



# STB7N52K3 - STD7N52K3 STF7N52K3 - STP7N52K3

N-channel 525 V, 0.84  $\Omega$ , 6.3 A, D<sup>2</sup>PAK, DPAK, TO-220FP, TO-220  
SuperMESH3™ Power MOSFET

Preliminary Data

## Features

| Type      | V <sub>DSS</sub> | R <sub>DS(on) max</sub> | I <sub>D</sub>       | P <sub>w</sub> |
|-----------|------------------|-------------------------|----------------------|----------------|
| STB7N52K3 | 525 V            | < 0.98 $\Omega$         | 6.3 A                | 90 W           |
| STD7N52K3 | 525 V            | < 0.98 $\Omega$         | 6.3 A                | 90 W           |
| STF7N52K3 | 525 V            | < 0.98 $\Omega$         | 6.3 A <sup>(1)</sup> | 25 W           |
| STP7N52K3 | 525 V            | < 0.98 $\Omega$         | 6.3 A                | 90 W           |

1. Limited by package

- 100% avalanche tested
- Extremely high dv/dt capability
- Gate charge minimized
- Very low intrinsic capacitances
- Improved diode reverse recovery characteristics
- Zener-protected

## Application

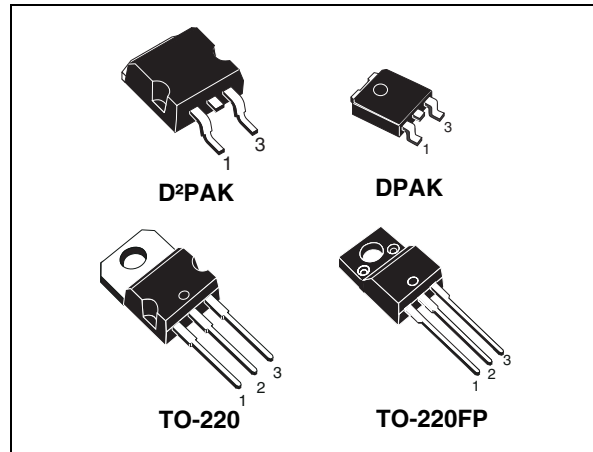
- Switching applications

## Description

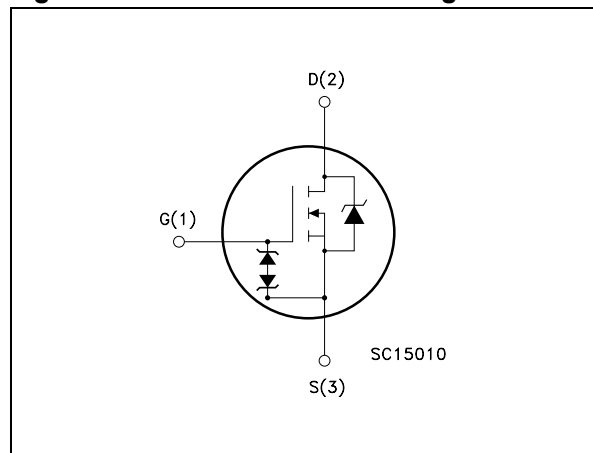
The new SuperMESH3™ series is obtained through the combination of a further fine tuning of ST's well established strip-based PowerMESH™ layout with a new optimization of the vertical structure. In addition to reducing on-resistance significantly versus previous generation, special attention has been taken to ensure a very good dv/dt capability and higher margin in breakdown voltage for the most demanding application.

**Table 1. Device summary**

| Order codes | Marking | Package            | Packaging     |
|-------------|---------|--------------------|---------------|
| STB7N52K3   | 7N52K3  | D <sup>2</sup> PAK | Tape and reel |
| STD7N52K3   | 7N52K3  | DPAK               | Tape and reel |
| STF7N52K3   | 7N52K3  | TO-220FP           | Tube          |
| STP7N52K3   | 7N52K3  | TO-220             | Tube          |



**Figure 1. Internal schematic diagram**



# Contents

|   |                                  |    |
|---|----------------------------------|----|
| 1 | Electrical ratings .....         | 3  |
| 2 | Electrical characteristics ..... | 4  |
| 3 | Test circuits .....              | 6  |
| 4 | Package mechanical data .....    | 7  |
| 5 | Package mechanical data .....    | 12 |
| 6 | Revision history .....           | 14 |

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol         | Parameter  | Value      |      |                    |          | Unit |
|----------------|--|------------|------|--------------------|----------|------|
|                |  | TO-220     | DPAK | D <sup>2</sup> PAK | TO-220FP |      |
| $V_{DS}$       | Drain-source voltage ( $V_{GS} = 0$ )  | 525        |      |                    |          | V    |
| $V_{GS}$       | Gate- source voltage   | ± 30       |      |                    |          | V    |
| $I_D$          | Drain current (continuous) at $T_C = 25\text{ °C}$   | 6.3        |      | 6.3 <sup>(1)</sup> |          | A    |
| $I_D$          | Drain current (continuous) at $T_C = 100\text{ °C}$  | 4          |      | 4 <sup>(1)</sup>   |          | A    |
| $I_{DM}^{(2)}$ | Drain current (pulsed)   | 25         |      | 25 <sup>(1)</sup>  |          | A    |
| $P_{TOT}$      | Total dissipation at $T_C = 25\text{ °C}$  | 90         |      | 25                 |          | W    |
|                | Derating factor  | 0.72       |      | 0.2                |          | W/°C |
| $V_{ESD(G-S)}$ | Gate source ESD(HBM-C = 100 pF, R = 1.5 kΩ)  | 2500       |      |                    |          | V    |
| $dv/dt^{(3)}$  | Peak diode recovery voltage slope  | TBD        |      |                    |          | V/ns |
| $V_{ISO}$      | Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; $T_C = 25\text{ °C}$ ) | --         |      | 2500               |          | V    |
| $T_{stg}$      | Storage temperature  | -55 to 150 |      |                    |          | °C   |
| $T_j$          | Max. operating junction temperature  | 150        |      |                    |          | °C   |

1. Limited by package
2. Pulse width limited by safe operating area
3.  $I_{SD} \leq 6.3\text{ A}$ ,  $di/dt = \text{TBD}$ ,  $V_{DD} = 80\% V_{(BR)DSS}$ .

**Table 3. Thermal data**

| Symbol         | Parameter                                      | TO-220 | DPAK | D <sup>2</sup> PAK | TO-220FP | Unit |
|----------------|--|--------|------|--------------------|----------|------|
| $R_{thj-case}$ | Thermal resistance junction-case max           | 1.39   |      |                    | 5        | °C/W |
| $R_{thj-pcb}$  | Thermal resistance junction-pcb max            | --     | 50   | 30                 | --       | °C/W |
| $R_{thj-amb}$  | Thermal resistance junction-ambient max        | 62.5   | --   | --                 | 62.5     | °C/W |
| $T_l$          | Maximum lead temperature for soldering purpose | 300    |      |                    |          | °C   |

**Table 4. Avalanche characteristics**

| Symbol   | Parameter  | Max value | Unit |
|----------|--|-----------|------|
| $I_{AR}$ | Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ max)                       | 6.3       | A    |
| $E_{AS}$ | Single pulse avalanche energy (starting $T_j = 25\text{ °C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ ) | TBD       | mJ   |

## 2 Electrical characteristics

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

**Table 5. On /off states**

| Symbol        | Parameter  | Test conditions  | Min. | Typ. | Max.     | Unit                           |
|---------------|--|--|------|------|----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage                   | $I_D = 1\text{ mA}$ , $V_{GS} = 0$   | 525  |      |          | V                              |
| $I_{DSS}$     | Zero gate voltage drain current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max rating}$<br>$V_{DS} = \text{Max rating}$ , $T_C = 125\text{ °C}$ |      |      | 1<br>50  | $\mu\text{A}$<br>$\mu\text{A}$ |
| $I_{GSS}$     | Gate-body leakage current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20\text{ V}$   |      |      | $\pm 10$ | $\mu\text{A}$                  |
| $V_{GS(th)}$  | Gate threshold voltage                           | $V_{DS} = V_{GS}$ , $I_D = 50\text{ }\mu\text{A}$                                    | 3    | 3.75 | 4.5      | V                              |
| $R_{DS(on)}$  | Static drain-source on resistance                | $V_{GS} = 10\text{ V}$ , $I_D = 3.1\text{ A}$  |      | 0.84 | 0.98     | $\Omega$                       |

**Table 6. Dynamic**

| Symbol                              | Parameter   | Test conditions   | Min. | Typ.              | Max. | Unit           |
|-------------------------------------|---|---|------|-------------------|------|----------------|
| $g_{fs} (1)$                        | Forward transconductance  | $V_{DS} = 15\text{ V}$ , $I_D = 3.1\text{ A}$   |      | TBD               |      | S              |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS} = 50\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$  |      | TBD<br>TBD<br>TBD |      | pF<br>pF<br>pF |
| $C_{OSS\ eq}^{(1)}$                 | Equivalent output capacitance   | $V_{GS} = 0$ , $V_{DS} = 0\text{ to }420\text{ V}$  |      | TBD               |      | pF             |
| $R_G$                               | Intrinsic gate resistance   | $f = 1\text{ MHz}$ open drain   |      | TBD               |      | $\Omega$       |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$       | Total gate charge<br>Gate-source charge<br>Gate-drain charge            | $V_{DD} = 420\text{ V}$ , $I_D = 6.3\text{ A}$ ,<br>$V_{GS} = 10\text{ V}$<br>(see <a href="#">Figure 3</a> ) |      | TBD<br>TBD<br>TBD |      | nC<br>nC<br>nC |

1.  $C_{OSS\ eq}$  is defined as a constant equivalent capacitance giving the same charging time as  $C_{OSS}$  when  $V_{DS}$  increases from 0 to 80%  $V_{DSS}$

**Table 7. Switching times**

| Symbol  | Parameter   | Test conditions   | Min. | Typ.                     | Max | Unit                 |
|---|---|---|------|--------------------------|-----|----------------------|
| $t_{d(on)}$<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 | $V_{DD} = 262\text{ V}$ , $I_D = 3.1\text{ A}$ ,<br>$R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$<br>(see <a href="#">Figure 2</a> ) |      | TBD<br>TBD<br>TBD<br>TBD |     | ns<br>ns<br>ns<br>ns |

**Table 8. Source drain diode**

| Symbol          | Parameter                     | Test conditions   | Min. | Typ. | Max. | Unit |
|-----------------|-------------------------------|---|------|------|------|------|
| $I_{SD}$        | Source-drain current          |   |      |      | 6.3  | A    |
| $I_{SDM}^{(1)}$ | Source-drain current (pulsed) |   |      |      | 25   | A    |
| $V_{SD}^{(2)}$  | Forward on voltage            | $I_{SD} = 6.3 \text{ A}, V_{GS} = 0$  |      |      | 1.6  | V    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 6.3 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$<br>$V_{DD} = 30 \text{ V}$ (see <a href="#">Figure 7</a> )                                      |      | TBD  |      | ns   |
| $Q_{rr}$        | Reverse recovery charge       |   |      | TBD  |      | nC   |
| $I_{RRM}$       | Reverse recovery current      |   |      | TBD  |      | A    |
| $t_{rr}$        | Reverse recovery time         | $I_{SD} = 6.3 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$<br>$V_{DD} = 30 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$<br>(see <a href="#">Figure 7</a> ) |      | TBD  |      | ns   |
| $Q_{rr}$        | Reverse recovery charge       |   |      | TBD  |      | nC   |
| $I_{RRM}$       | Reverse recovery current      |   |      | TBD  |      | A    |

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

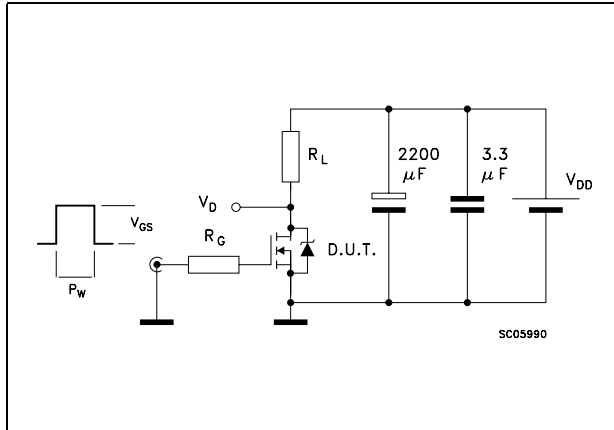
**Table 9. Gate-source Zener diode**

| Symbol           | Parameter                     | Test conditions                          | Min | Typ | Max | Unit |
|------------------|-------------------------------|--|-----|-----|-----|------|
| $BV_{GSO}^{(1)}$ | Gate-source breakdown voltage | $I_{GS} = \pm 1 \text{ mA}$ (open drain) | 30  |     |     | V    |

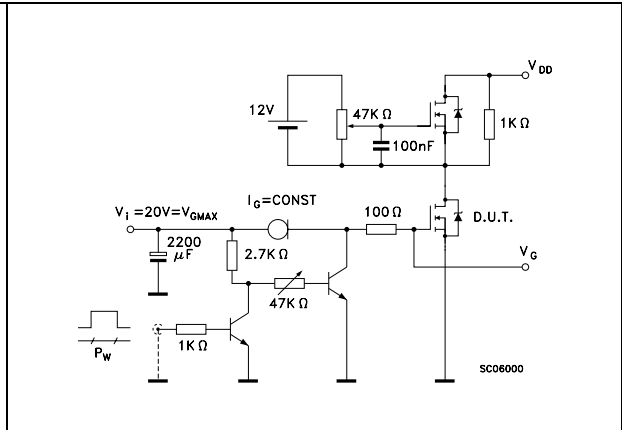
1. The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components

### 3 Test circuits

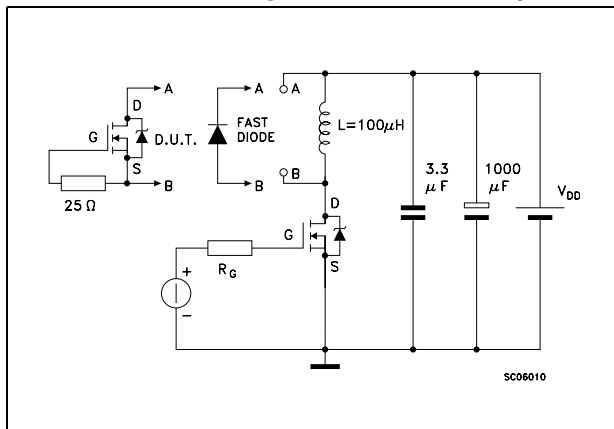
**Figure 2. Switching times test circuit for resistive load**



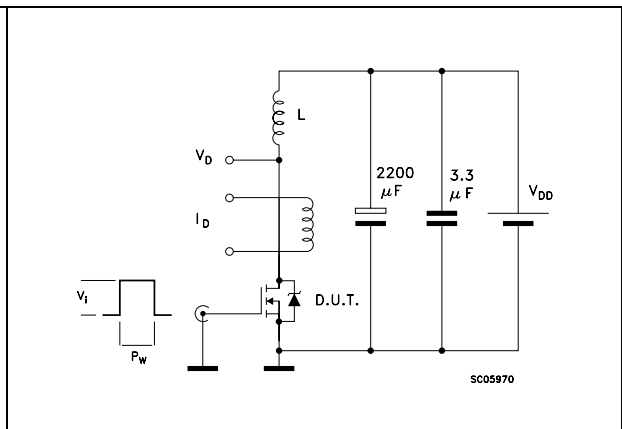
**Figure 3. Gate charge test circuit**



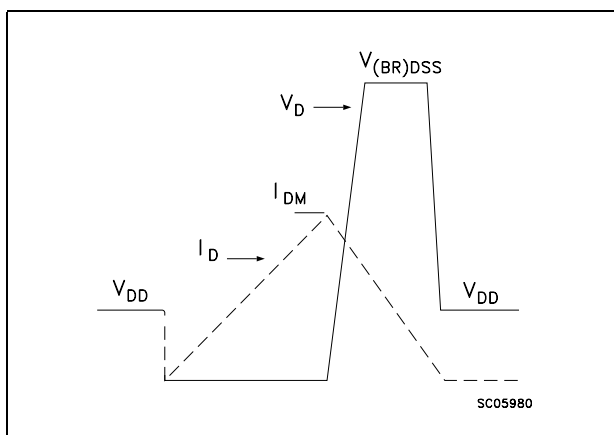
**Figure 4. Test circuit for inductive load switching and diode recovery times**



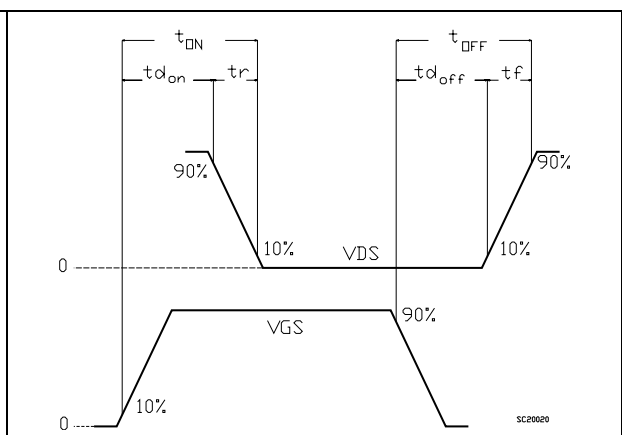
**Figure 5. Unclamped Inductive load test circuit**



**Figure 6. Unclamped inductive waveform**



**Figure 7. Switching time waveform**

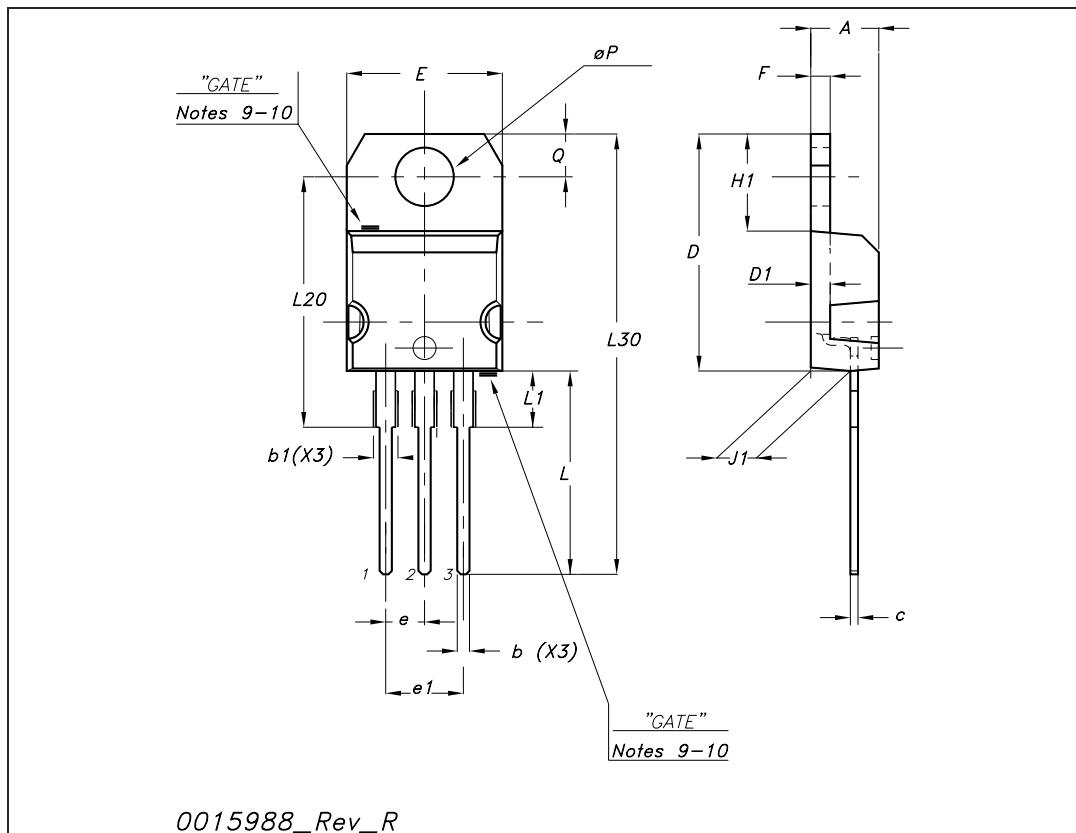


## 4 Package mechanical data

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

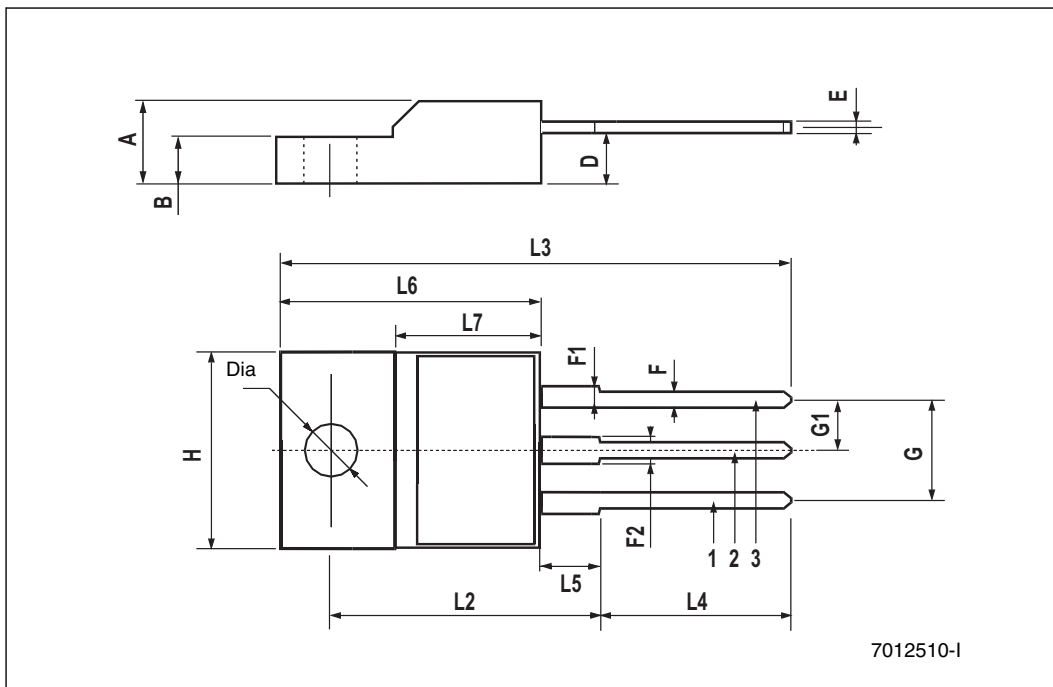
| Dim | mm    |       |       | inch  |       |       |
|-----|-------|-------|-------|-------|-------|-------|
|     | Min   | Typ   | Max   | Min   | Typ   | Max   |
| A   | 4.40  |       | 4.60  | 0.173 |       | 0.181 |
| b   | 0.61  |       | 0.88  | 0.024 |       | 0.034 |
| b1  | 1.14  |       | 1.70  | 0.044 |       | 0.066 |
| c   | 0.48  |       | 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 |





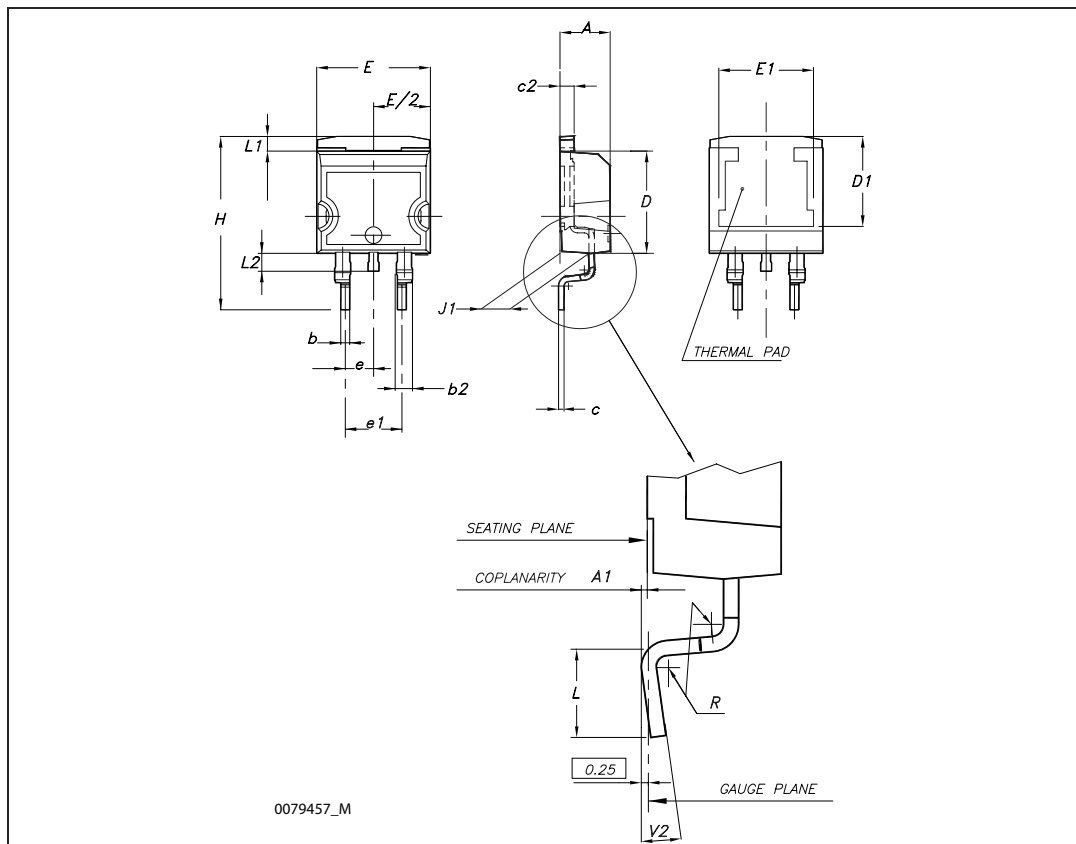
**TO-220FP mechanical data**

| Dim. | mm.   |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | Min.  | Typ. | Max.  | Min.  | Typ.  | Max.  |
| A    | 4.40  |      | 4.60  | 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  |      | 0.70  | 0.017 |       | 0.027 |
| F    | 0.75  |      | 1.00  | 0.030 |       | 0.039 |
| F1   | 1.15  |      | 1.50  | 0.045 |       | 0.067 |
| F2   | 1.15  |      | 1.50  | 0.045 |       | 0.067 |
| G    | 4.95  |      | 5.20  | 0.195 |       | 0.204 |
| G1   | 2.40  |      | 2.70  | 0.094 |       | 0.106 |
| H    | 10    |      | 10.40 | 0.393 |       | 0.409 |
| L2   |       | 16   |       |       | 0.630 |       |
| L3   | 28.6  |      | 30.6  | 1.126 |       | 1.204 |
| L4   | 9.80  |      | 10.60 | 0.385 |       | 0.417 |
| L5   | 2.9   |      | 3.6   | 0.114 |       | 0.141 |
| L6   | 15.90 |      | 16.40 | 0.626 |       | 0.645 |
| L7   | 9     |      | 9.30  | 0.354 |       | 0.366 |
| Dia  | 3     |      | 3.2   | 0.118 |       | 0.126 |



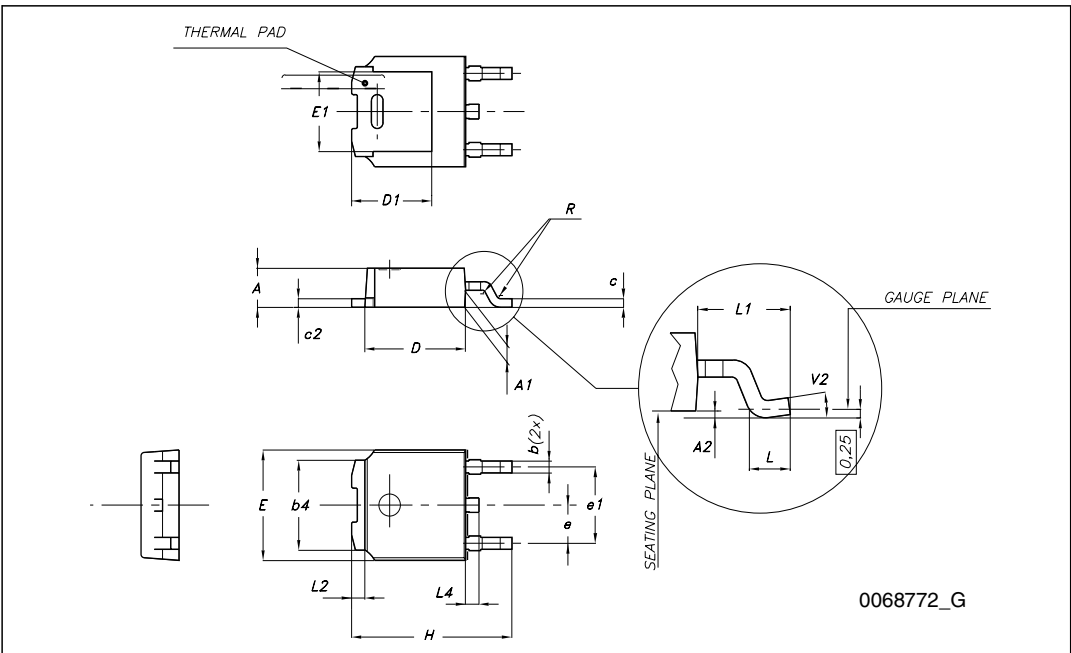
D<sup>2</sup>PAK (TO-263) mechanical data

| 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°    |



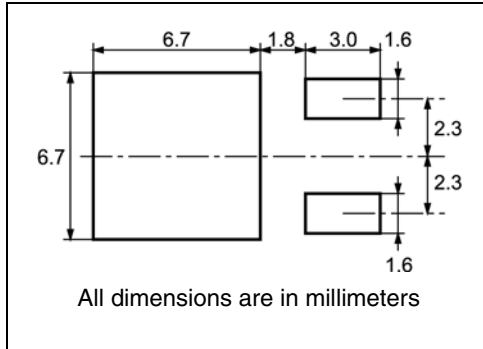
**TO-252 (DPAK) mechanical data**

| DIM. | mm.  |      |       |
|------|------|------|-------|
|      | min. | typ  | max.  |
| A    | 2.20 |      | 2.40  |
| A1   | 0.90 |      | 1.10  |
| A2   | 0.03 |      | 0.23  |
| b    | 0.64 |      | 0.90  |
| b4   | 5.20 |      | 5.40  |
| c    | 0.45 |      | 0.60  |
| c2   | 0.48 |      | 0.60  |
| D    | 6.00 |      | 6.20  |
| D1   |      | 5.10 |       |
| E    | 6.40 |      | 6.60  |
| E1   |      | 4.70 |       |
| e    |      | 2.28 |       |
| e1   | 4.40 |      | 4.60  |
| H    | 9.35 |      | 10.10 |
| L    | 1    |      |       |
| L1   |      | 2.80 |       |
| L2   |      | 0.80 |       |
| L4   | 0.60 |      | 1     |
| R    |      | 0.20 |       |
| V2   | 0°   |      | 8°    |



# 5 Package mechanical data

## DPAK FOOTPRINT



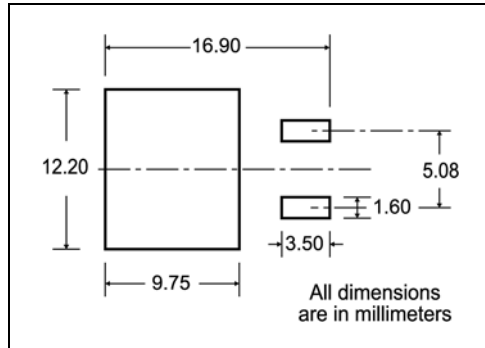
## TAPE AND REEL SHIPMENT

| 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    | 16.4 | 18.4 | 0.645 | 0.724  |
| N    | 50   |      | 1.968 |        |
| T    |      | 22.4 |       | 0.881  |

| BASE QTY | BULK QTY |
|----------|----------|
| 2500     | 2500     |

| DIM. | mm   |      | inch  |       |
|------|------|------|-------|-------|
|      | MIN. | MAX. | MIN.  | MAX.  |
| A0   | 6.8  | 7    | 0.267 | 0.275 |
| B0   | 10.4 | 10.6 | 0.409 | 0.417 |
| B1   |      | 12.1 |       | 0.476 |
| D    | 1.5  | 1.6  | 0.059 | 0.063 |
| D1   | 1.5  |      | 0.059 |       |
| E    | 1.65 | 1.85 | 0.065 | 0.073 |
| F    | 7.4  | 7.6  | 0.291 | 0.299 |
| K0   | 2.55 | 2.75 | 0.100 | 0.108 |
| P0   | 3.9  | 4.1  | 0.153 | 0.161 |
| P1   | 7.9  | 8.1  | 0.311 | 0.319 |
| P2   | 1.9  | 2.1  | 0.075 | 0.082 |
| R    | 40   |      | 1.574 |       |
| W    | 15.7 | 16.3 | 0.618 | 0.641 |

**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 10. Document revision history

| Date        | Revision | Changes       |
|-------------|----------|---------------|
| 07-Jul-2008 | 1        | First release |

**Please Read Carefully:**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2008 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

[www.st.com](http://www.st.com)

