



# STP200NF03 STB200NF03 - STB200NF03-1

N-channel 30V - 0.0032Ω - 120A - D<sup>2</sup>PAK/I<sup>2</sup>PAK/TO-220  
STripFET™ III Power MOSFET

## General features

| Type         | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub>      |
|--------------|------------------|---------------------|---------------------|
| STP200NF03   | 30V              | <0.0037Ω            | 120A <sup>(1)</sup> |
| STB200NF03   | 30V              | <0.0037Ω            | 120A <sup>(1)</sup> |
| STB200NF03-1 | 30V              | <0.0037Ω            | 120A <sup>(1)</sup> |

1. Current Limited by Package

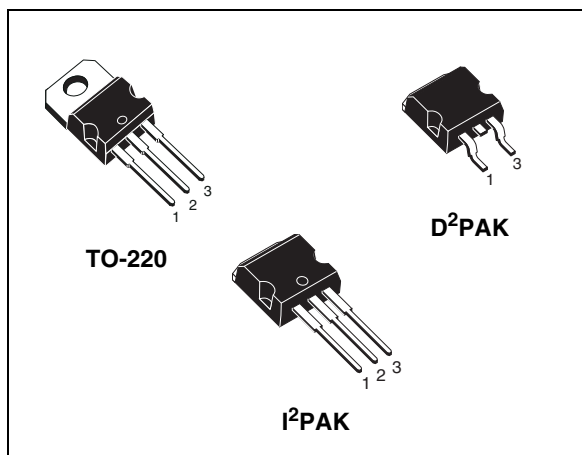
- Standard threshold drive
- 100% avalanche tested

## Description

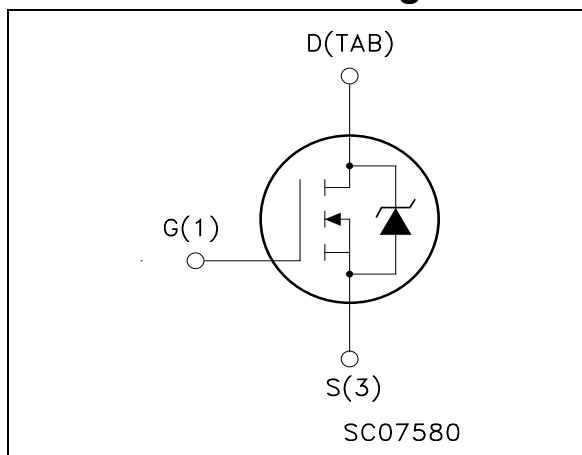
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

## Applications

- Switching application



## Internal schematic diagram



## Order codes

| Part number  | Marking  | Package            | Packaging   |
|--------------|----------|--------------------|-------------|
| STB200NF03T4 | B200NF03 | D <sup>2</sup> PAK | Tape & reel |
| STB200NF03-1 | B200NF03 | I <sup>2</sup> PAK | Tube        |
| STP200NF03   | P200NF03 | TO-220             | Tube        |

Contents

1      **Electrical ratings** ..... 3

2      **Electrical characteristics** ..... 4

      2.1    Electrical characteristics (curves) ..... 6

3      **Spice thermal model** ..... 10

4      **Test circuit** ..... 11

5      **Package mechanical data** ..... 12

6      **Packaging mechanical data** ..... 16

7      **Revision history** ..... 17

# 1 Electrical ratings

**Table 1. 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                                    | $\pm 20$   | V                   |
| $I_D^{(1)}$    | Drain current (continuous) at $T_C = 25^\circ\text{C}$  | 120        | A                   |
| $I_D^{(1)}$    | Drain current (continuous) at $T_C = 100^\circ\text{C}$ | 120        | A                   |
| $I_{DM}^{(2)}$ | Drain current (pulsed)                                  | 480        | A                   |
| $P_{tot}$      | Total dissipation at $T_C = 25^\circ\text{C}$           | 300        | W                   |
|                | Derating factor                                         | 2.0        | W/ $^\circ\text{C}$ |
| $dv/dt^{(3)}$  | Peak diode recovery voltage slope                       | 1.5        | V/ns                |
| $E_{AS}^{(4)}$ | Single pulse avalanche energy                           | 1.45       | J                   |
| $T_{stg}$      | Storage temperature                                     | -55 to 175 | $^\circ\text{C}$    |
| $T_j$          | Max. operating junction temperature                     |            |                     |

1. Value limited by package
2. Pulse width limited by safe operating area.
3.  $I_{SD} \leq 20\text{A}$ ,  $di/dt \leq 400\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_j \leq T_{JMAX}$
4. Starting  $T_j = 25^\circ\text{C}$ ,  $I_D = 60\text{A}$ ,  $V_{DD} = 25\text{V}$

**Table 2. Thermal data**

|           |                                                               |                     |                           |
|-----------|---------------------------------------------------------------|---------------------|---------------------------|
| Rthj-case | Thermal resistance junction-case max                          | 0.5                 | $^\circ\text{C}/\text{W}$ |
| Rthj-amb  | Thermal resistance junction-ambient max                       | 62.5                | $^\circ\text{C}/\text{W}$ |
| Rthj-pcb  | Thermal resistance junction-pcb                               | see curve 13 and 14 |                           |
| $T_J$     | Maximum lead temperature for soldering purpose <sup>(1)</sup> | 300                 | $^\circ\text{C}$          |

1. for 10 sec. 1.6mm from case

## 2 Electrical characteristics

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

**Table 3. On/off states**

| Symbol        | Parameter                                        | Test conditions                                                                                 | Min. | Typ.   | Max.      | Unit                           |
|---------------|--------------------------------------------------|-------------------------------------------------------------------------------------------------|------|--------|-----------|--------------------------------|
| $V_{(BR)DSS}$ | Drain-source breakdown voltage                   | $I_D = 250\mu\text{A}$ , $V_{GS} = 0$                                                           | 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                           | $V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$                                                      | 2    |        | 4         | V                              |
| $R_{DS(on)}$  | Static drain-source on resistance                | $V_{GS} = 10\text{V}$ , $I_D = 60\text{A}$                                                      |      | 0.0032 | 0.0036    | $\Omega$                       |

**Table 4. Dynamic**

| Symbol                                        | Parameter                                                               | Test conditions                                                                                                             | Min. | Typ.                  | Max. | Unit                 |
|-----------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------|-----------------------|------|----------------------|
| $g_{fs}^{(1)}$                                | Forward transconductance                                                | $V_{DS} = 15\text{V}$ , $I_D = 60\text{A}$                                                                                  |      | 200                   |      | 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>$V_{GS} = 0$                                                                 |      | 4950<br>1750<br>280   |      | 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     | $V_{DD} = 15\text{V}$ , $I_D = 60\text{A}$<br>$R_G = 4.7\Omega$ , $V_{GS} = 10\text{V}$<br>(see <a href="#">Figure 19</a> ) |      | 30<br>195<br>75<br>60 |      | 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            | $V_{DD} = 24\text{V}$ , $I_D = 120\text{A}$ ,<br>$V_{GS} = 10\text{V}$<br>(see <a href="#">Figure 20</a> )                  |      | 113<br>32<br>41       | 140  | nC<br>nC<br>nC       |

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

**Table 5. 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)                     |                                                                                                                         |      |                | 120<br>480 | A<br>A        |
| $V_{SD}^{(2)}$                    | Forward on voltage                                                           | $I_{SD} = 120A$ , $V_{GS} = 0$                                                                                          |      |                | 1.3        | V             |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse recovery time<br>Reverse recovery charge<br>Reverse recovery current | $I_{SD} = 120A$ ,<br>$di/dt = 100A/\mu s$ ,<br>$V_{DD} = 25V$ , $T_j = 150^\circ C$<br>(see <a href="#">Figure 21</a> ) |      | 70<br>170<br>5 |            | 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 1. Safe operating area

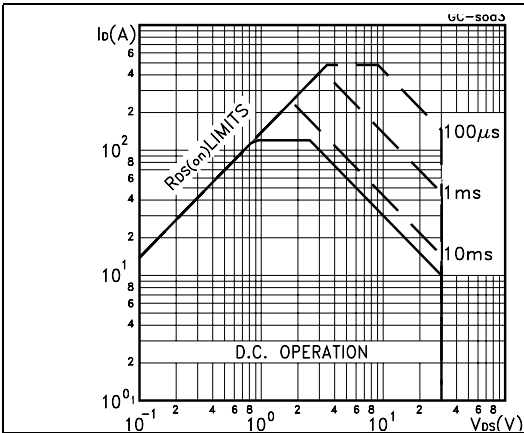


Figure 2. Thermal impedance

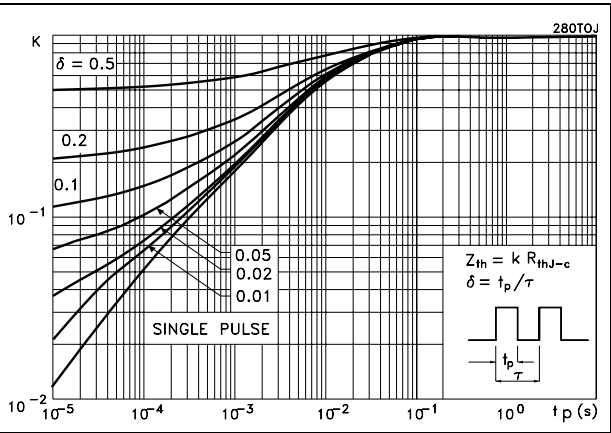


Figure 3. Output characteristics

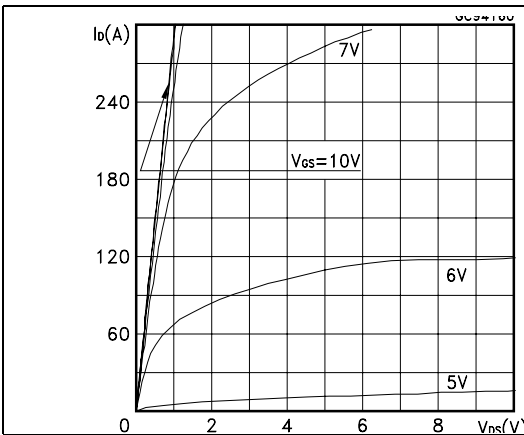


Figure 4. Transfer characteristics

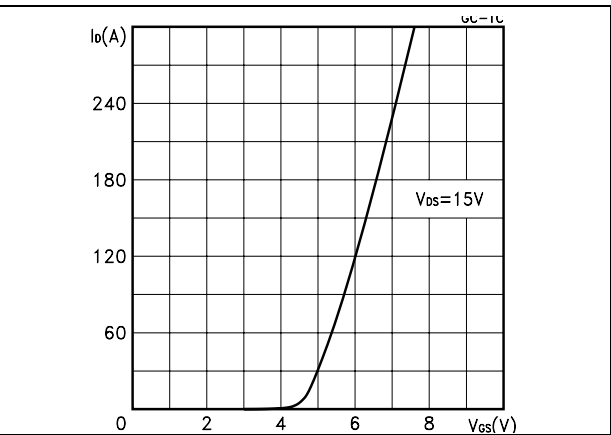


Figure 5. Transconductance

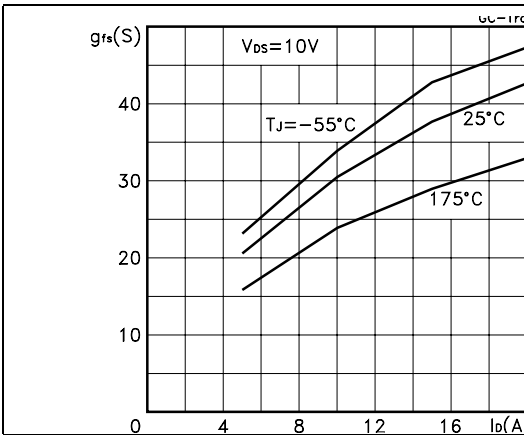


Figure 6. Static drain-source on resistance

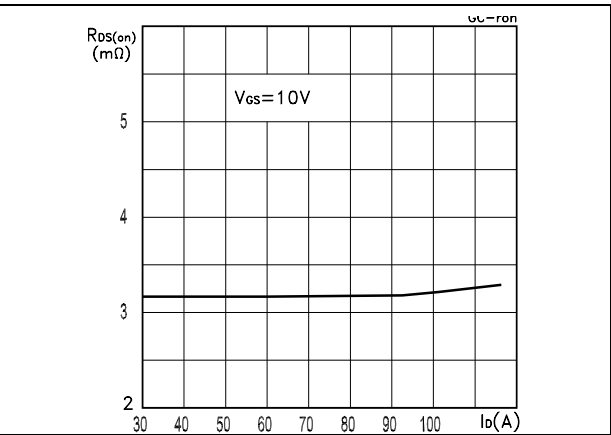


Figure 7. Gate charge vs. gate-source voltage Figure 8. Capacitance variations

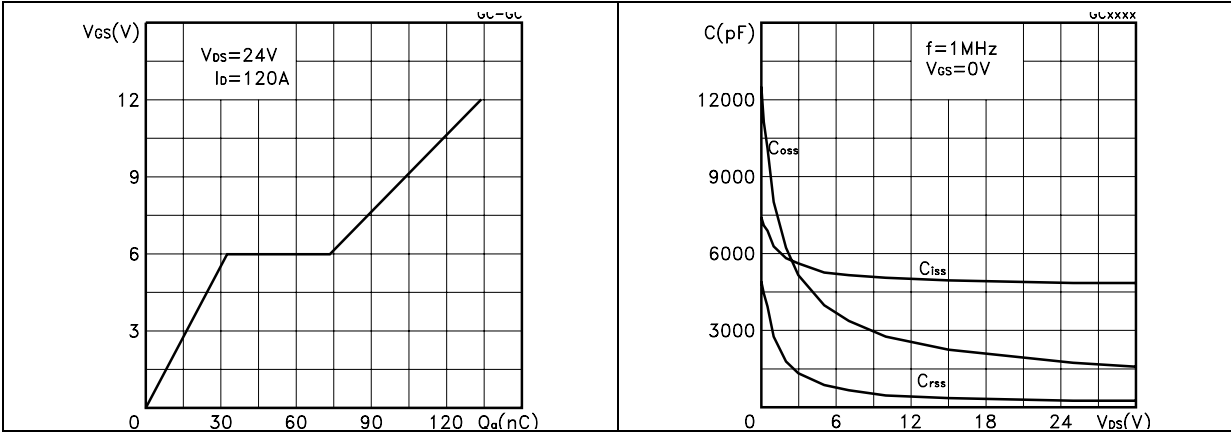


Figure 9. Normalized gate threshold voltage vs. temperature Figure 10. Normalized on resistance vs. temperature

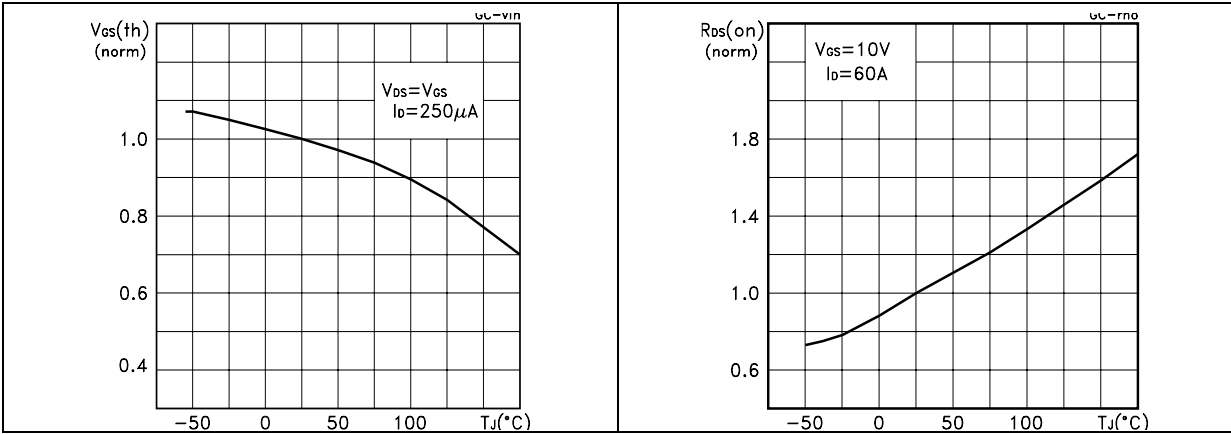


Figure 11. Normalized  $B_{V_{DSS}}$  vs. temperature Figure 12. Source-drain diode forward characteristics

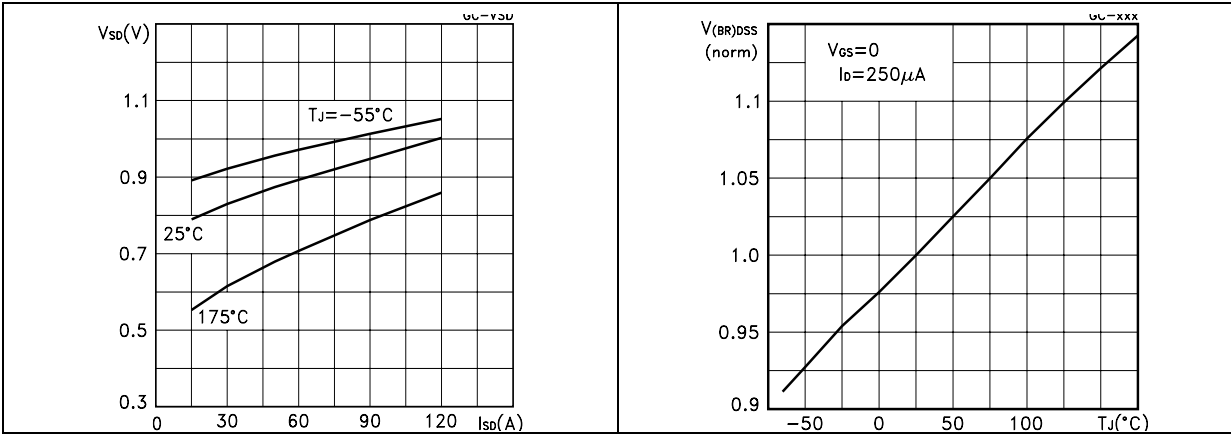


Figure 13. Thermal resistance  $r_{thj-a}$  vs. PCB copper area

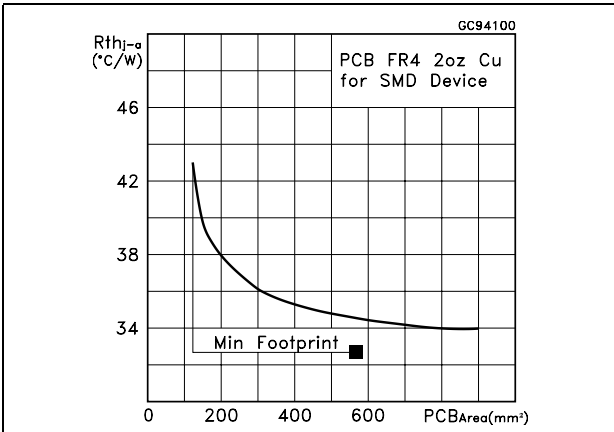


Figure 14. Max power dissipation vs. PCB copper area

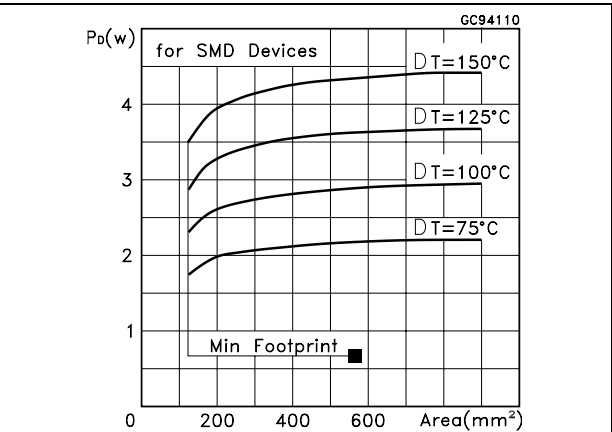


Figure 15. Power Derating vs.  $T_c$

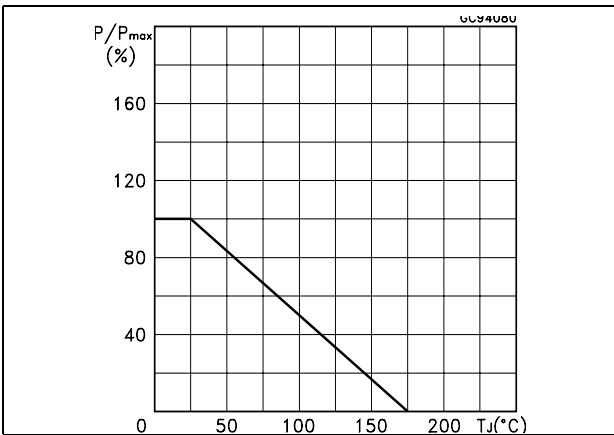


Figure 16. Max Id Current vs.  $T_c$

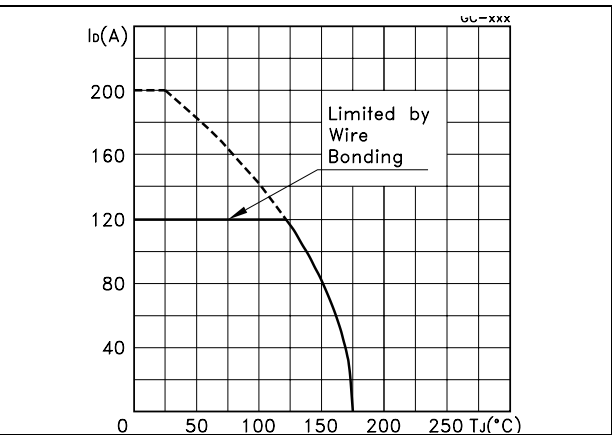
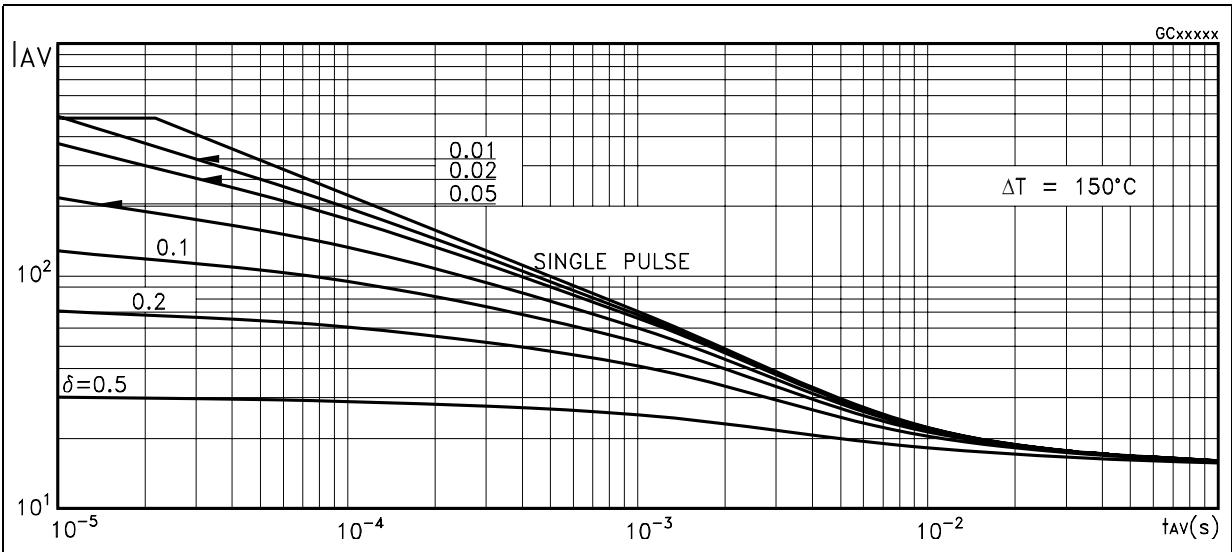


Figure 17. Allowable  $i_{av}$  vs. Time in Avalanche



The previous curve gives the safe operating area for unclamped inductive loads, single pulse or repetitive, under the following conditions:

$$P_{D(AVE)} = 0.5 * (1.3 * BV_{DSS} * I_{AV})$$

$$E_{AS(AR)} = P_{D(AVE)} * t_{AV}$$

Where:

$I_{AV}$  is the Allowable Current in Avalanche

$P_{D(AVE)}$  is the Average Power Dissipation in Avalanche (Single Pulse)

$t_{AV}$  is the Time in Avalanche

To de rate above 25 °C, at fixed  $I_{AV}$ , the following equation must be applied:

$$I_{AV} = 2 * (T_{jmax} - T_{CASE}) / (1.3 * BV_{DSS} * Z_{th})$$

Where:

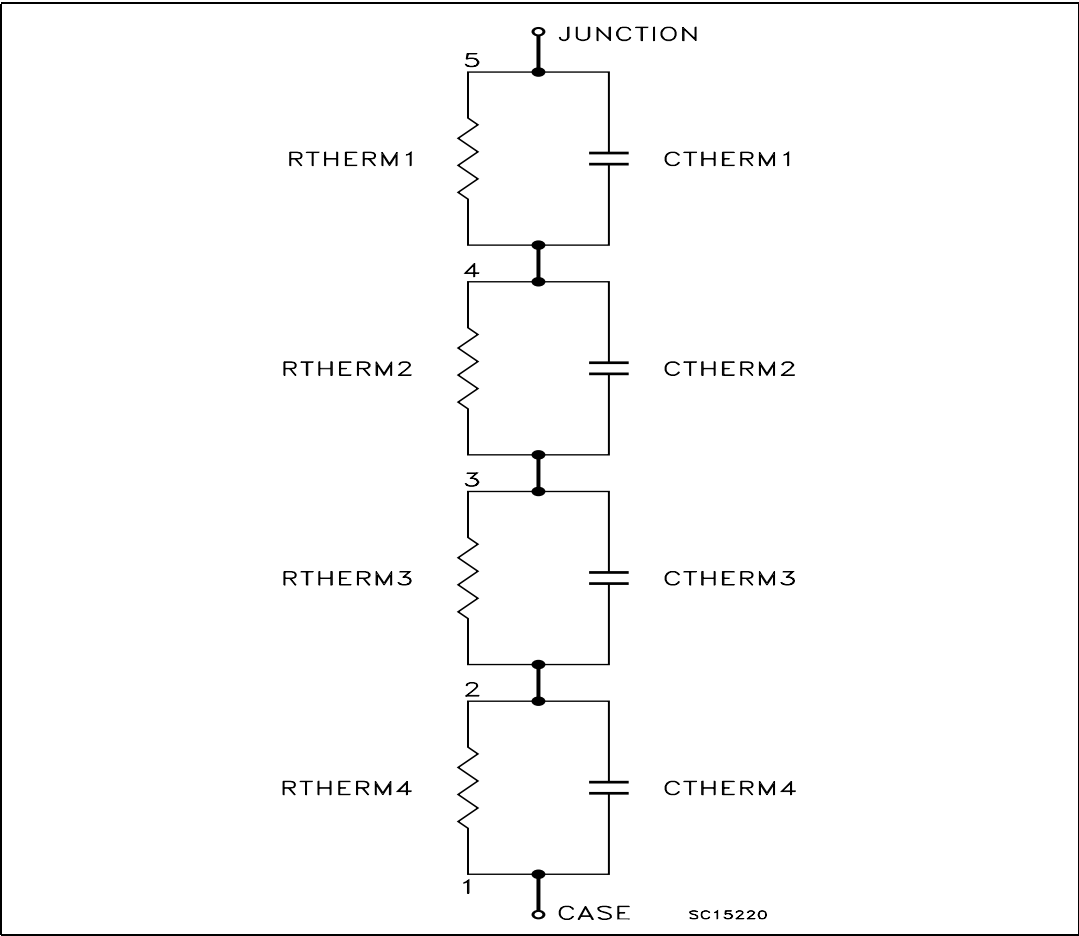
$Z_{th} = K * R_{th}$  is the value coming from Normalized Thermal Response at fixed pulse width equal to  $T_{AV}$ .

### 3      Spice thermal model

Table 6.      Spice parameters

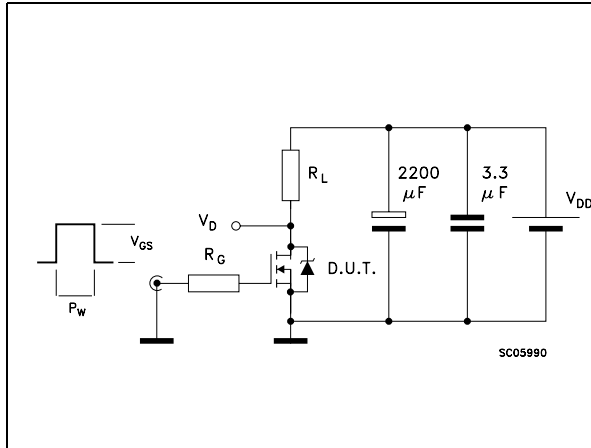
| Parameter | Node  | Value  |
|-----------|-------|--------|
| CTHERM1   | 5 - 4 | 0.011  |
| CTHERM2   | 4 - 3 | 0.0012 |
| CTHERM3   | 3 - 2 | 0.05   |
| CTHERM4   | 2 - 1 | 0.1    |
|           |       |        |
| R THERM1  | 5 - 4 | 0.09   |
| R THERM2  | 4 - 3 | 0.02   |
| R THERM3  | 3 - 2 | 0.11   |
| R THERM4  | 2 - 1 | 0.17   |

Figure 18.      Circuit

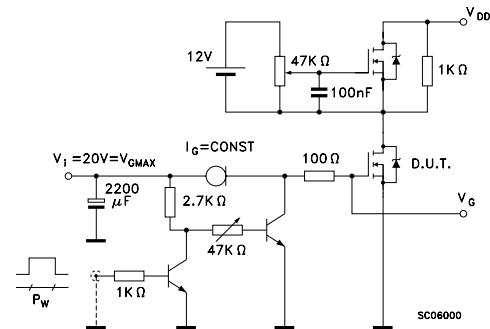


## 4 Test circuit

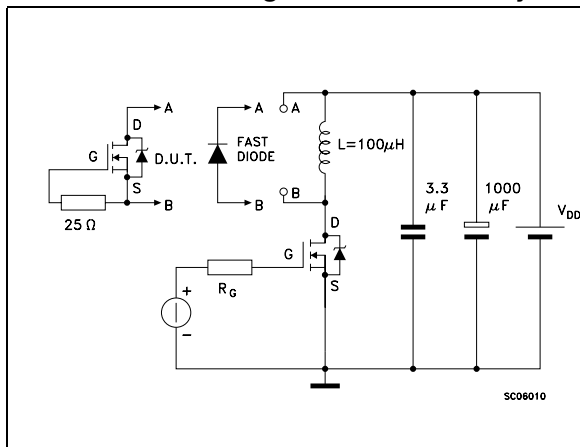
**Figure 19. Switching times test circuit for resistive load**



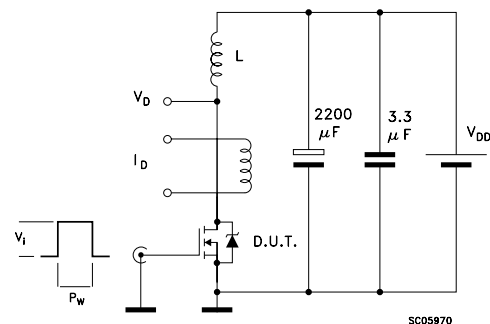
**Figure 20. Gate charge test circuit**



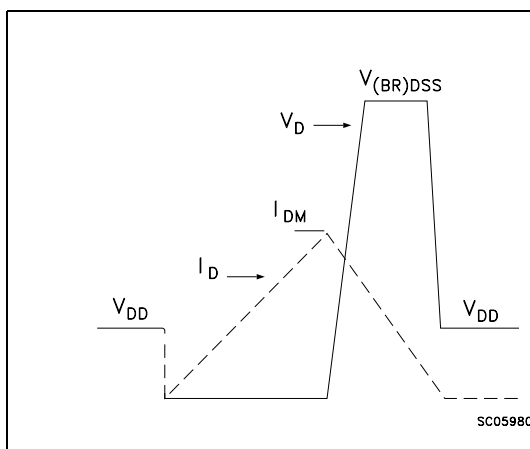
**Figure 21. Test circuit for inductive load switching and diode recovery times**



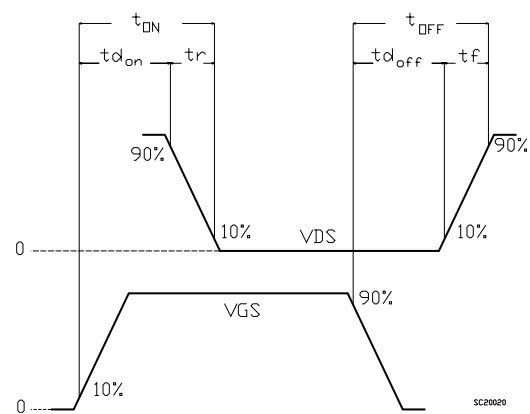
**Figure 22. Unclamped Inductive load test circuit**



**Figure 23. Unclamped inductive waveform**



**Figure 24. Switching time waveform**

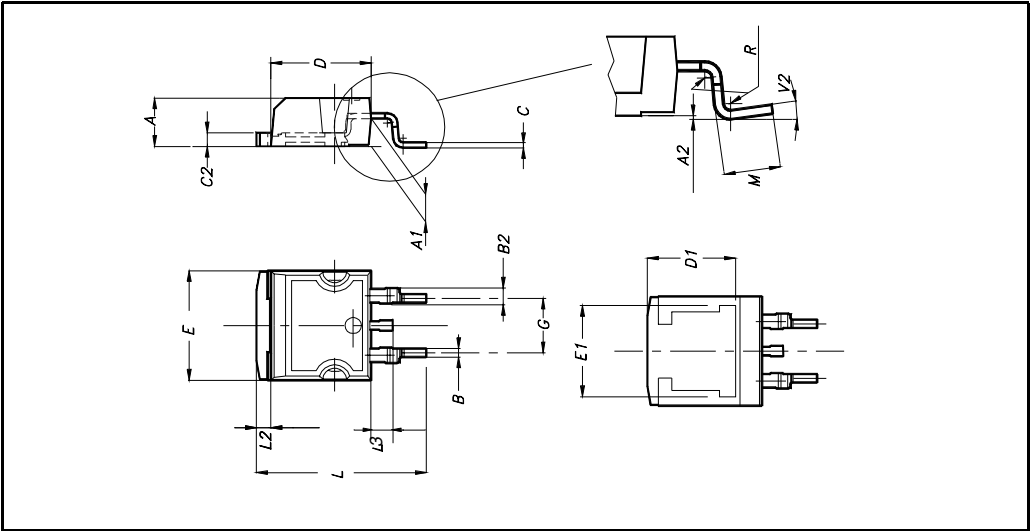


## 5 Package mechanical data

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)

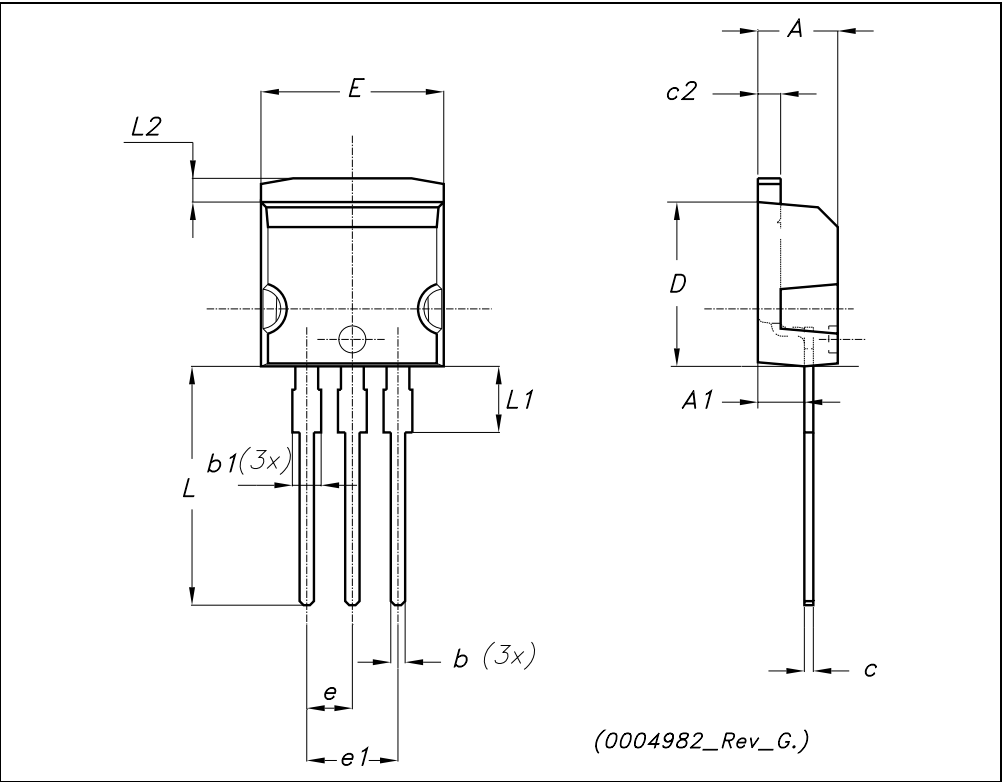
D<sup>2</sup>PAK MECHANICAL DATA

| 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°    |       |       |       |

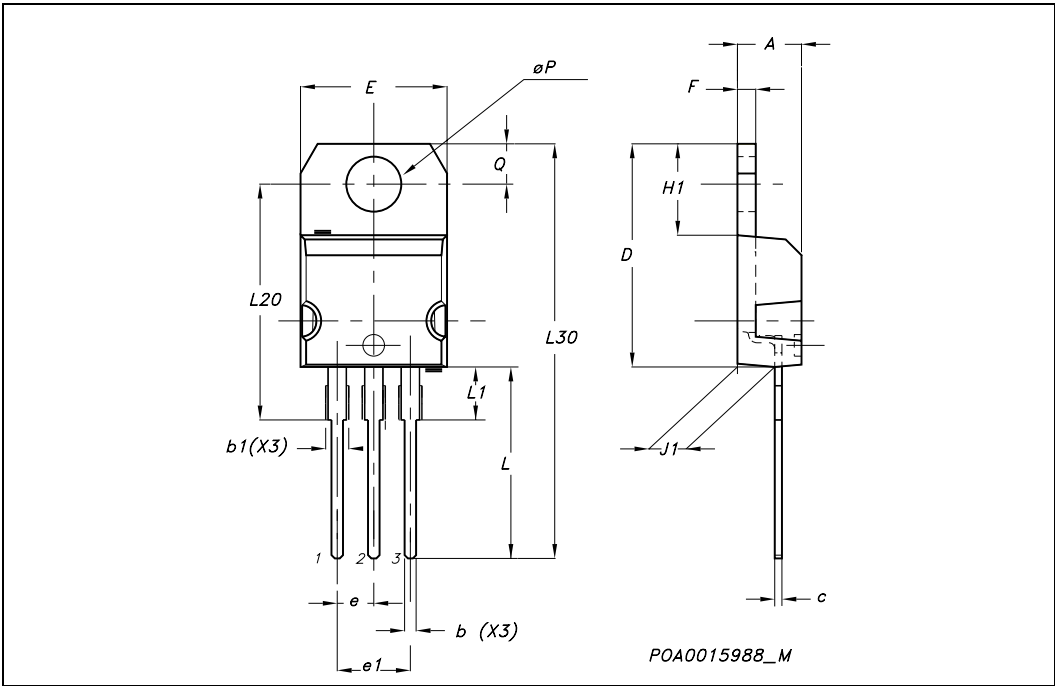


TO-262 (I<sup>2</sup>PAK) MECHANICAL DATA

| 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 |

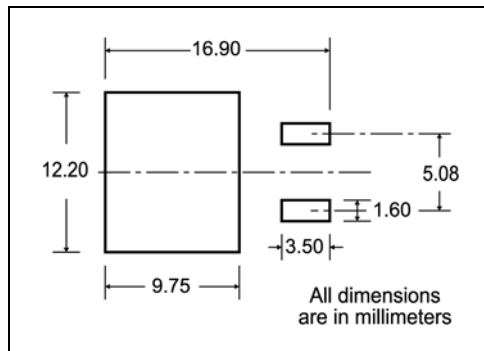


| TO-220 MECHANICAL DATA |       |       |       |       |       |       |
|------------------------|-------|-------|-------|-------|-------|-------|
| DIM.                   | mm.   |       |       | inch  |       |       |
|                        | MIN.  | TYP.  | MAX.  | MIN.  | TYP.  | MAX.  |
| 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 |

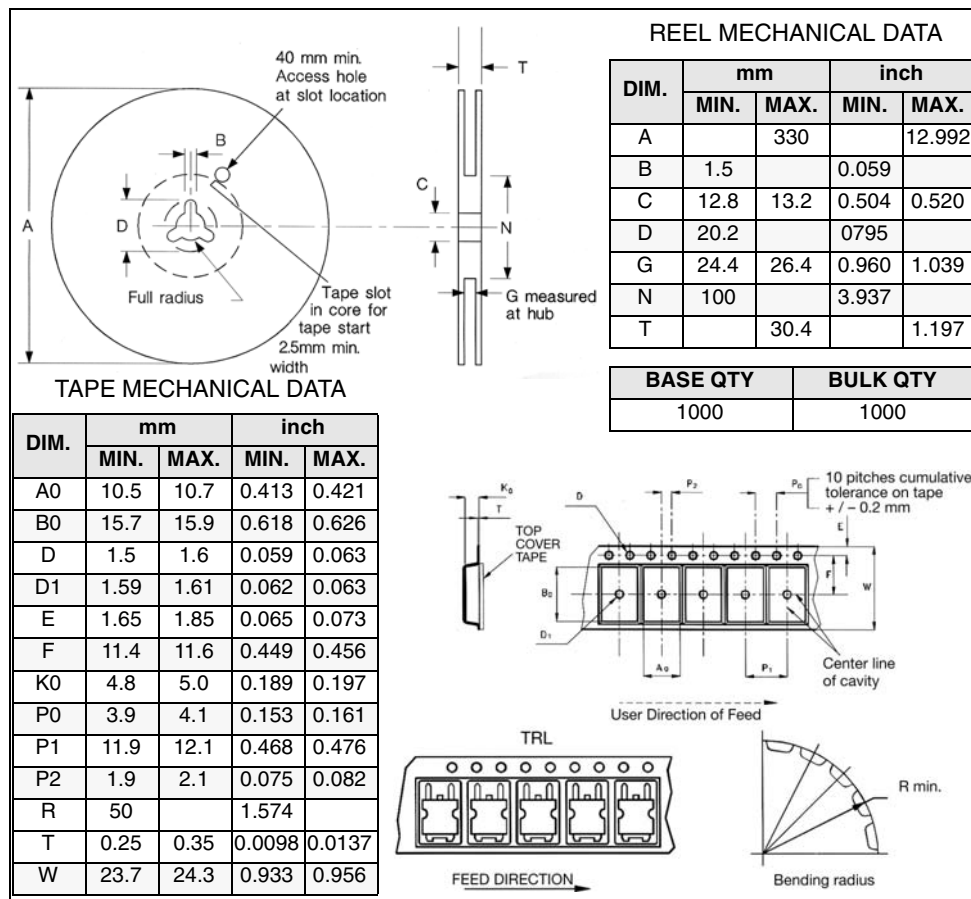


## 6 Packaging mechanical data

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



### TAPE AND REEL SHIPMENT



\* on sales type

## 7 Revision history

**Table 7. Revision history**

| <b>Date</b> | <b>Revision</b> | <b>Changes</b>                  |
|-------------|-----------------|---------------------------------|
| 09-Sep-2004 | 2               | Complete version                |
| 09-Aug-2006 | 3               | New template, no content change |

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## Данный компонент на территории Российской Федерации

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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