



# STB20PF75

## P-CHANNEL 75V - 0.10 $\Omega$ - 20A D<sup>2</sup>PAK STripFET™ II POWER MOSFET

| TYPE      | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|-----------|------------------|---------------------|----------------|
| STB20PF75 | 75 V             | < 0.12 $\Omega$     | 20 A           |

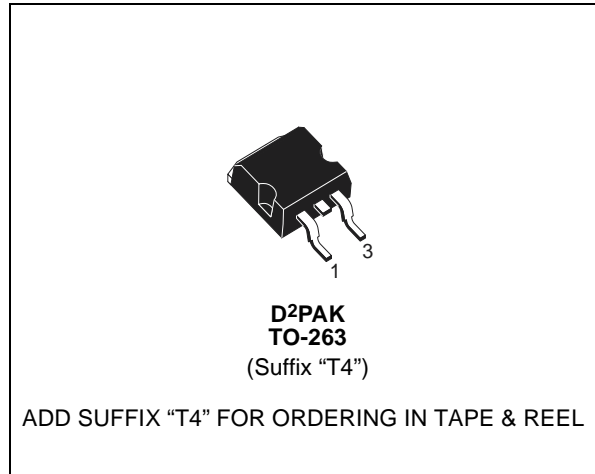
- TYPICAL R<sub>DS(on)</sub> = 0.10  $\Omega$
- EXCEPTIONAL dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- APPLICATION ORIENTED CHARACTERIZATION

### DESCRIPTION

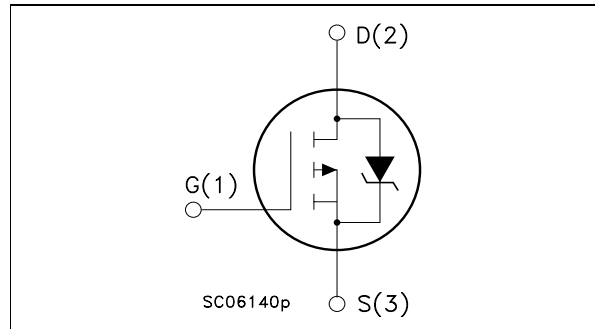
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing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

### APPLICATIONS

- MOTOR CONTROL
- DC-DC & DC-AC CONVERTERS



### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter   | Value      | Unit |
|---------------------|---|------------|------|
| 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> = 20 k $\Omega$ ) | 75         | V    |
| V <sub>GS</sub>     | Gate- source Voltage                                  | $\pm$ 20   | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 25°C   | 20         | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 100°C  | 14         | A    |
| I <sub>DM</sub> (*) | Drain Current (pulsed)                                | 80         | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>C</sub> = 25°C            | 80         | W    |
|                     | Derating Factor                                       | 0.53       | W/°C |
| dv/dt (1)           | Peak Diode Recovery voltage slope                     | 10         | V/ns |
| E <sub>AS</sub> (2) | Single Pulse Avalanche Energy                         | 350        | mJ   |
| T <sub>stg</sub>    | Storage Temperature                                   | -55 to 175 | °C   |
| T <sub>j</sub>      | Operating Junction Temperature                        |            |      |

(\*) Pulse width limited by safe operating area  
(1) I<sub>SD</sub>  $\leq$  20A, di/dt  $\leq$  200A/ $\mu$ s, V<sub>DD</sub>  $\leq$  V<sub>(BR)DSS</sub>, T<sub>j</sub>  $\leq$  T<sub>JMAX</sub>  
(2) Starting T<sub>j</sub> = 25 °C, I<sub>D</sub> = 10 A, V<sub>DD</sub> = 30V

Note: For the P-CHANNEL MOSFET actual polarity of voltages and current has to be reversed

## STB20PF75

### THERMAL DATA

|                |  |     |      |      |
|----------------|--|-----|------|------|
| Rthj-case      | Thermal Resistance Junction-case   | Max | 1.88 | °C/W |
| Rthj-PCB       | Thermal Resistance Junction-PCB  | Max | 34   | °C/W |
| T <sub>l</sub> | Maximum Lead Temperature For Soldering Purpose<br>(1.6 mm from case, for 10 sec) | Typ | 300  | °C   |

(\*) When Mounted on 1 inch<sup>2</sup> FR-4 board, 2 oz of Cu

### 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  | 75   |      |         | 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> = ± 20 V  |      |      | ±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 | 2    | 3    | 4    | V    |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10 V I <sub>D</sub> = 10 A              |      | 0.10 | 0.12 | Ω    |

#### DYNAMIC

| Symbol           | Parameter                    | Test Conditions                                       | Min. | Typ. | Max. | Unit |
|------------------|------------------------------|---|------|------|------|------|
| g <sub>fs</sub>  | Forward Transconductance     | V <sub>DS</sub> = 15 V I <sub>D</sub> = 10 A          |      | 15   |      | S    |
| C <sub>iss</sub> | Input Capacitance            | V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0 |      | 1150 |      | pF   |
| C <sub>oss</sub> | Output Capacitance           |   |      | 170  |      | pF   |
| C <sub>rss</sub> | Reverse Transfer Capacitance |   |      | 70   |      | 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                              | $V_{DD} = 37.5\text{ V}$ $I_D = 10\text{ A}$<br>$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$<br>(Resistive Load, Figure 1) |      | 20<br>51      |      | ns<br>ns       |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD}=60\text{V}$ $I_D=20\text{A}$ $V_{GS}=10\text{V}$<br>(See test circuit, Figure 2)                                 |      | 38<br>7<br>10 | 52   | 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 | $V_{DD} = 60\text{ V}$ $I_D = 10\text{ A}$<br>$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$<br>(Resistive Load, Figure 1) |      | 40<br>13 |      | ns<br>ns |

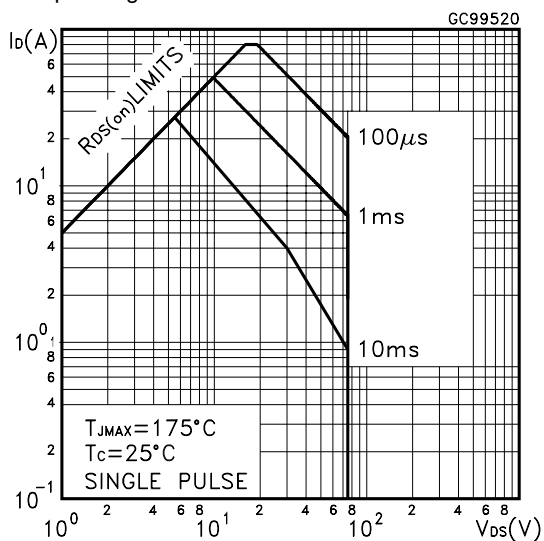
SOURCE DRAIN DIODE (\*)

| Symbol                            | Parameter  | Test Conditions  | Min. | Typ.             | Max.     | Unit          |
|-----------------------------------|--|--|------|------------------|----------|---------------|
| $I_{SD}$<br>$I_{SDM}$ (*)         | Source-drain Current<br>Source-drain Current (pulsed)                        |  |      |                  | 20<br>80 | A<br>A        |
| $V_{SD}$ (*)                      | Forward On Voltage   | $I_{SD} = 20\text{ A}$ $V_{GS} = 0$  |      |                  | 1.3      | V             |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD} = 20\text{ A}$ $di/dt = 100\text{A}/\mu\text{s}$<br>$V_{DD} = 25\text{ V}$ $T_j = 150^\circ\text{C}$<br>(see test circuit, Figure 3) |      | 80<br>250<br>6.2 |          | ns<br>nC<br>A |

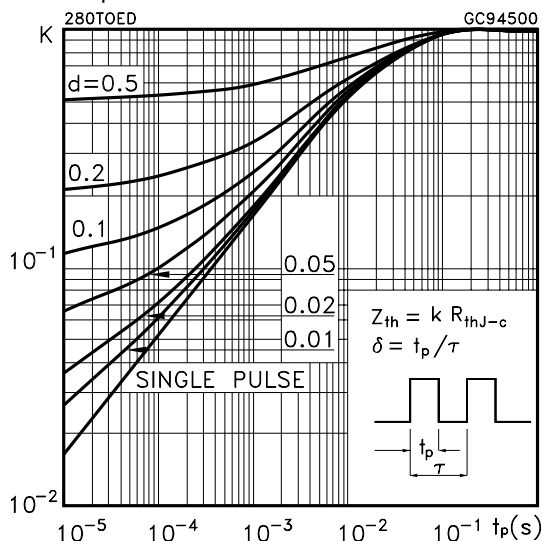
(\*) Pulse width  $\leq 300\ \mu\text{s}$ , duty cycle 1.5 %.

(\*) Pulse width limited by  $T_{JMAX}$

Safe Operating Area

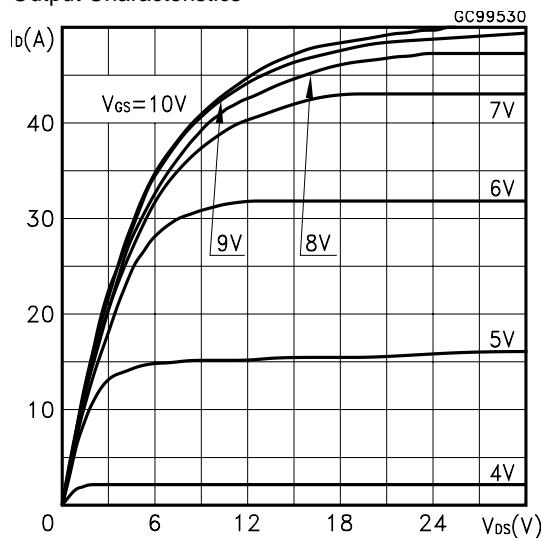


Thermal Impedance

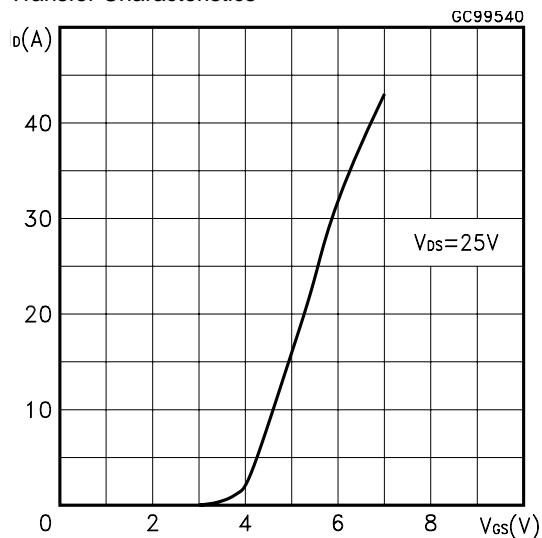


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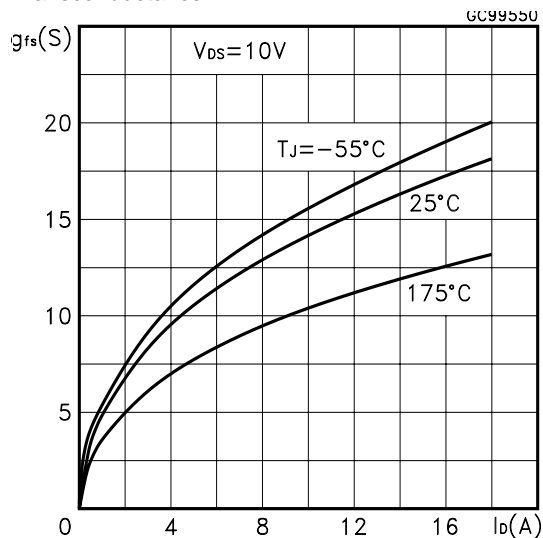
Output Characteristics



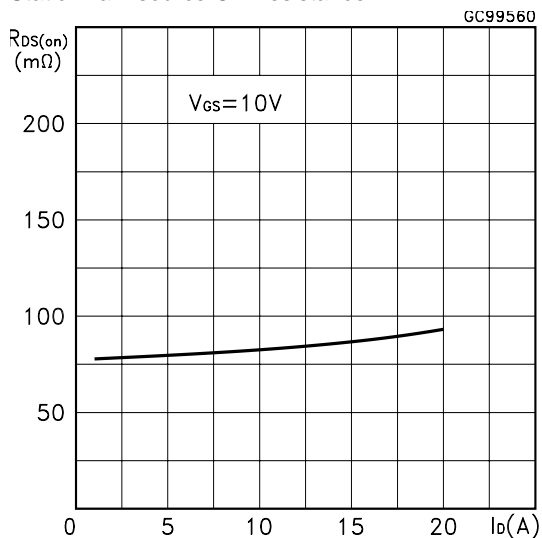
Transfer Characteristics



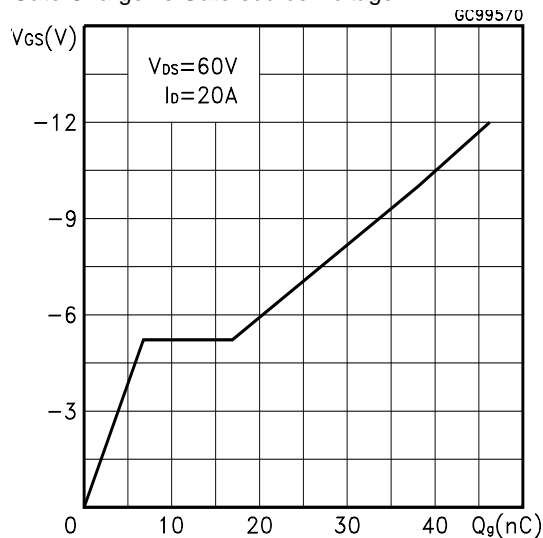
Transconductance



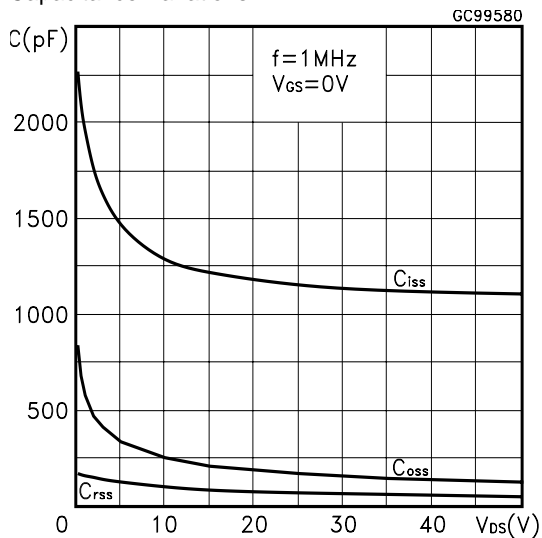
Static Drain-source On Resistance



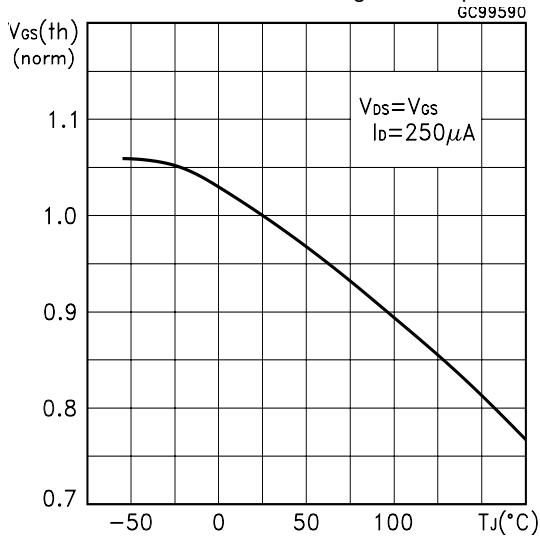
Gate Charge vs Gate-source Voltage



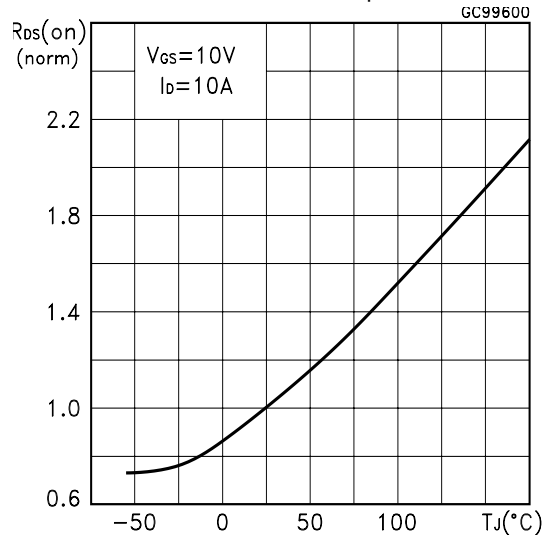
Capacitance Variations



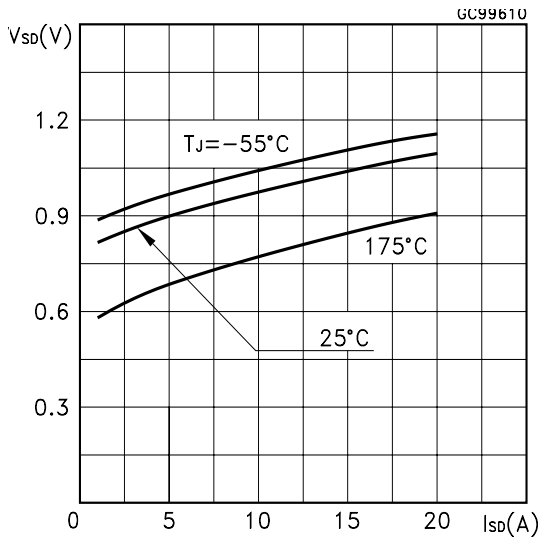
Normalized Gate Threshold Voltage vs Temperature



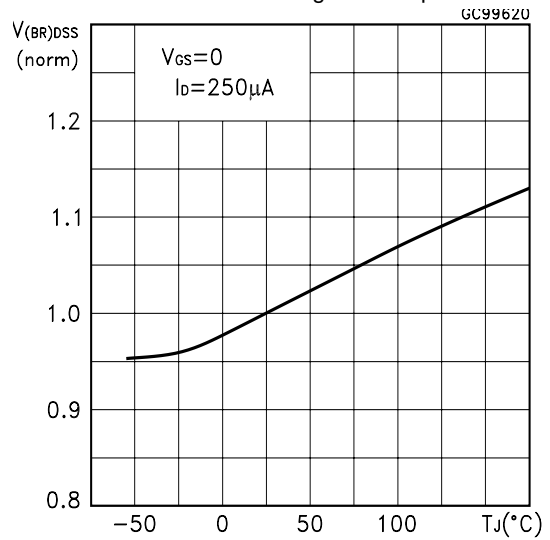
Normalized on Resistance vs Temperature



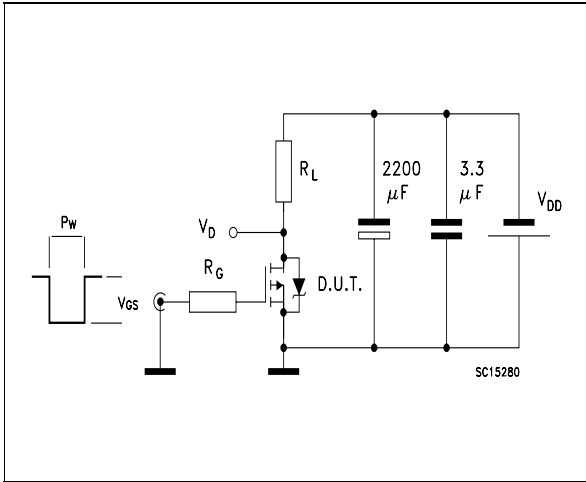
Source-drain Diode Forward Characteristics



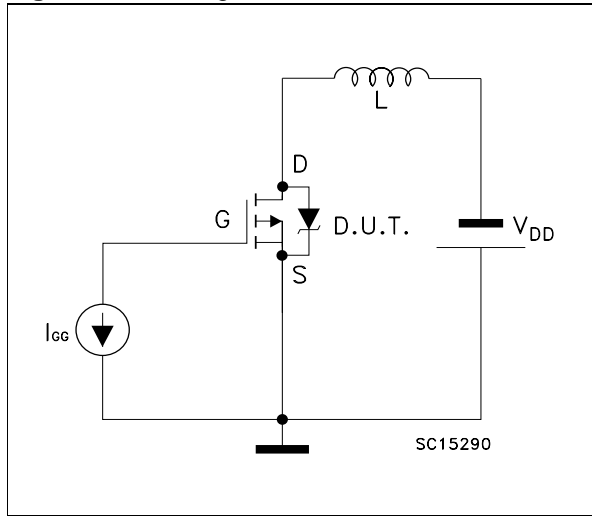
Normalized Breakdown Voltage vs Temperature



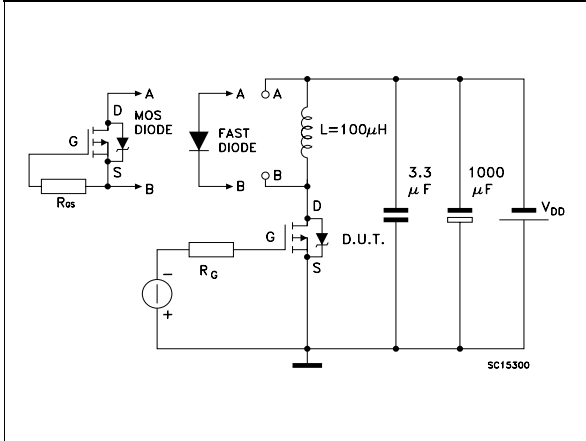
**Fig. 1: Switching Times Test Circuits For Resistive Load**



**Fig. 2: Gate Charge test Circuit**

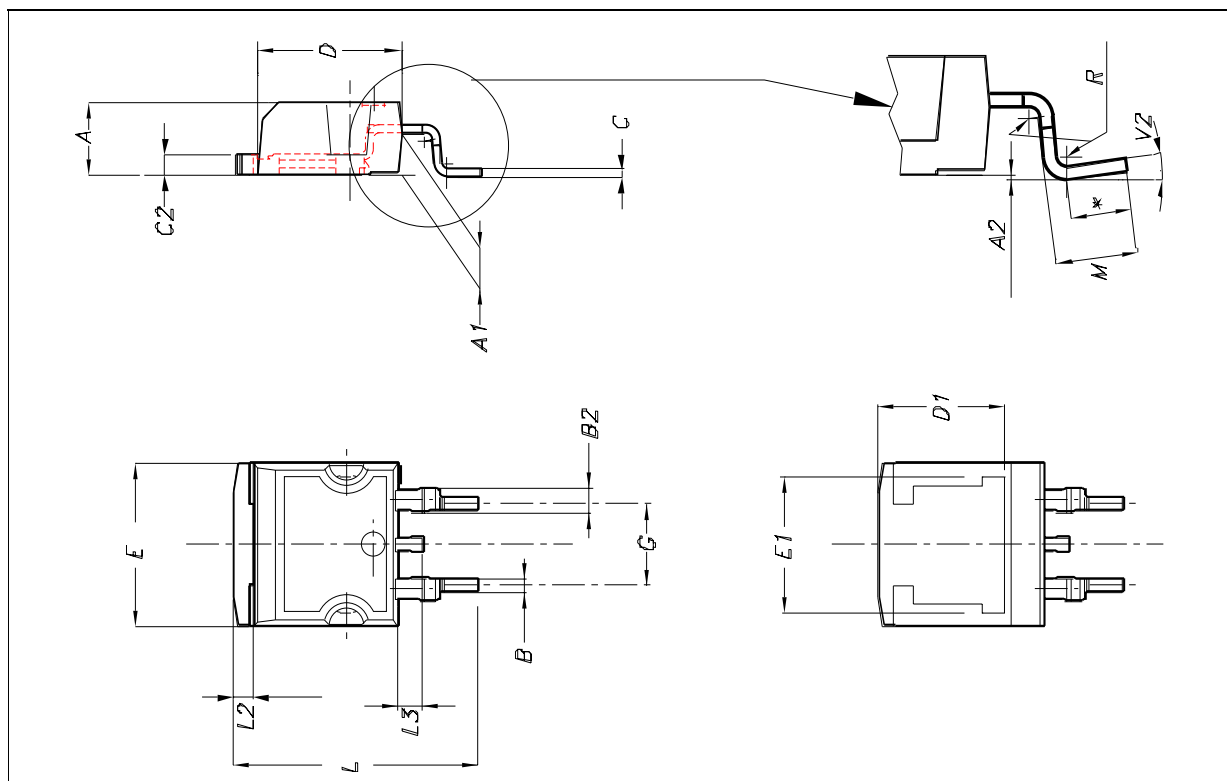


**Fig. 3: Test Circuit For Diode Recovery Behaviour**

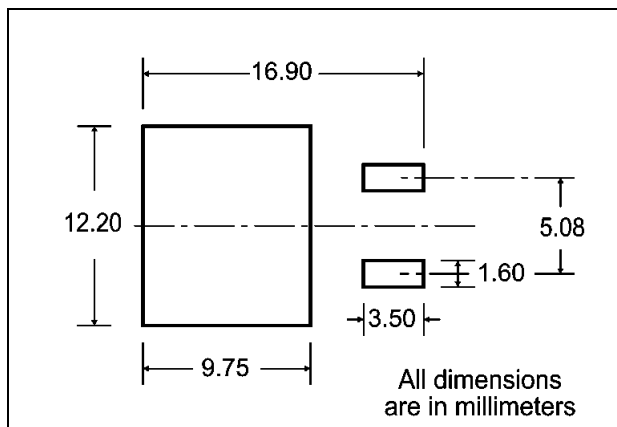


D<sup>2</sup>PAK MECHANICAL DATA

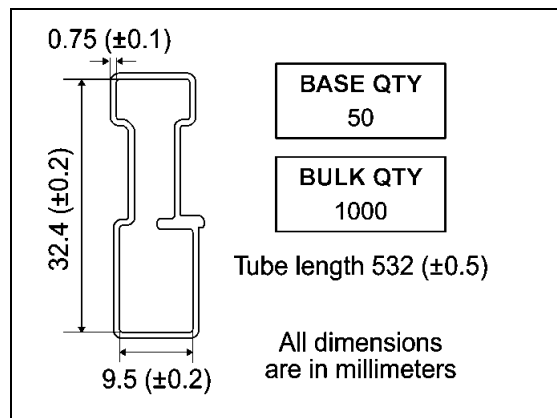
| DIM. | mm.  |      |       | inch. |       |       |
|------|------|------|-------|-------|-------|-------|
|      | MIN. | TYP. | MAX.  | MIN.  | TYP.  | TYP.  |
| A    | 4.4  |      | 4.6   | 0.173 |       | 0.181 |
| A1   | 2.49 |      | 2.69  | 0.098 |       | 0.106 |
| A2   | 0.03 |      | 0.23  | 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  |       |       | 0.015 |       |
| V2   | 0°   |      | 8°    | 0°    |       | 8°    |



**D2PAK FOOTPRINT**



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



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

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

G measured at hub

**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  |

|                 |      |
|-----------------|------|
| <b>BASE QTY</b> | 1000 |
| <b>BULK QTY</b> | 1000 |

**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  |

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

User Direction of Feed

FEED DIRECTION

Bending radius R min.

\* on sales type



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