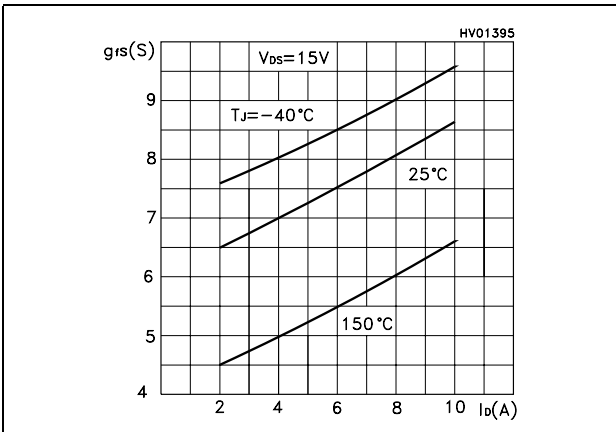


Figure 7. Static drain-source on resistance

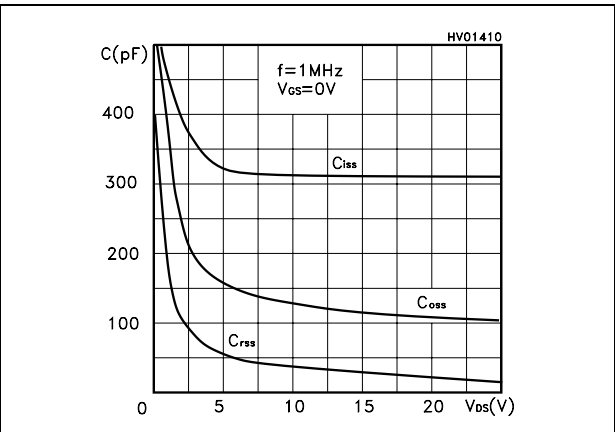


Figure 8. Gate charge vs. gate-source voltage Figure 9. Capacitance variations

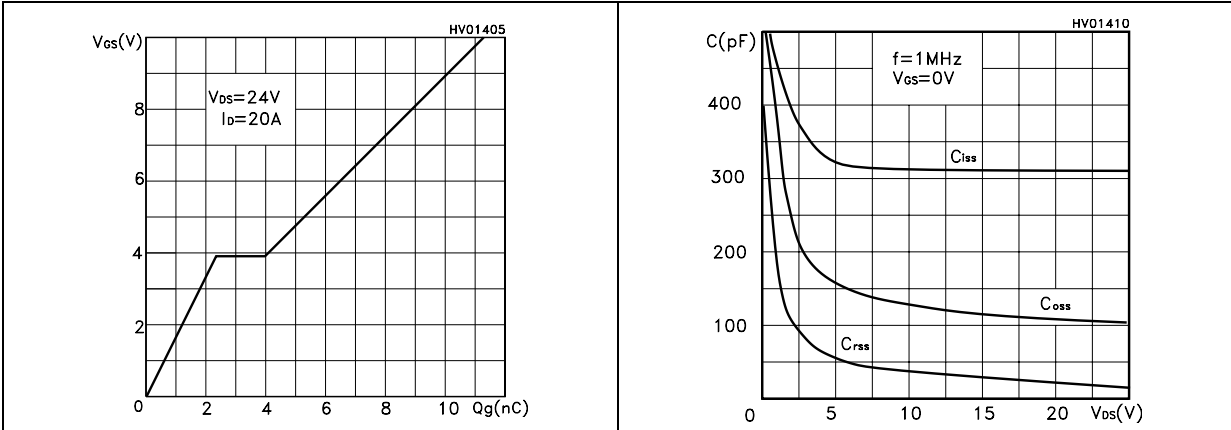


Figure 10. Normalized gate threshold voltage vs. temperature Figure 11. Normalized on resistance vs. temperature

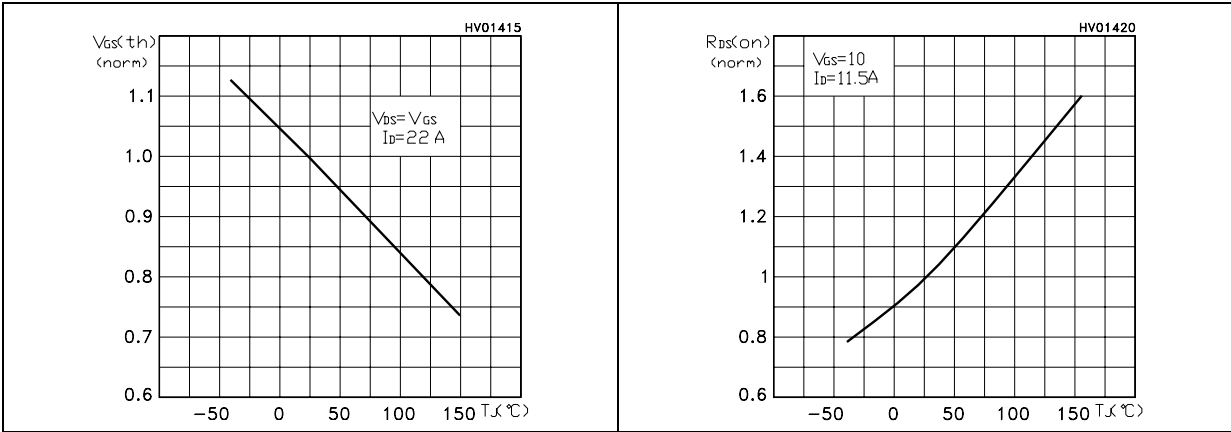
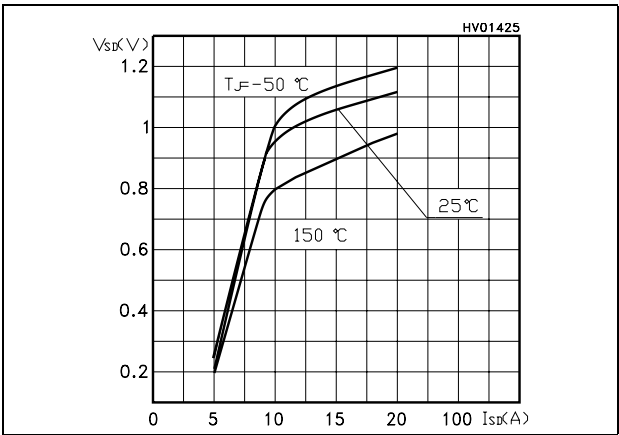
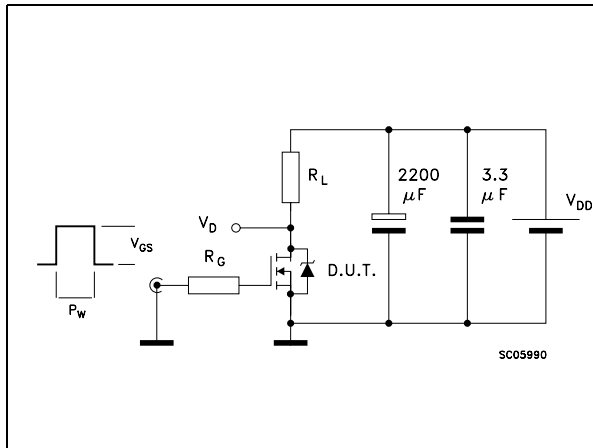


Figure 12. Source-drain diode forward characteristics

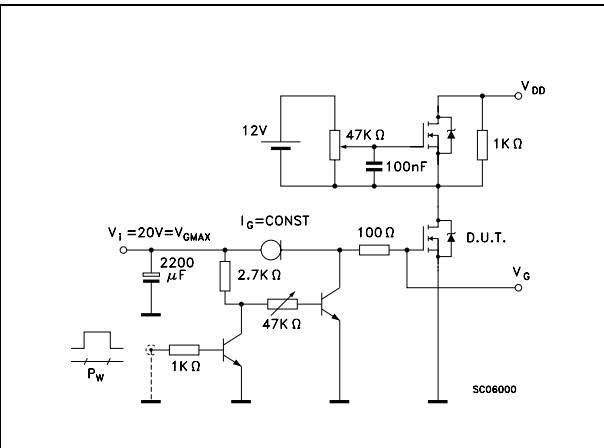


### 3 Test circuit

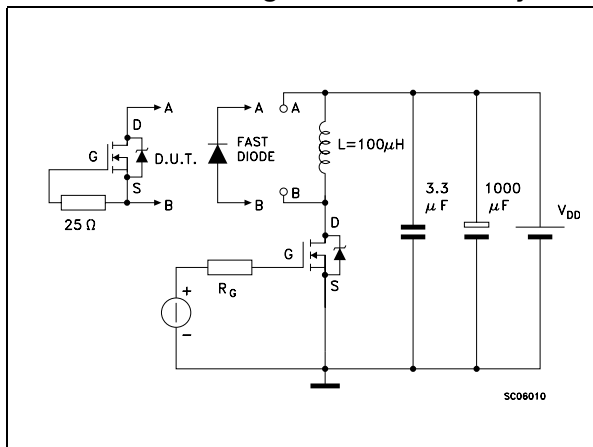
**Figure 13. Switching times test circuit for resistive load**



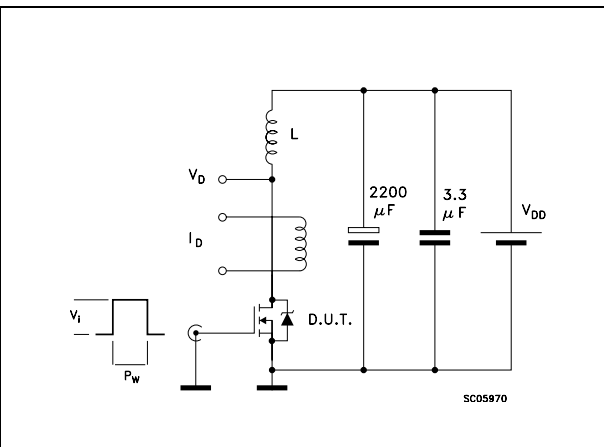
**Figure 14. Gate charge test circuit**



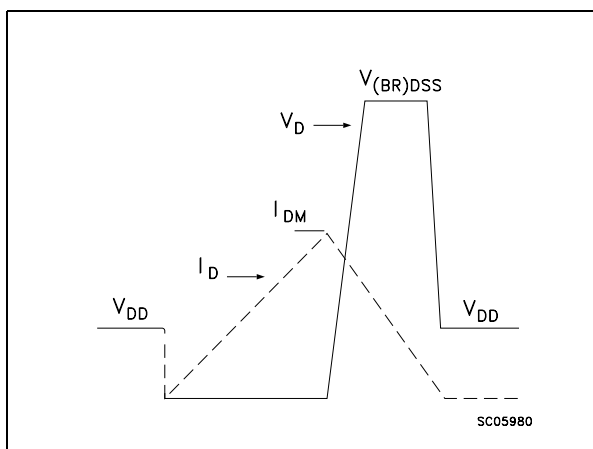
**Figure 15. Test circuit for inductive load switching and diode recovery times**



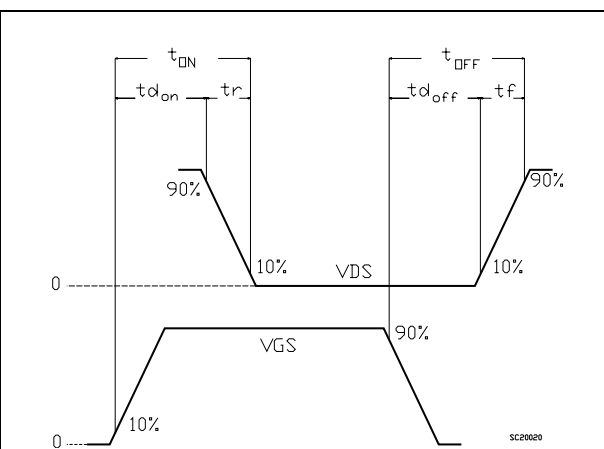
**Figure 16. Unclamped Inductive load test circuit**



**Figure 17. Unclamped inductive waveform**



**Figure 18. Switching time waveform**

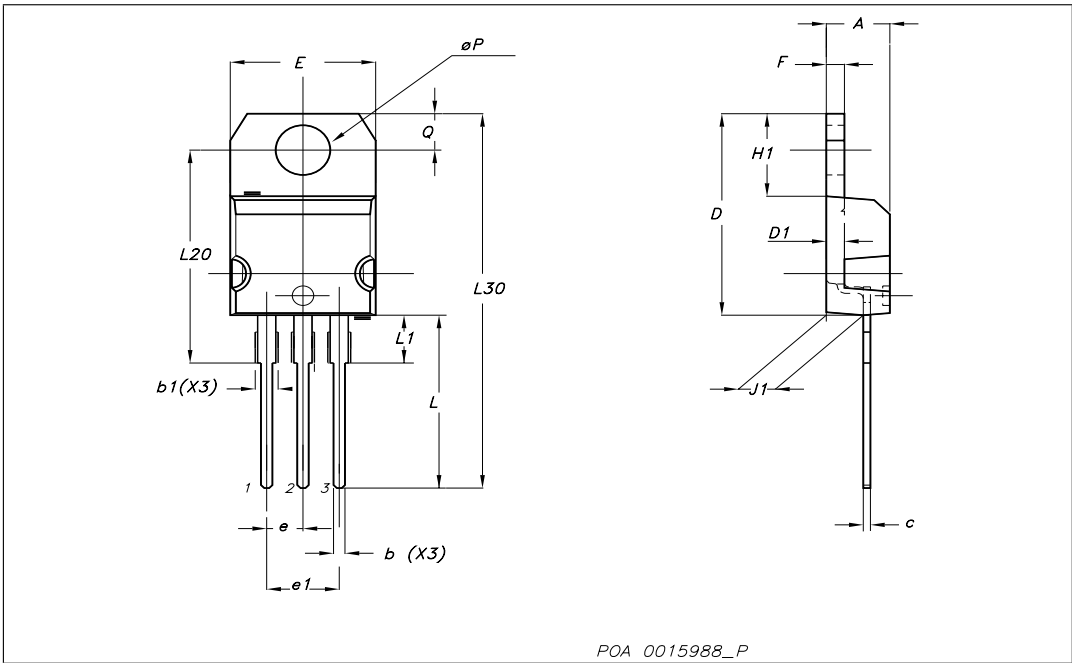


## 4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

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   | 0.49  |       | 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 |       |
| ØP  | 3.75  |       | 3.85  | 0.147 |       | 0.151 |
| Q   | 2.65  |       | 2.95  | 0.104 |       | 0.116 |



## 5 Revision history

**Table 7. Document revision history**

| Date        | Revision | Changes                                              |
|-------------|----------|------------------------------------------------------|
| 09-Sep-2004 | 1        | Datasheet according to PCN DSG-TRA/04/532            |
| 09-Aug-2006 | 2        | New template, no content change                      |
| 20-Feb-2007 | 3        | Typo mistake on page 1                               |
| 03-Sep-2007 | 4        | <i>Figure 2: Safe operating area</i> has been update |

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