



# STB75NF75 STP75NF75 - STP75NF75FP

N-channel 75V - 0.0095Ω - 80A - TO-220 - TO-220FP - D<sup>2</sup>PAK  
STripFET™ II Power MOSFET

## General features

| Type        | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub>     |
|-------------|------------------|---------------------|--------------------|
| STB75NF75   | 75V              | <0.011Ω             | 80A <sup>(1)</sup> |
| STP75NF75   | 75V              | <0.011Ω             | 80A <sup>(1)</sup> |
| STP75NF75FP | 75V              | <0.011Ω             | 80A <sup>(1)</sup> |

1. Current limited by package

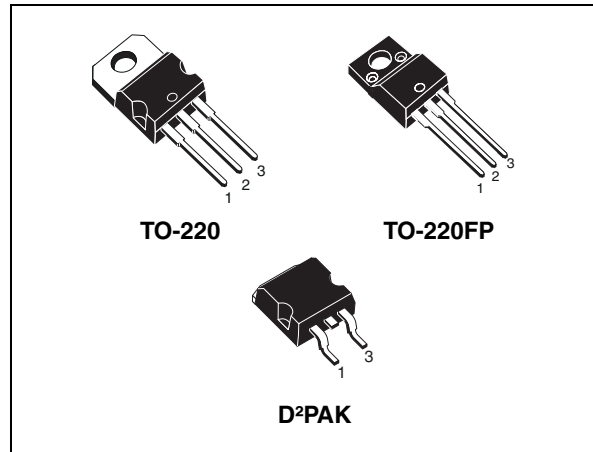
- Exceptional dv/dt capability
- 100% avalanche tested

## Description

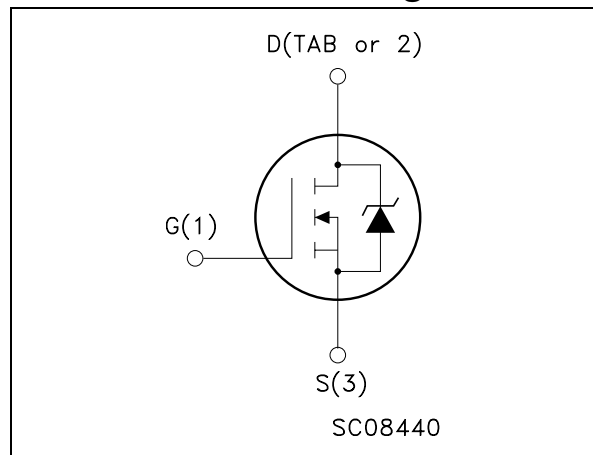
This Power MOSFET series realized with STMicroelectronics unique STripFET™ process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency, high-frequency isolated DC-DC converters for Telecom and Computer applications.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

## Applications

- Switching application



## Internal schematic diagram



## Order codes

| Part number | Marking | Package            | Packaging   |
|-------------|---------|--------------------|-------------|
| STB75NF75T4 | B75NF75 | D <sup>2</sup> PAK | Tape & reel |
| STP75NF75   | P75NF75 | TO-220             | Tube        |
| STP75NF75FP | P75NF75 | TO-220FP           | Tube        |

# Contents

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

| Symbol                             | Parameter   | Value                      |          | Unit |
|------------------------------------|---|----------------------------|----------|------|
|                                    |   | D <sup>2</sup> PAK /TO-220 | TO-220FP |      |
| V <sub>DS</sub>                    | Drain-source voltage (V <sub>GS</sub> = 0)  | 75                         |          | V    |
| V <sub>DGR</sub>                   | Drain-gate voltage (R <sub>GS</sub> = 20KΩ)   | 75                         |          | V    |
| V <sub>GS</sub>                    | Gate-source voltage   | ± 20                       |          | V    |
| I <sub>D</sub> <sup>(1)</sup>      | Drain current (continuous) at T <sub>C</sub> = 25°C   | 80                         | 80       | A    |
| I <sub>D</sub> <sup>(1)</sup>      | Drain current (continuous) at T <sub>C</sub> =100°C   | 70                         | 70       | A    |
| I <sub>DM</sub> <sup>(2)</sup>     | Drain current (pulsed)  | 320                        | 320      | A    |
| P <sub>TOT</sub>                   | Total dissipation at T <sub>C</sub> = 25°C  | 300                        | 45       | W    |
|                                    | Derating factor   | 2.0                        | 0.3      | W/°C |
| dv/dt <sup>(3)</sup>               | Peak diode recovery voltage slope   | 12                         |          | V/ns |
| E <sub>AS</sub> <sup>(4)</sup>     | Single pulse avalanche energy   | 700                        |          | mJ   |
| V <sub>ISO</sub>                   | Insulation withstand voltage (RMS) from all three leads to external heat sink (t=1s;T <sub>C</sub> =25°C) | --                         | 2000     | V    |
| T <sub>J</sub><br>T <sub>stg</sub> | Operating junction temperature<br>Storage temperature   | -55 to 175                 |          | °C   |

1. Current limited by package
2. Pulse width limited by safe operating area
3. I<sub>SD</sub> ≤80A, di/dt ≤300A/μs, V<sub>DD</sub> ≤V<sub>(BR)DSS</sub>, T<sub>J</sub> ≤T<sub>JMAX</sub>
4. Starting T<sub>J</sub> = 25 °C, I<sub>D</sub> = 40A, V<sub>DD</sub> = 37.5V

**Table 2. Thermal data**

| Symbol            | Parameter   | Value                      |          | Unit |
|-------------------|---|----------------------------|----------|------|
|                   |   | D <sup>2</sup> PAK /TO-220 | TO-220FP |      |
| R <sub>thJC</sub> | Thermal resistance junction-case max                          | 0.5                        | 3.33     | °C/W |
| R <sub>thJA</sub> | Thermal resistance junction-ambient max                       | 62.5                       |          | °C/W |
| T <sub>l</sub>    | Maximum lead temperature for soldering purpose <sup>(1)</sup> | 300                        |          | °C   |

1. 1.6mm from case for 10sec)

## 2 Electrical characteristics

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

**Table 3. On/off states**

| Symbol        | Parameter  | Test conditions  | Min. | Typ.   | Max.      | Unit               |
|---------------|--|--|------|--------|-----------|--------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage                   | $I_D = 250\mu A, V_{GS} = 0$   | 75   |        |           | V                  |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max rating},$<br>$V_{DS} = \text{Max rating} @ 125^{\circ}C$ |      |        | 1<br>10   | $\mu A$<br>$\mu A$ |
| $I_{GSS}$     | Gate body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20V$   |      |        | $\pm 100$ | nA                 |
| $V_{GS(th)}$  | Gate threshold voltage                           | $V_{DS} = V_{GS}, I_D = 250\mu A$  | 2    | 3      | 4         | V                  |
| $R_{DS(on)}$  | Static drain-source on resistance                | $V_{GS} = 10V, I_D = 40A$  |      | 0.0095 | 0.011     | $\Omega$           |

**Table 4. Dynamic**

| Symbol         | Parameter                    | Test conditions                                    | Min. | Typ. | Max. | Unit |
|----------------|------------------------------|--|------|------|------|------|
| $g_{fs}^{(1)}$ | Forward transconductance     | $V_{DS} = 15V, I_D = 40A$                          |      | 20   |      | S    |
| $C_{iss}$      | Input capacitance            | $V_{DS} = 25V, f = 1 \text{ MHz},$<br>$V_{GS} = 0$ |      | 3700 |      | pF   |
| $C_{oss}$      | Output capacitance           |  |      | 730  |      | pF   |
| $C_{rss}$      | Reverse transfer capacitance |  |      | 240  |      | pF   |
| $Q_g$          | Total gate charge            | $V_{DD} = 60V, I_D = 80A$<br>$V_{GS} = 10V$        |      | 117  | 160  | nC   |
| $Q_{gs}$       | Gate-source charge           |  |      | 27   |      | nC   |
| $Q_{gd}$       | Gate-drain charge            |  |      | 47   |      | nC   |

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

**Table 5. Switching times**

| Symbol       | Parameter           | Test conditions   | Min. | Typ. | Max. | Unit |
|--------------|---------------------|---|------|------|------|------|
| $t_{d(on)}$  | Turn-on delay time  | $V_{DD} = 37.5V, I_D = 45A,$<br>$R_G = 4.7\Omega, V_{GS} = 10V$<br><i>Figure 15 on page 9</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 6. 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            | $I_{SD} = 80A, V_{GS} = 0$  |     |      | 1.5 | V    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 80A,$<br>$di/dt = 100A/\mu s,$<br>$V_{DD} = 25V, T_J = 150^\circ C$<br><i>Figure 17 on page 9</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 $\mu s$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 1. Safe operating area for TO-220 - D<sup>2</sup>PAK

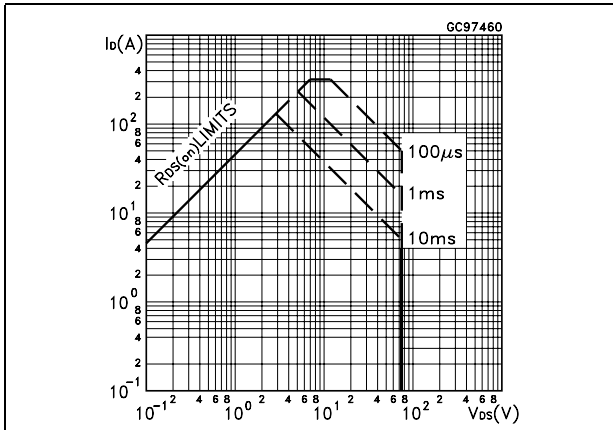


Figure 2. Thermal impedance for TO-220 - D<sup>2</sup>PAK

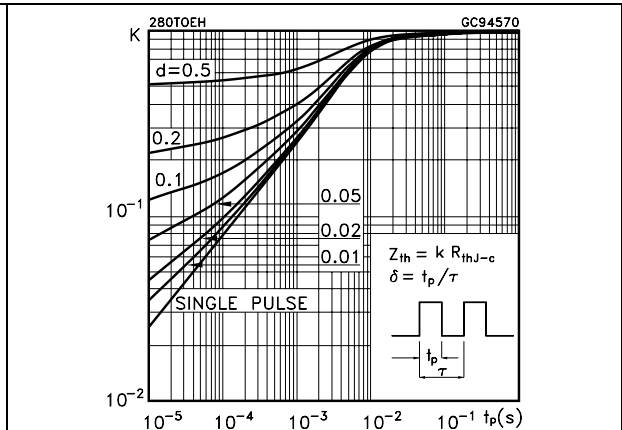


Figure 3. Safe operating area for TO-220FP

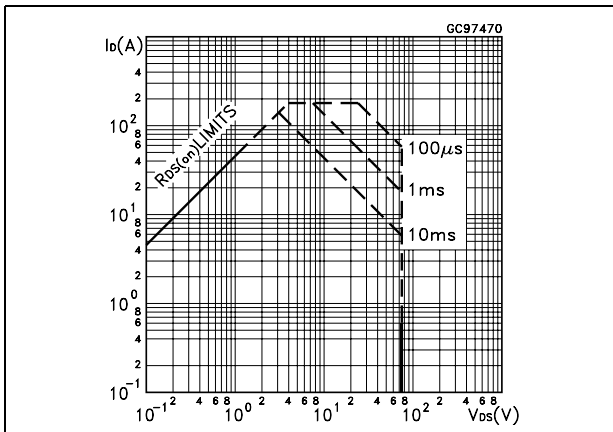


Figure 4. Thermal impedance for TO-220FP

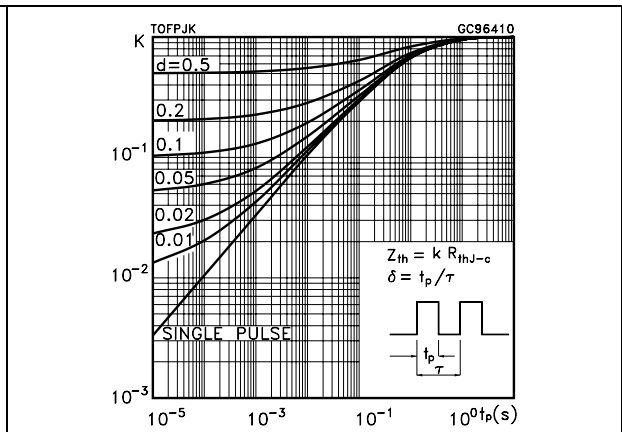


Figure 5. Output characteristics

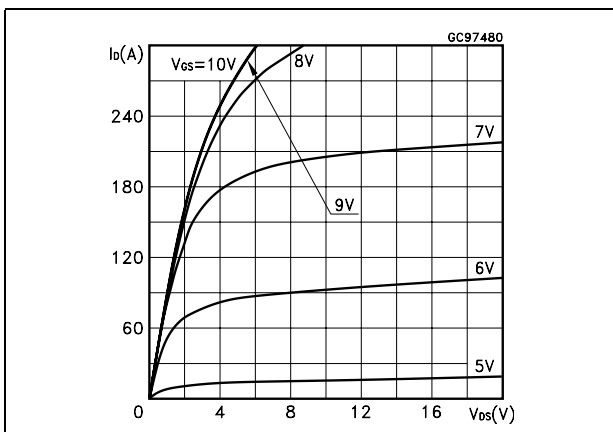


Figure 6. Transfer characteristics

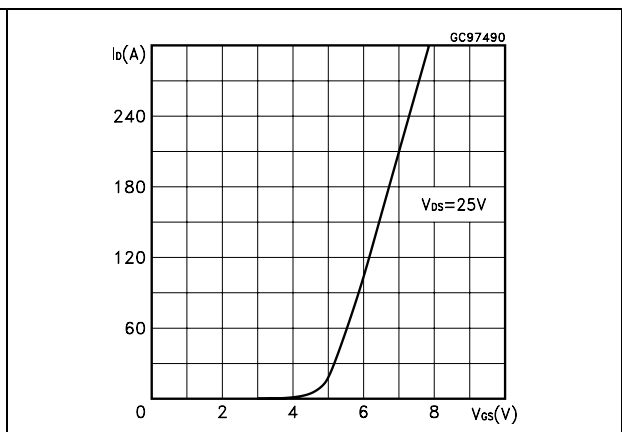


Figure 7. Transconductance

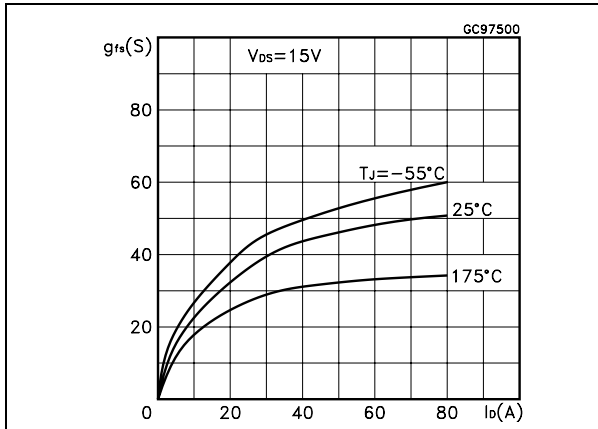


Figure 8. Static drain-source on resistance

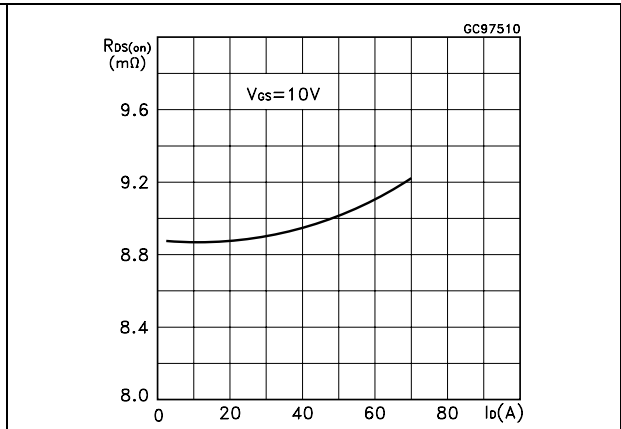


Figure 9. Gate charge vs gate-source voltage Figure 10. Capacitance variations

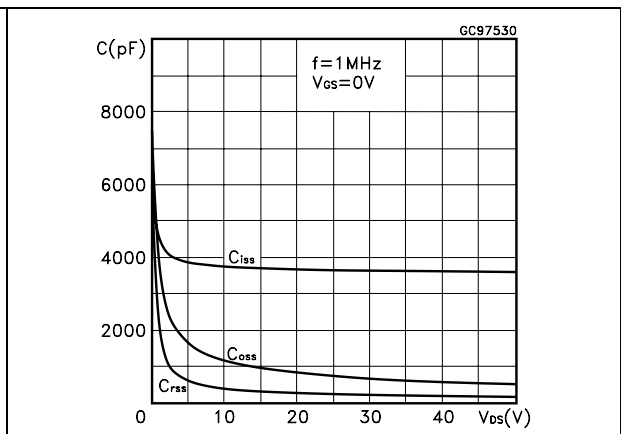
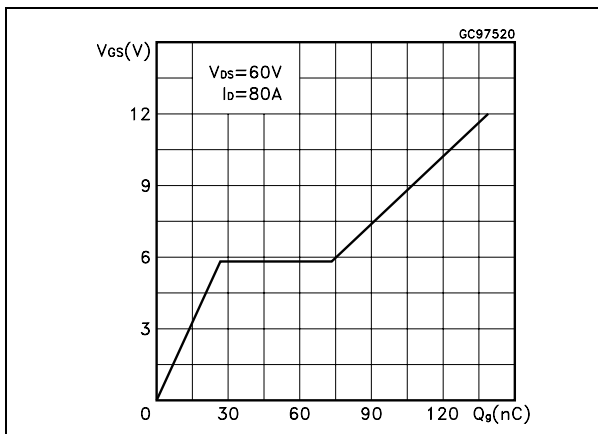


Figure 11. Normalized gate threshold voltage vs temperature

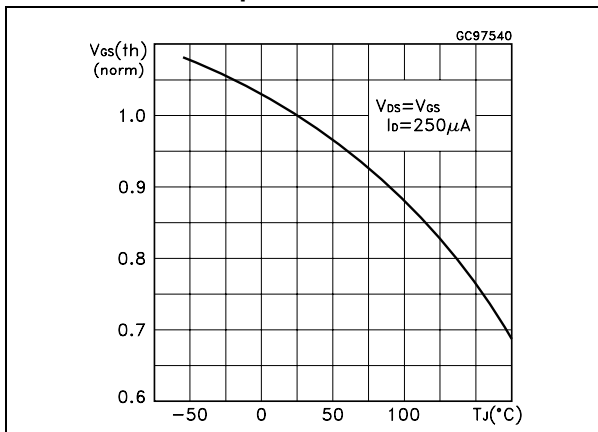


Figure 12. Normalized on resistance vs temperature

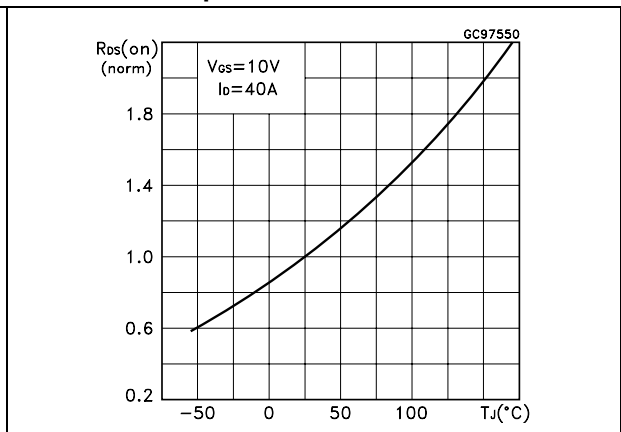


Figure 13. Source-drain diode forward characteristics

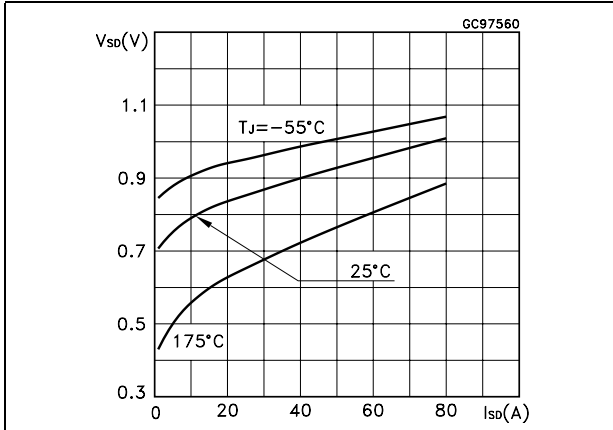
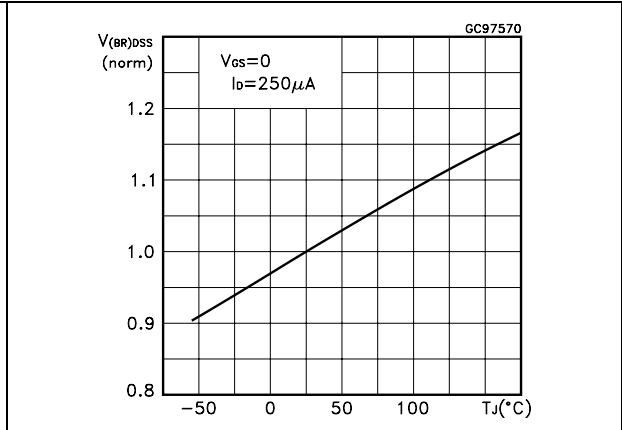


Figure 14. Normalized  $B_{VDSS}$  vs temperature





### 3 Test circuit

Figure 15. Switching times test circuit for resistive load



Figure 16. Gate charge test circuit



Figure 17. Test circuit for inductive load switching and diode recovery times



Figure 18. Unclamped inductive load test circuit



Figure 19. Unclamped inductive waveform

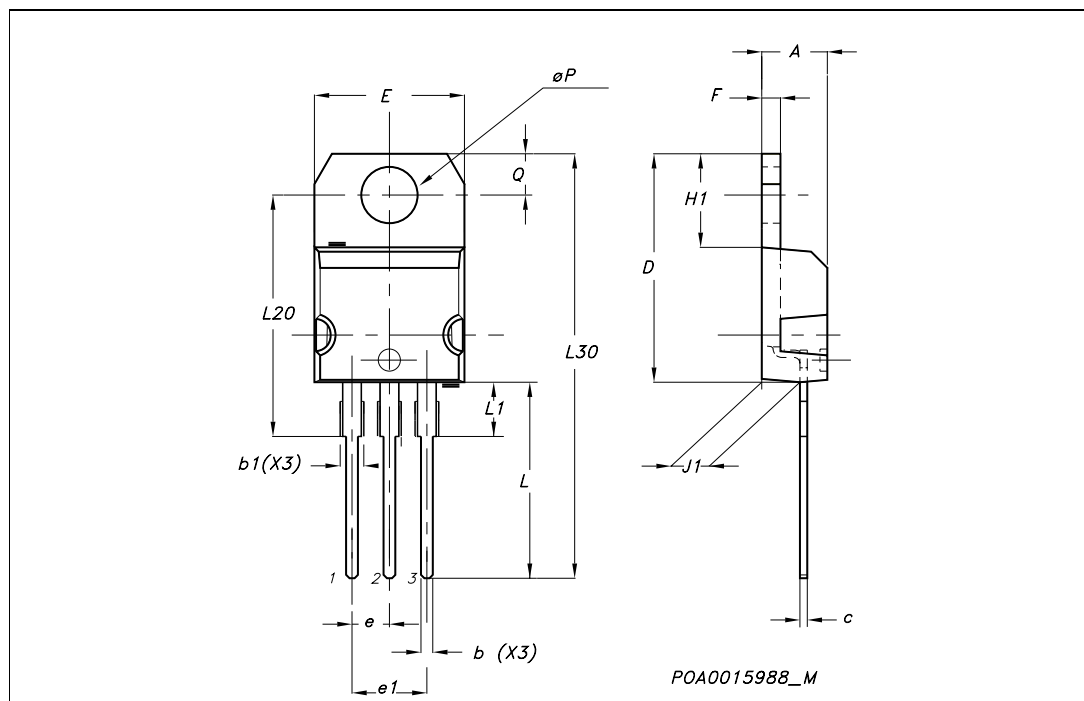


## 4 Package mechanical data

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)

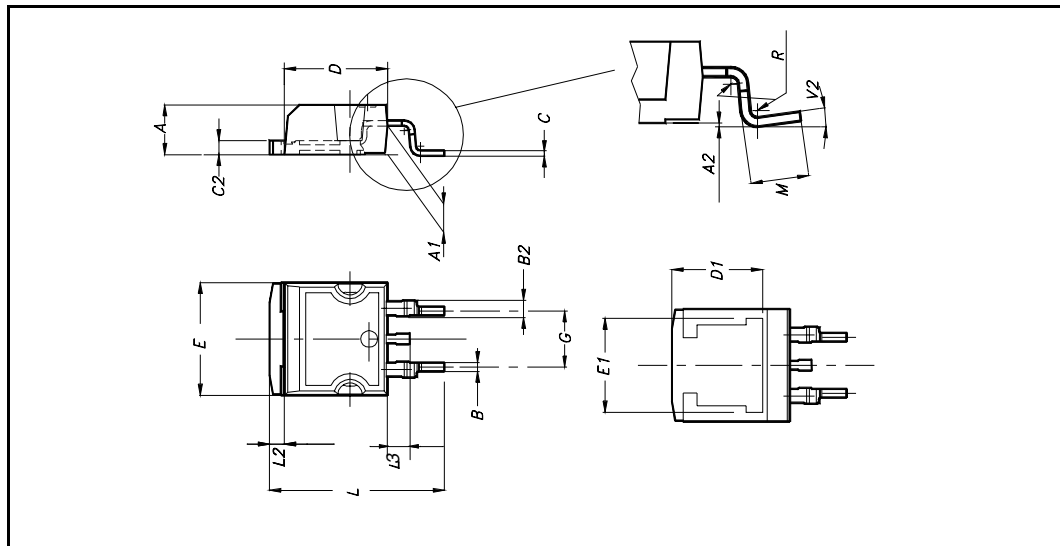
## TO-220 MECHANICAL DATA

| 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   | 1.15  |       | 1.70  | 0.045 |       | 0.066 |
| c    | 0.49  |       | 0.70  | 0.019 |       | 0.027 |
| D    | 15.25 |       | 15.75 | 0.60  |       | 0.620 |
| 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 |       | 0.052 |
| 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 |



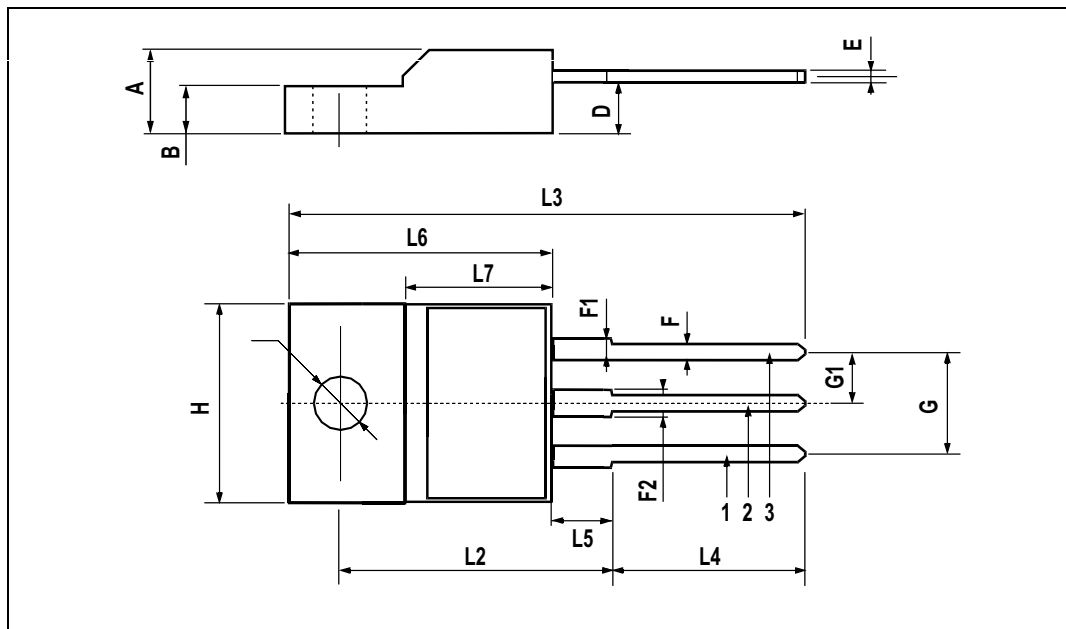
**D<sup>2</sup>PAK MECHANICAL DATA**

| DIM. | mm.  |     |       | inch  |       |       |
|------|------|-----|-------|-------|-------|-------|
|      | MIN. | TYP | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.4  |     | 4.6   | 0.173 |       | 0.181 |
| A1   | 2.49 |     | 2.69  | 0.098 |       | 0.106 |
| A2   | 0.03 |     | 0.23  | 0.001 |       | 0.009 |
| B    | 0.7  |     | 0.93  | 0.027 |       | 0.036 |
| B2   | 1.14 |     | 1.7   | 0.044 |       | 0.067 |
| C    | 0.45 |     | 0.6   | 0.017 |       | 0.023 |
| C2   | 1.23 |     | 1.36  | 0.048 |       | 0.053 |
| D    | 8.95 |     | 9.35  | 0.352 |       | 0.368 |
| D1   |      | 8   |       |       | 0.315 |       |
| E    | 10   |     | 10.4  | 0.393 |       |       |
| E1   |      | 8.5 |       |       | 0.334 |       |
| G    | 4.88 |     | 5.28  | 0.192 |       | 0.208 |
| L    | 15   |     | 15.85 | 0.590 |       | 0.625 |
| L2   | 1.27 |     | 1.4   | 0.050 |       | 0.055 |
| L3   | 1.4  |     | 1.75  | 0.055 |       | 0.068 |
| M    | 2.4  |     | 3.2   | 0.094 |       | 0.126 |
| R    |      | 0.4 |       |       | 0.015 |       |
| V2   | 0°   |     | 4°    |       |       |       |



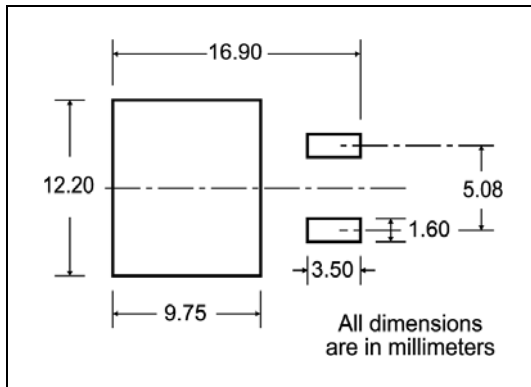
## TO-220FP MECHANICAL DATA

| DIM. | mm.  |     |      | inch  |       |       |
|------|------|-----|------|-------|-------|-------|
|      | MIN. | TYP | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 4.4  |     | 4.6  | 0.173 |       | 0.181 |
| B    | 2.5  |     | 2.7  | 0.098 |       | 0.106 |
| D    | 2.5  |     | 2.75 | 0.098 |       | 0.108 |
| E    | 0.45 |     | 0.7  | 0.017 |       | 0.027 |
| F    | 0.75 |     | 1    | 0.030 |       | 0.039 |
| F1   | 1.15 |     | 1.7  | 0.045 |       | 0.067 |
| F2   | 1.15 |     | 1.7  | 0.045 |       | 0.067 |
| G    | 4.95 |     | 5.2  | 0.195 |       | 0.204 |
| G1   | 2.4  |     | 2.7  | 0.094 |       | 0.106 |
| H    | 10   |     | 10.4 | 0.393 |       | 0.409 |
| L2   |      | 16  |      |       | 0.630 |       |
| L3   | 28.6 |     | 30.6 | 1.126 |       | 1.204 |
| L4   | 9.8  |     | 10.6 | .0385 |       | 0.417 |
| L5   | 2.9  |     | 3.6  | 0.114 |       | 0.141 |
| L6   | 15.9 |     | 16.4 | 0.626 |       | 0.645 |
| L7   | 9    |     | 9.3  | 0.354 |       | 0.366 |
| Ø    | 3    |     | 3.2  | 0.118 |       | 0.126 |



## 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     |

\* on sales type

## 6 Revision history

Table 7. Revision history

| Date        | Revision | Changes                           |
|-------------|----------|-----------------------------------|
| 03-Aug-2006 | 6        | Complete version                  |
| 15-Sep-2006 | 7        | R <sub>DS(on)</sub> value update  |
| 27-Feb-2007 | 8        | The document has been reformatted |

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