



# STP55NF03L STB55NF03L STB55NF03L-1

N-CHANNEL 30V - 0.01  $\Omega$  - 55A TO-220/D<sup>2</sup>PAK/I<sup>2</sup>PAK

STripFET™ II POWER MOSFET

| TYPE         | V <sub>DS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|--------------|-----------------|---------------------|----------------|
| STP55NF03L   | 30 V            | <0.013 $\Omega$     | 55 A           |
| STB55NF03L   | 30 V            | <0.013 $\Omega$     | 55 A           |
| STB55NF03L-1 | 30 V            | <0.013 $\Omega$     | 55 A           |

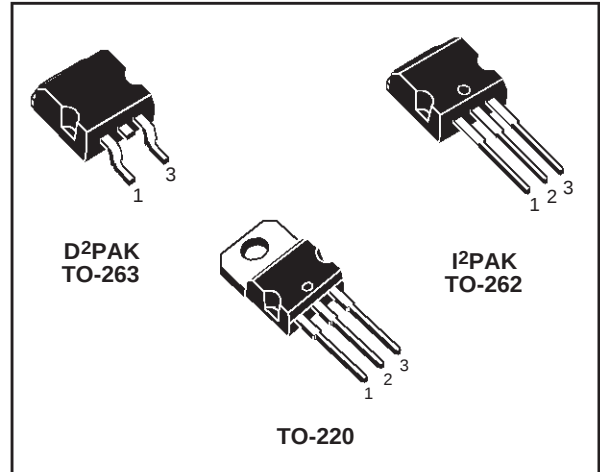
- TYPICAL R<sub>DS(on)</sub> = 0.01  $\Omega$
- OPTIMIZED FOR HIGH SWITCHING OPERATIONS
- LOW GATE CHARGE
- LOGIC LEVEL GATE DRIVE

## DESCRIPTION

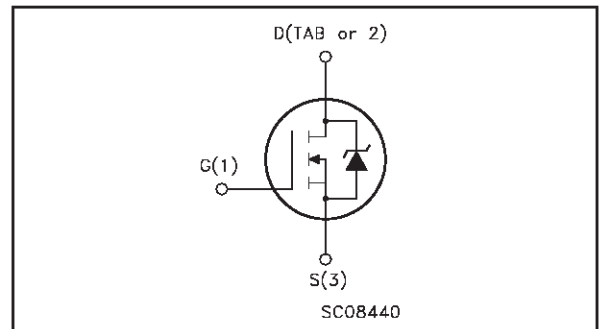
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing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

## APPLICATIONS

- LOW VOLTAGE DC-DC CONVERTERS
- HIGH CURRENT, HIGH SWITCHING SPEED
- HIGH EFFICIENCY SWITCHING CIRCUITS



## INTERNAL SCHEMATIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                             | Value      | Unit |
|---------------------|-------------------------------------------------------|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)            | 30         | V    |
| V <sub>DGR</sub>    | Drain-gate Voltage (R <sub>GS</sub> = 20 k $\Omega$ ) | 30         | V    |
| V <sub>GS</sub>     | Gate- source Voltage                                  | $\pm 16$   | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 25°C   | 55         | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 100°C  | 39         | A    |
| I <sub>DM</sub> (•) | Drain Current (pulsed)                                | 220        | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>C</sub> = 25°C            | 80         | W    |
|                     | Derating Factor                                       | 0.53       | W/°C |
| T <sub>stg</sub>    | Storage Temperature                                   | -60 to 175 | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                   | 175        | °C   |

(•) Pulse width limited by safe operating area.

**STP55NF03L STB55NF03L/-1****THERMAL DATA**

|                       |                                                |     |       |      |
|-----------------------|------------------------------------------------|-----|-------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-case               | Max | 1.875 | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-ambient            | Max | 62.5  | °C/W |
| T <sub>l</sub>        | Maximum Lead Temperature For Soldering Purpose | Typ | 300   | °C   |

**ELECTRICAL CHARACTERISTICS** (T<sub>case</sub> = 25 °C unless otherwise specified)**OFF**

| Symbol               | Parameter                                             | Test Conditions                                                                     | Min. | Typ. | Max.    | Unit     |
|----------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------|------|------|---------|----------|
| V <sub>(BR)DSS</sub> | Drain-source Breakdown Voltage                        | I <sub>D</sub> = 250 µA, V <sub>GS</sub> = 0                                        | 30   |      |         | V        |
| I <sub>DSS</sub>     | Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0) | V <sub>DS</sub> = Max Rating<br>V <sub>DS</sub> = Max Rating T <sub>C</sub> = 125°C |      |      | 1<br>10 | µA<br>µA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ± 16V                                                             |      |      | ±100    | nA       |

**ON (\*)**

| Symbol              | Parameter                         | Test Conditions                                                                                   | Min. | Typ.          | Max.           | Unit   |
|---------------------|-----------------------------------|---------------------------------------------------------------------------------------------------|------|---------------|----------------|--------|
| V <sub>GS(th)</sub> | Gate Threshold Voltage            | V <sub>DS</sub> = V <sub>GS</sub> I <sub>D</sub> = 250 µA                                         | 1    |               |                | V      |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10 V I <sub>D</sub> = 27.5 A<br>V <sub>GS</sub> = 4.5 V I <sub>D</sub> = 27.5 A |      | 0.01<br>0.013 | 0.013<br>0.020 | Ω<br>Ω |

**DYNAMIC**

| Symbol                                                   | Parameter                                                               | Test Conditions                                                                            | Min. | Typ.               | Max. | Unit           |
|----------------------------------------------------------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|------|--------------------|------|----------------|
| g <sub>fs</sub> (*)                                      | Forward Transconductance                                                | V <sub>DS</sub> > I <sub>D(on)</sub> × R <sub>DS(on)max</sub> ,<br>I <sub>D</sub> = 27.5 A |      | 30                 |      | S              |
| C <sub>iss</sub><br>C <sub>oss</sub><br>C <sub>rss</sub> | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0                                      |      | 1265<br>435<br>115 |      | pF<br>pF<br>pF |

## ELECTRICAL CHARACTERISTICS (continued)

## SWITCHING ON

| Symbol                        | Parameter                                                    | Test Conditions                                                                                                           | Min. | Typ.          | Max. | Unit           |
|-------------------------------|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|------|---------------|------|----------------|
| $t_{d(on)}$<br>$t_r$          | Turn-on Delay Time<br>Rise Time                              | $V_{DD} = 15\text{ V}$ $I_D = 27.5\text{ A}$<br>$R_G = 4.7\ \Omega$ $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, Figure 3) |      | 28<br>400     |      | ns<br>ns       |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD} = 24\text{ V}$ $I_D = 55\text{ A}$ $V_{GS} = 4.5\text{ V}$                                                        |      | 20<br>7<br>10 | 27   | nC<br>nC<br>nC |

## SWITCHING OFF

| Symbol                | Parameter                        | Test Conditions                                                                                                             | Min. | Typ.     | Max. | Unit     |
|-----------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------|----------|------|----------|
| $t_{d(off)}$<br>$t_f$ | Turn-off Delay Time<br>Fall Time | $V_{DD} = 15\text{ V}$ $I_D = 27.5\text{ A}$<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, Figure 3) |      | 25<br>50 |      | ns<br>ns |

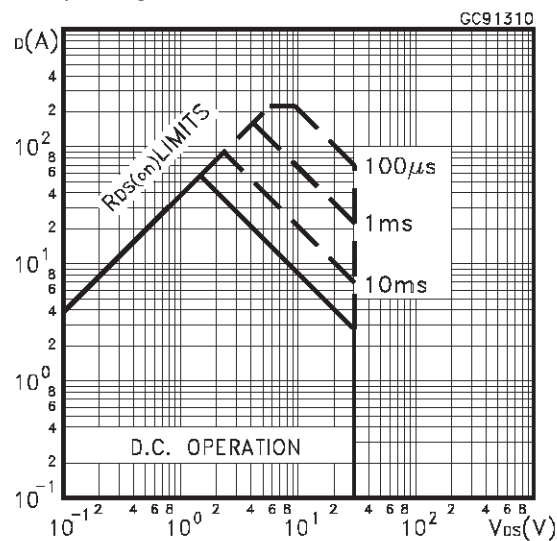
## SOURCE DRAIN DIODE

| Symbol                            | Parameter                                                                    | Test Conditions                                                                                                                               | Min. | Typ.             | Max.      | Unit          |
|-----------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|-----------|---------------|
| $I_{SD}$<br>$I_{SDM} (\bullet)$   | Source-drain Current<br>Source-drain Current (pulsed)                        |                                                                                                                                               |      |                  | 55<br>220 | A<br>A        |
| $V_{SD} (*)$                      | Forward On Voltage                                                           | $I_{SD} = 55\text{ A}$ $V_{GS} = 0$                                                                                                           |      |                  | 1.3       | V             |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD} = 55\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 30\text{ V}$ $T_j = 150^\circ\text{C}$<br>(see test circuit, Figure 5) |      | 70<br>160<br>4.5 |           | ns<br>nC<br>A |

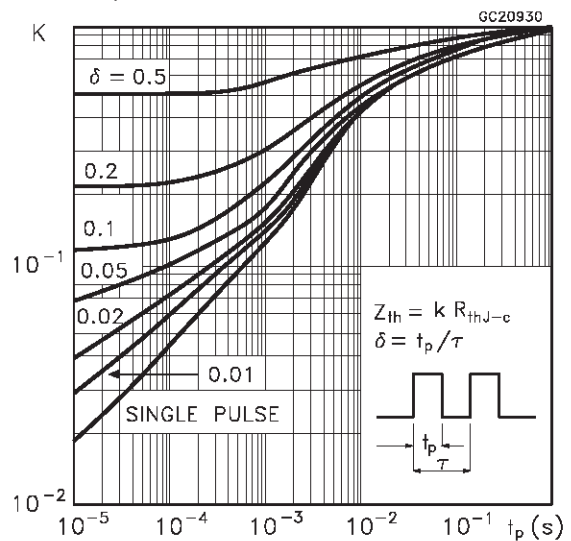
(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.

(•) Pulse width limited by safe operating area.

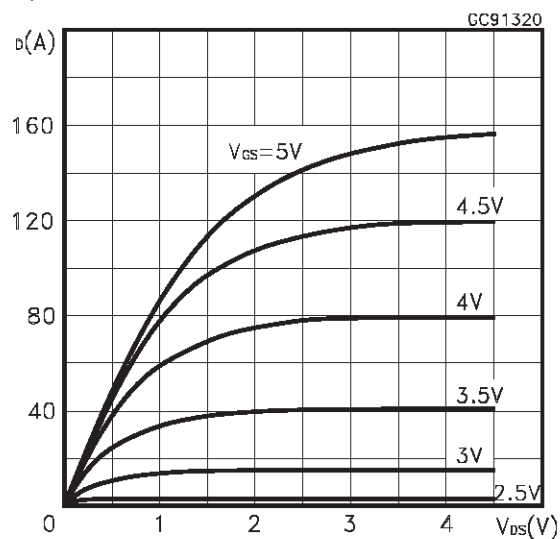
## Safe Operating Area



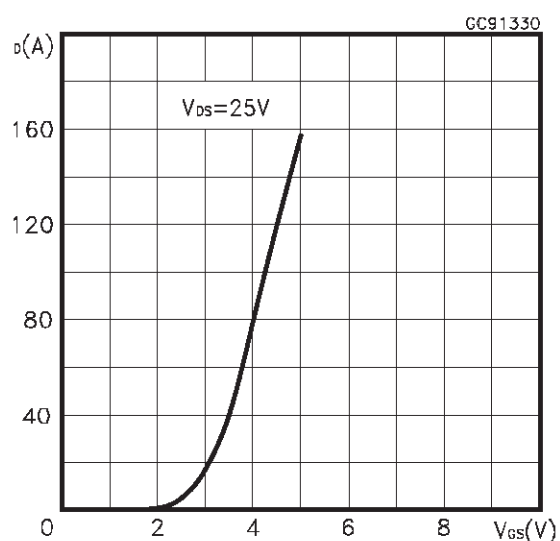
## Thermal Impedance



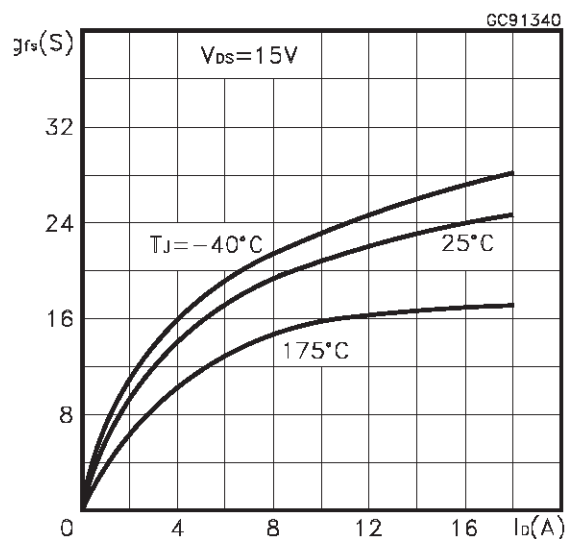
Output Characteristics



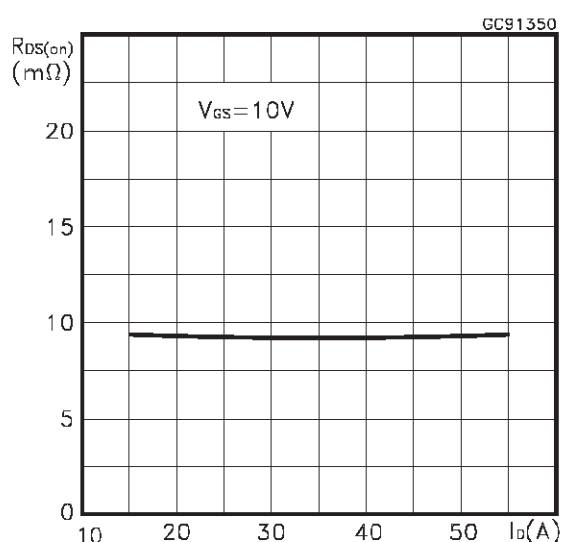
Transfer Characteristics



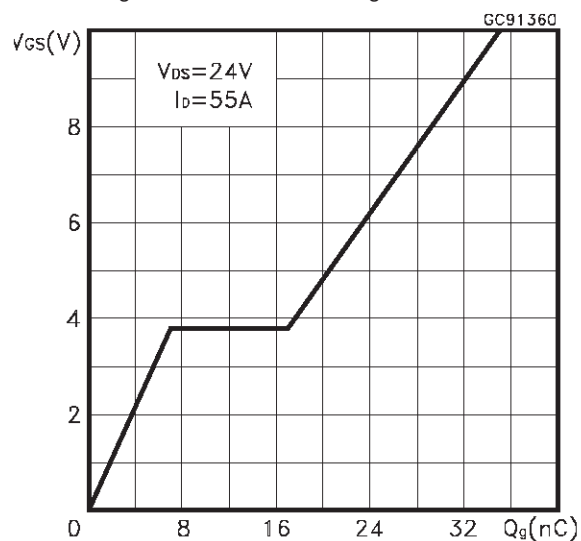
Transconductance



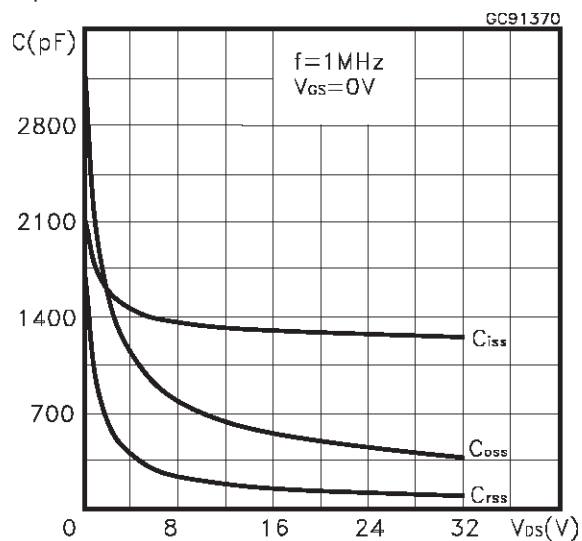
Static Drain-source On Resistance



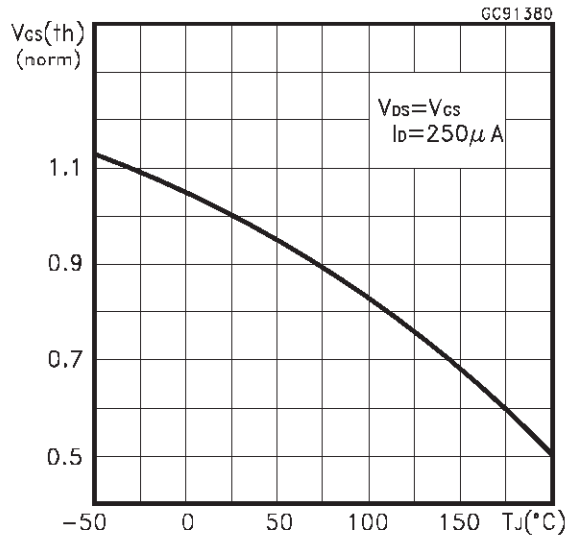
Gate Charge vs. Gate-source Voltage



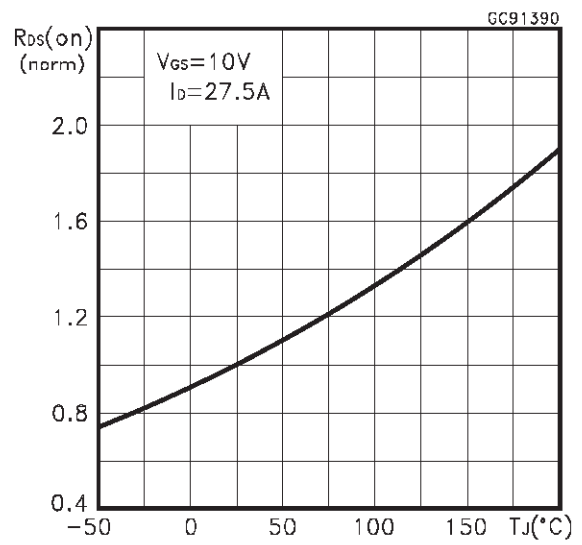
Capacitance Variations



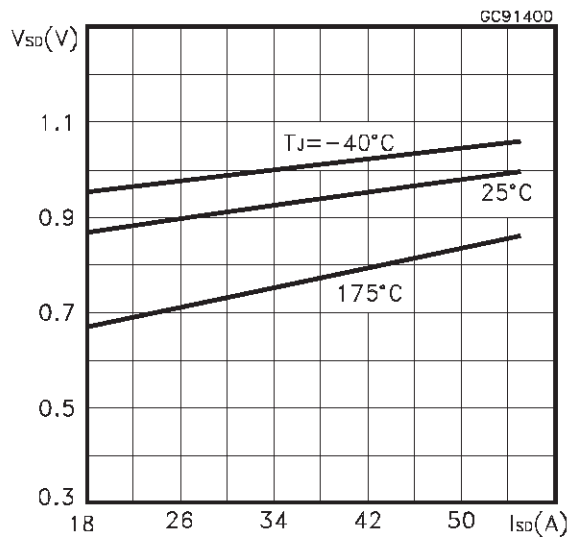
Normalized Gate Threshold Voltage vs Temperature



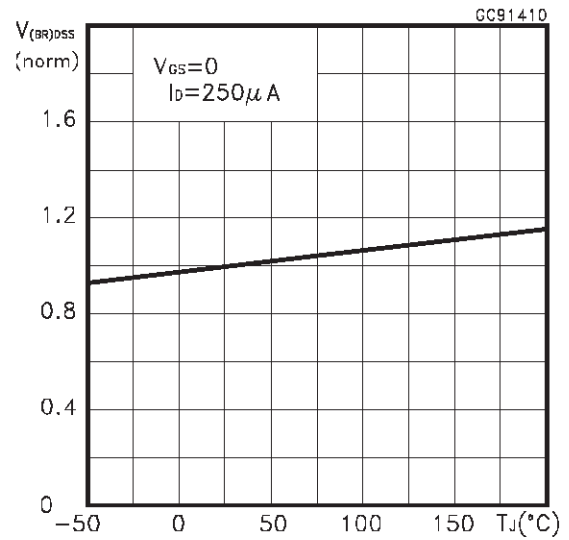
Normalized on Resistance vs Temperature



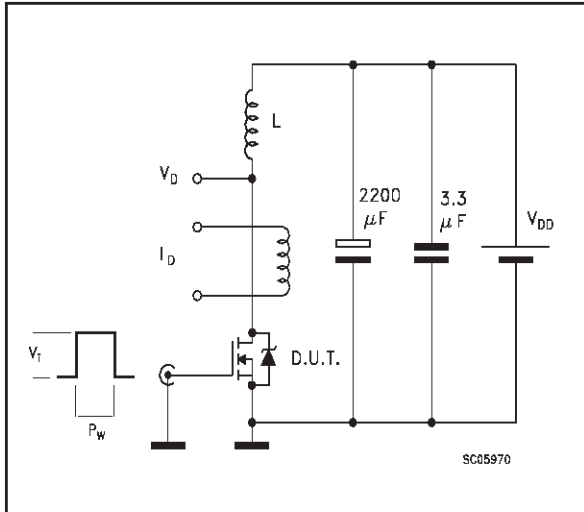
Source-drain Diode Forward Characteristics



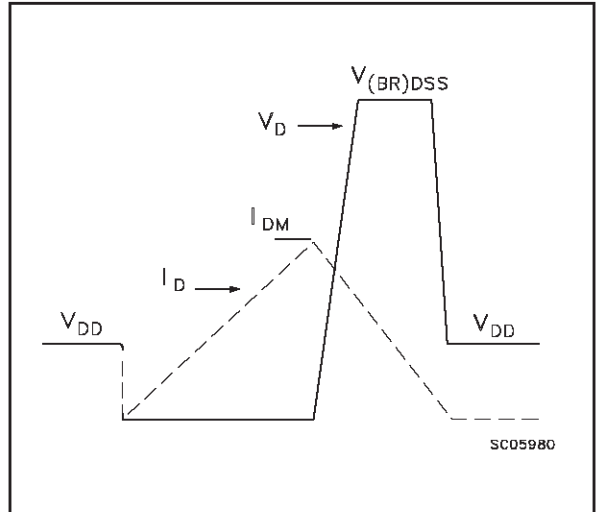
Normalized Breakdown Voltage vs Temperature.



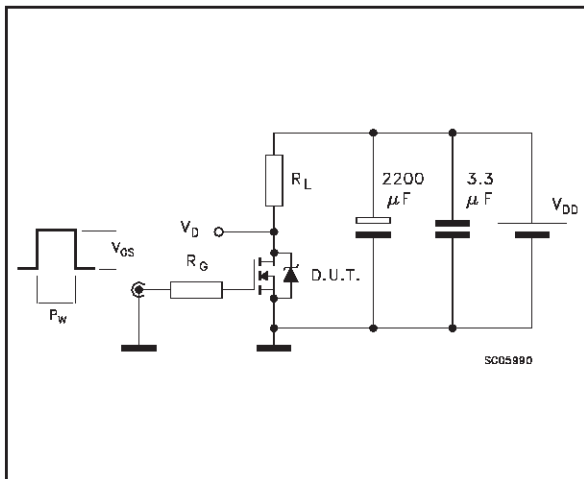
**Fig. 1: Unclamped Inductive Load Test Circuit**



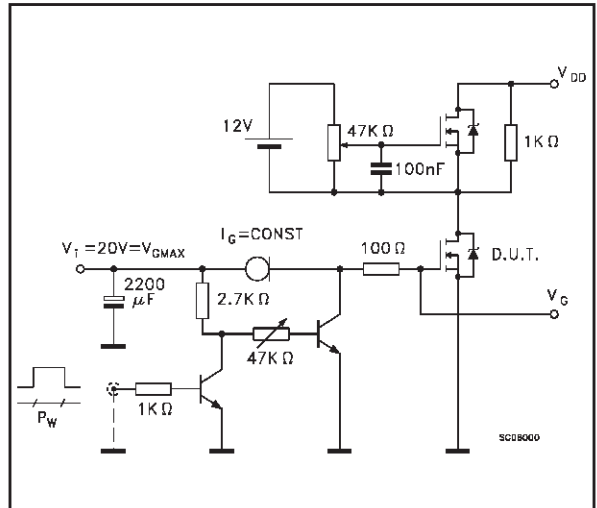
**Fig. 2: Unclamped Inductive Waveform**



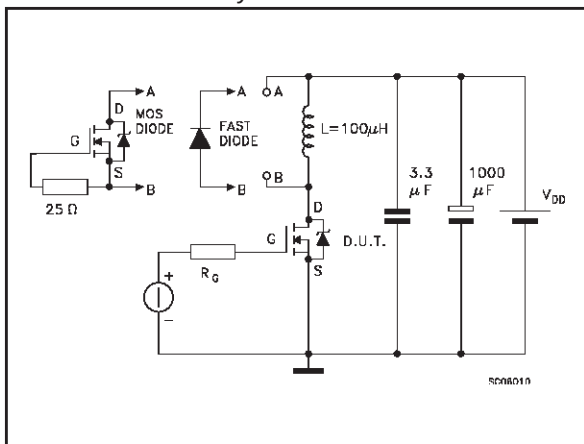
**Fig. 3: Switching Times Test Circuits For Resistive Load**



**Fig. 4: Gate Charge test Circuit**

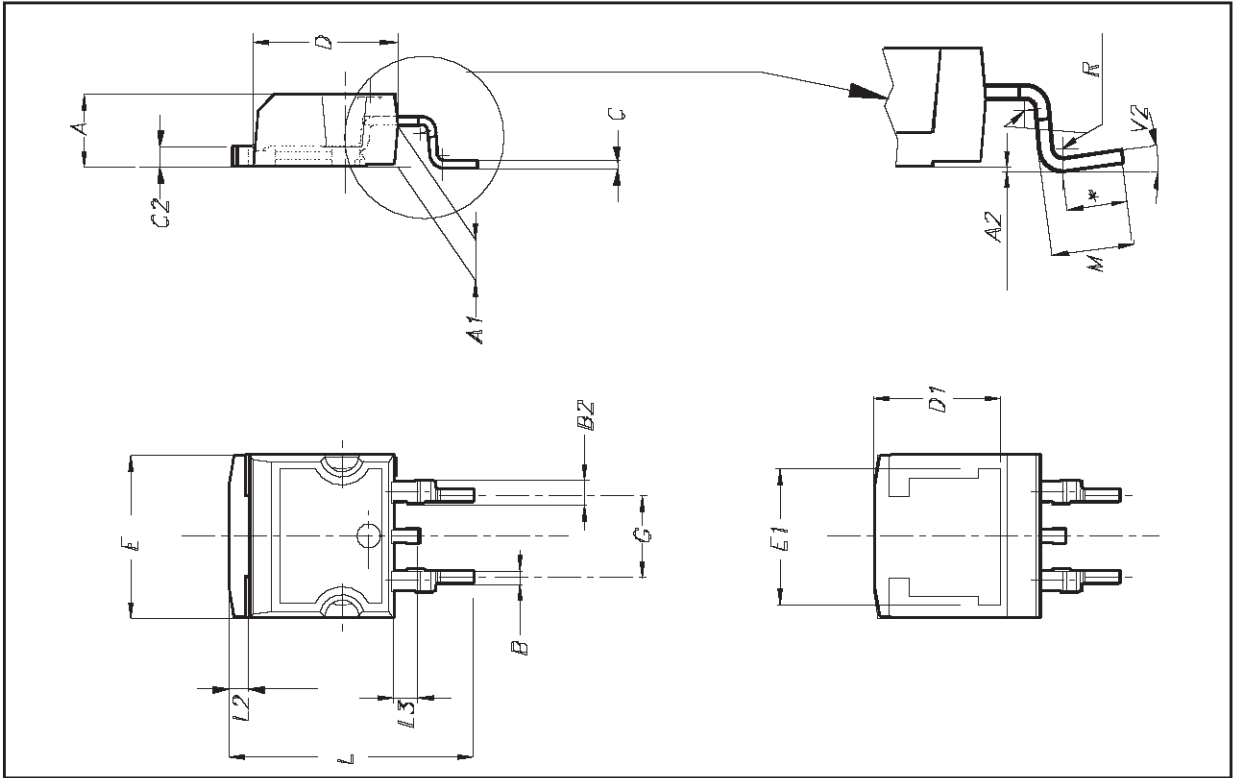


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



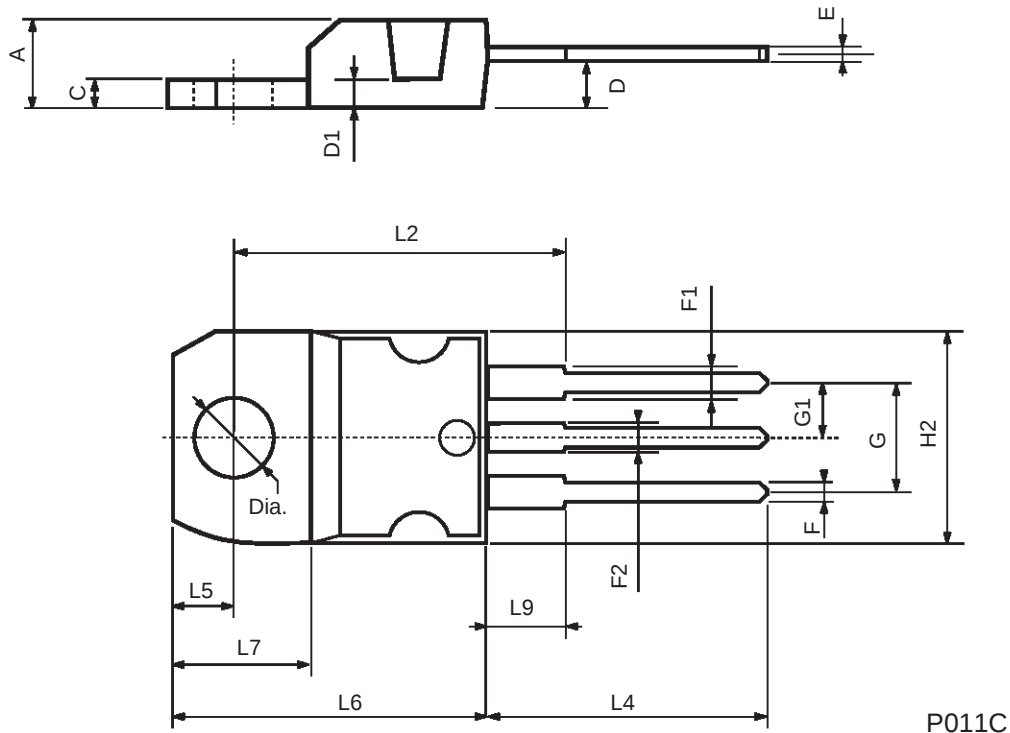
D<sup>2</sup>PAK MECHANICAL DATA

| DIM. | mm.  |      |       | inch. |       |       |
|------|------|------|-------|-------|-------|-------|
|      | MIN. | TYP. | MAX.  | MIN.  | TYP.  | TYP.  |
| 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  | 0.028 |       | 0.037 |
| B2   | 1.14 |      | 1.7   | 0.045 |       | 0.067 |
| C    | 0.45 |      | 0.6   | 0.018 |       | 0.024 |
| C2   | 1.21 |      | 1.36  | 0.048 |       | 0.054 |
| D    | 8.95 |      | 9.35  | 0.352 |       | 0.368 |
| D1   |      | 8    |       |       | 0.315 |       |
| E    | 10   |      | 10.4  | 0.394 |       | 0.409 |
| E1   | 8.5  |      |       |       | 0.334 |       |
| G    | 4.88 |      | 5.28  | 0.192 |       | 0.208 |
| L    | 15   |      | 15.85 | 0.591 |       | 0.624 |
| L2   | 1.27 |      | 1.4   | 0.050 |       | 0.055 |
| L3   | 1.4  |      | 1.75  | 0.055 |       | 0.069 |
| M    | 2.4  |      | 3.2   | 0.094 |       | 0.126 |
| R    |      | 0.4  |       |       | 0.016 |       |
| V2   | 0°   |      | 4°    | 0°    |       | 4°    |



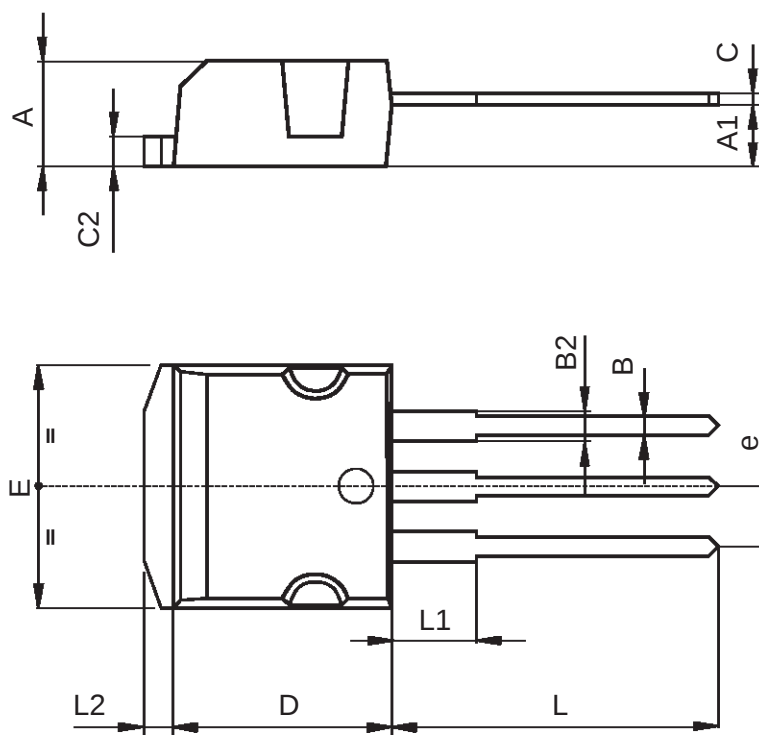
TO-220 MECHANICAL DATA

| DIM. | mm    |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.40  |      | 4.60  | 0.173 |       | 0.181 |
| C    | 1.23  |      | 1.32  | 0.048 |       | 0.051 |
| D    | 2.40  |      | 2.72  | 0.094 |       | 0.107 |
| D1   |       | 1.27 |       |       | 0.050 |       |
| E    | 0.49  |      | 0.70  | 0.019 |       | 0.027 |
| F    | 0.61  |      | 0.88  | 0.024 |       | 0.034 |
| F1   | 1.14  |      | 1.70  | 0.044 |       | 0.067 |
| F2   | 1.14  |      | 1.70  | 0.044 |       | 0.067 |
| G    | 4.95  |      | 5.15  | 0.194 |       | 0.203 |
| G1   | 2.4   |      | 2.7   | 0.094 |       | 0.106 |
| H2   | 10.0  |      | 10.40 | 0.393 |       | 0.409 |
| L2   |       | 16.4 |       |       | 0.645 |       |
| L4   | 13.0  |      | 14.0  | 0.511 |       | 0.551 |
| L5   | 2.65  |      | 2.95  | 0.104 |       | 0.116 |
| L6   | 15.25 |      | 15.75 | 0.600 |       | 0.620 |
| L7   | 6.2   |      | 6.6   | 0.244 |       | 0.260 |
| L9   | 3.5   |      | 3.93  | 0.137 |       | 0.154 |
| DIA. | 3.75  |      | 3.85  | 0.147 |       | 0.151 |



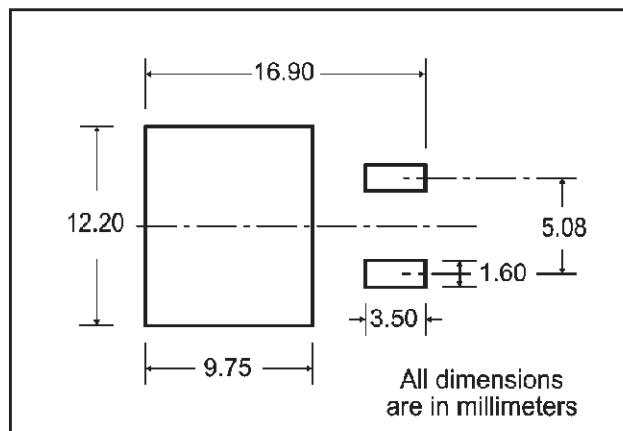
TO-262 (I<sup>2</sup>PAK) MECHANICAL DATA

| 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 |
| 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 |
| e    | 2.4  |      | 2.7  | 0.094 |      | 0.106 |
| E    | 10   |      | 10.4 | 0.393 |      | 0.409 |
| L    | 13.1 |      | 13.6 | 0.515 |      | 0.531 |
| L1   | 3.48 |      | 3.78 | 0.137 |      | 0.149 |
| L2   | 1.27 |      | 1.4  | 0.050 |      | 0.055 |

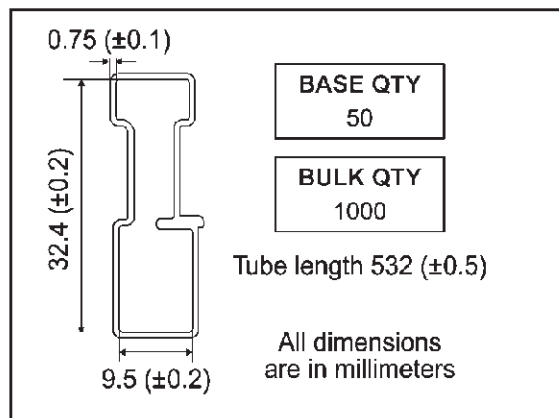


P011P5/E

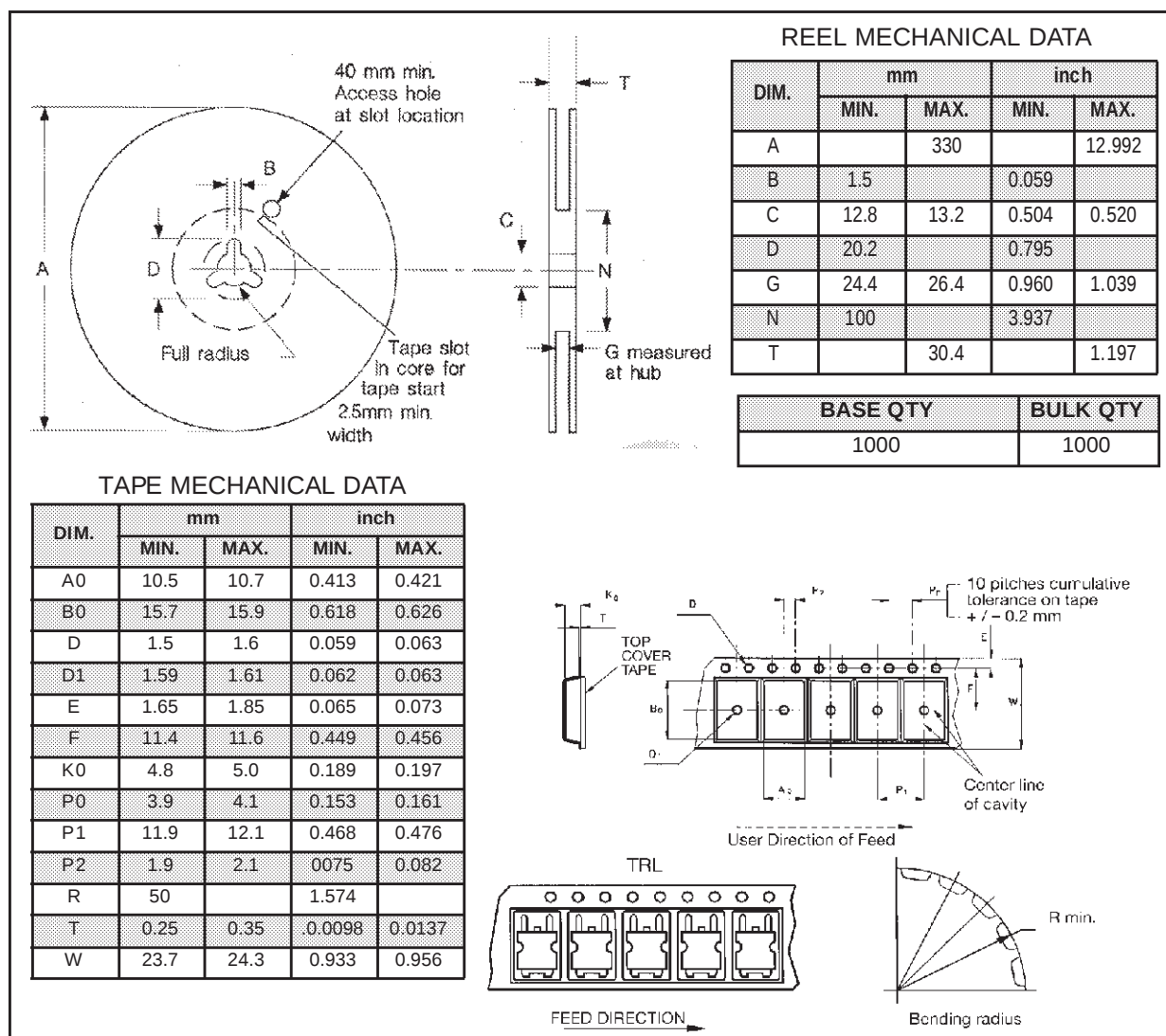
## D<sup>2</sup>PAK FOOTPRINT



**TUBE SHIPMENT (no suffix)\***



### TAPE AND REEL SHIPMENT (suffix "T4")\*



\* on sales type

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