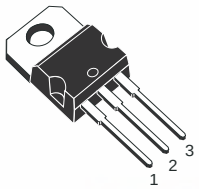
# STP62NS04Z

## N-CHANNEL CLAMPED 12.5mΩ - 62A TO-220
## FULLY PROTECTED MESH OVERLAY™ MOSFET

| TYPE | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STP62NS04Z | CLAMPED | <0.015 Ω | 62 A |

- TYPICAL $R_{DS}$(on) = 0.0125 Ω
- 100% AVALANCHE TESTED
- LOW CAPACITANCE AND GATE CHARGE
- 175 ºC MAXIMUM JUNCTION TEMPERATURE




**TO-220**

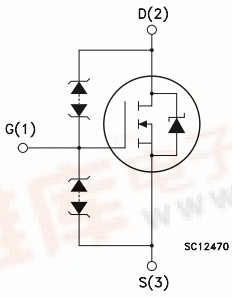
### DESCRIPTION

This fully clamped Mosfet is produced by using the latest advanced Company's Mesh Overlay process which is based on a novel strip layout.
The inherent benefits of the new technology coupled with the extra clamping capabilities make this product particularly suitable for the harshest operation conditions such as those encountered in the automotive environment. Any other application requiring extra ruggedness is also recommended.

### APPLICATIONS

- ABS, SOLENOID DRIVERS
- POWER TOOLS

### INTERNAL SCHEMATIC DIAGRAM




### Ordering Information

| SALES TYPE | MARKING | PACKAGE | PACKAGING |
|---|---|---|---|
| STP62NS04Z | P62NS04Z | TO-220 | TUBE |

### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source Voltage ($V_{GS}$ = 0) | CLAMPED | V |
| $V_{DG}$ | Drain-gate Voltage | CLAMPED | V |
| $V_{GS}$ | Gate- source Voltage | CLAMPED | V |
| $I_D$ | Drain Current (continuous) at $T_C$ = 25°C | 62 | A |
| $I_D$ | Drain Current (continuous) at $T_C$ = 100°C | 37.5 | A |
| $I_{DG}$ | Drain Gate Current (continuous) | ± 50 | mA |
| $I_{GS}$ | Gate SourceCurrent (continuous) | ± 50 | mA |
| $I_{DM}$(•) | Drain Current (pulsed) | 248 | A |
| $P_{tot}$ | Total Dissipation at $T_C$ = 25°C | 110 | W |
| | Derating Factor | 0.74 | W/°C |
| dv/dt (1) | Peak Diode Recovery voltage slope | 8 | V/ns |
| $E_{AS}$ (2) | Single Pulse Avalanche Energy | 500 | mJ |
| $V_{ESD}$ | ESD (HBM - C = 100pF, R=1.5 kΩ) | 8 | kV |
| $T_{stg}$ | Storage Temperature | -55 to 175 | °C |
| $T_j$ | Operating Junction Temperature | | |

(•) Pulse width limited by safe operating area.

(1) $I_{SD}$ ≤40A, di/dt ≤100A/µs, $V_{DD}$ ≤ $V_{(BR)DSS}$, $T_j$ ≤ $T_{JMAX}$
(2) Starting $T_j$ = 25 ºC, $I_D$ = 20A, $V_{DD}$= 20V

## THERMAL DATA

| | | | | |
|---|---|---|---|---|
| Rthj-case<br>Rthj-amb<br>$T_l$ | Thermal Resistance Junction-case<br>Thermal Resistance Junction-ambient<br>Maximum Lead Temperature For Soldering Purpose (for 10 sec., 1.6mm from case) | Max<br>Max | 1.36<br>62.5<br>300 | °C/W<br>°C/W<br>°C |

## ELECTRICAL CHARACTERISTICS ($T_{case}$ = 25 °C unless otherwise specified)

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Clamped Voltage | $I_D$ = 1 mA, $V_{GS}$ = 0 | 33 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current ($V_{GS}$ = 0) | $V_{DS}$ = 16 V | | | 10 | µA |
| $I_{GSS}$ | Gate-body Leakage Current ($V_{DS}$ = 0) | $V_{GS}$ = ± 10 V | | | 10 | µA |
| $V_{GSS}$ | Gate-Source Breakdown Voltage | $I_{GS}$ = 100 µA | 18 | | | V |

ON (*)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$ $I_D$ = 250 µA | 2 | | 4 | V |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS}$ = 10 V $I_D$ = 30 A | | 12.5 | 15 | mΩ |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (*) | Forward Transconductance | $V_{DS}$ = 15 V $I_D$=30A | | 20 | | S |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | $V_{DS}$ = 25V, f = 1 MHz, $V_{GS}$ = 0 | | 1330<br>420<br>135 | | 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 | $V_{DD}$ = 20 V $I_D$ = 20 A<br>$R_G$ = 4.7 Ω $V_{GS}$ = 10 V<br>(Resistive Load, Figure 3) | | 13<br>104 | | ns<br>ns |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD}$= 20 V $I_D$= 40 A $V_{GS}$= 10V | | 34<br>10<br>11.5 | 47 | nC<br>nC<br>nC |

SWITCHING OFF

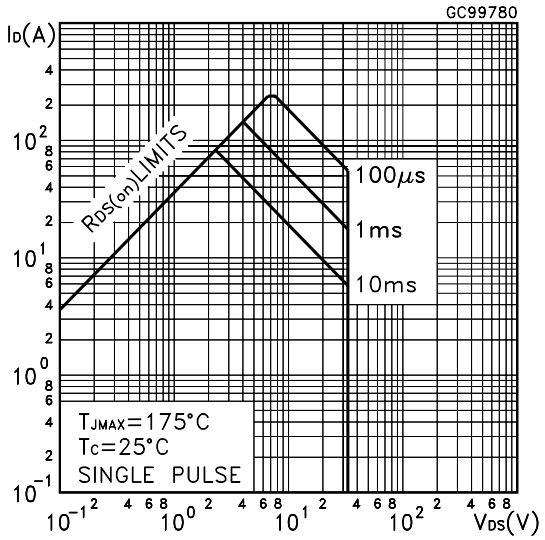
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(off)}$<br>$t_f$ | Turn-off Delay Time<br>Fall Time | $V_{DD}$ = 20 V $I_D$ = 20 A<br>$R_G$ = 4.7 Ω $V_{GS}$ = 10 V<br>(Resistive Load, Figure 3) | | 41<br>42 | | ns<br>ns |
| $t_{r(Voff)}$<br>$t_f$<br>$t_c$ | Off-voltage Rise Time<br>Fall Time<br>Cross-over Time | $V_{clamp}$ = 30 V $I_D$ = 40 A<br>$R_G$ = 4.7Ω, $V_{GS}$ = 10 V<br>(Inductive Load, Figure 5) | | 30<br>54<br>90 | | ns<br>ns<br>ns |

SOURCE DRAIN DIODE

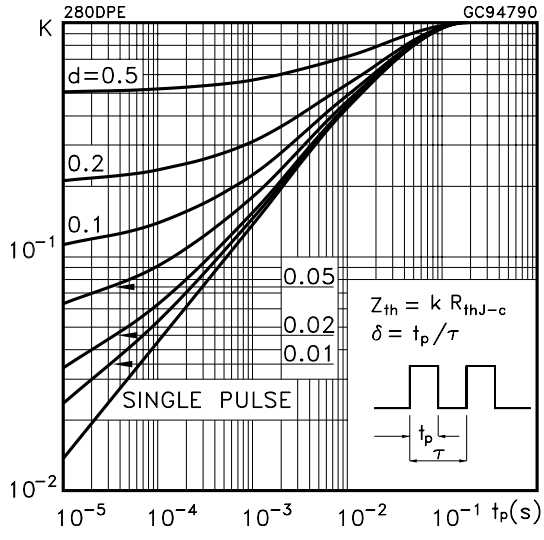
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$<br>$I_{SDM}$ (•) | Source-drain Current<br>Source-drain Current (pulsed) | | | | 62<br>248 | A<br>A |
| $V_{SD}$ (*) | Forward On Voltage | $I_{SD}$ = 62 A $V_{GS}$ = 0 | | | 1.5 | V |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD}$ = 40 A di/dt = 100A/µs<br>$V_{DD}$ = 20 V $T_j$ = 150°C<br>(see test circuit, Figure 5) | | 45<br>65<br>2.9 | | ns<br>nC<br>A |

(*)Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
(•)Pulse width limited by safe operating area.

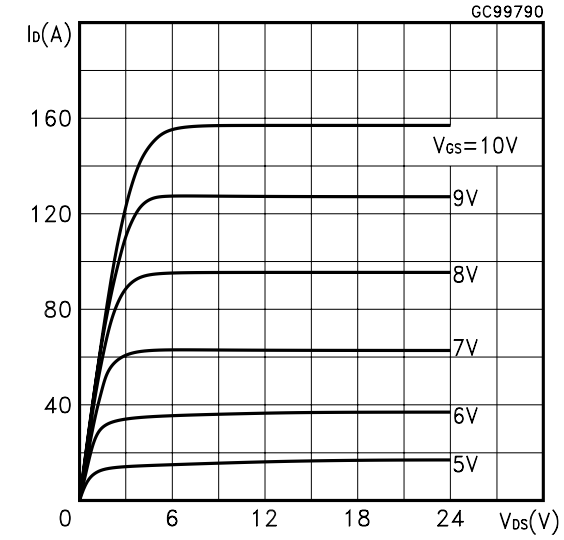
Safe Operating Area



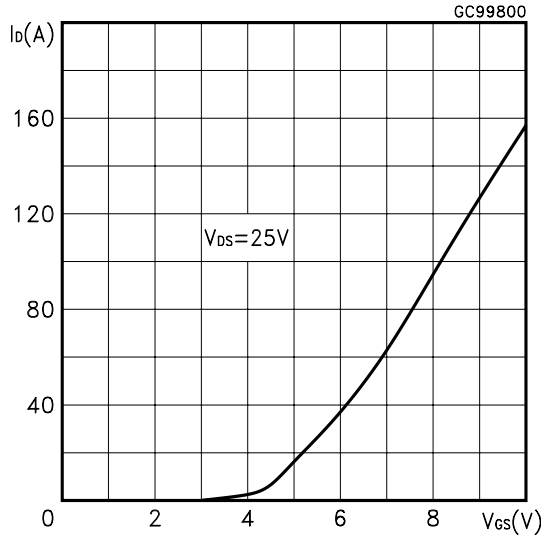

Thermal Impedance



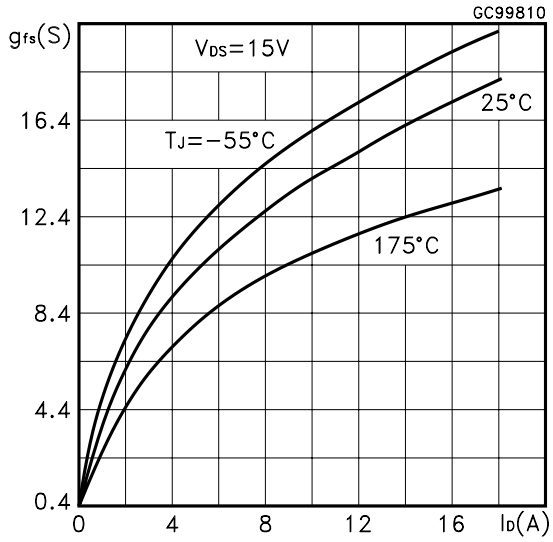
Output Characteristics



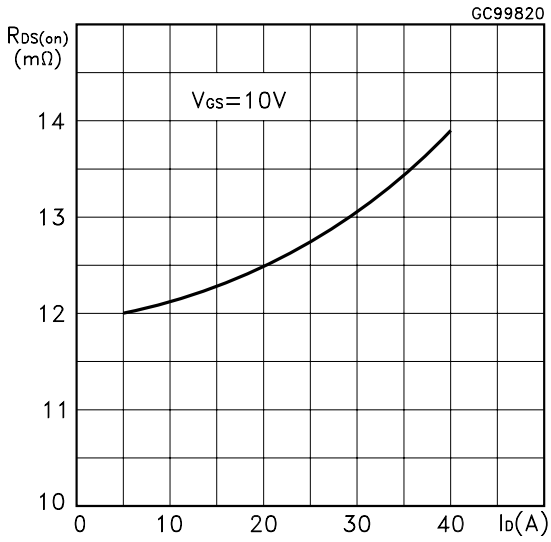

Transfer Characteristics



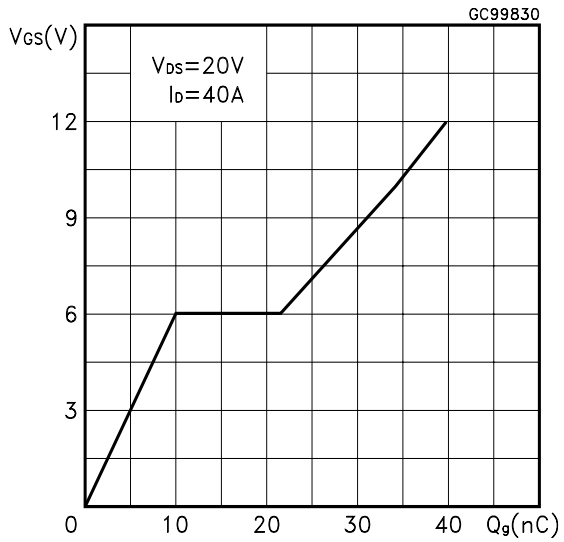

Transconductance



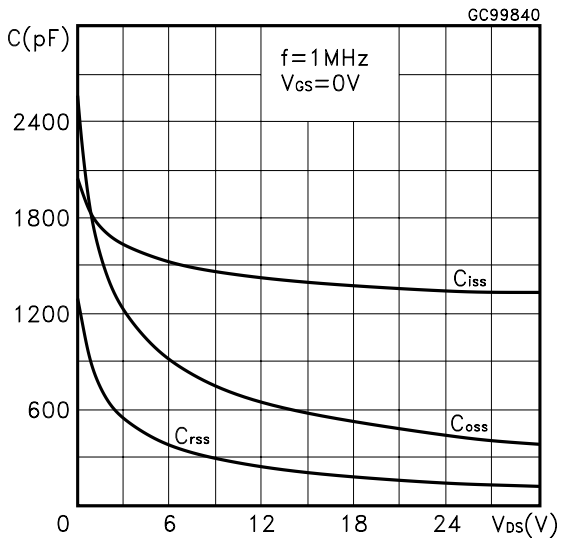

Static Drain-source On Resistance



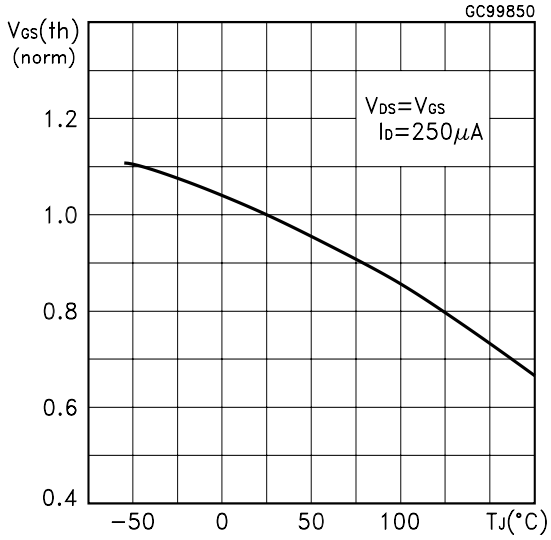

Gate Charge vs Gate-source Voltage



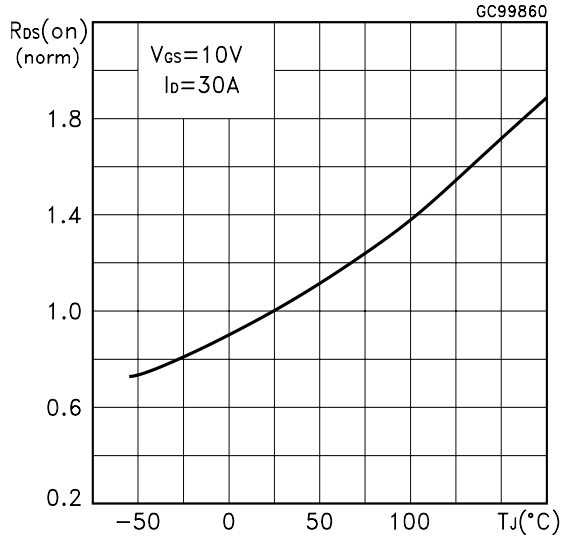

Capacitance Variations



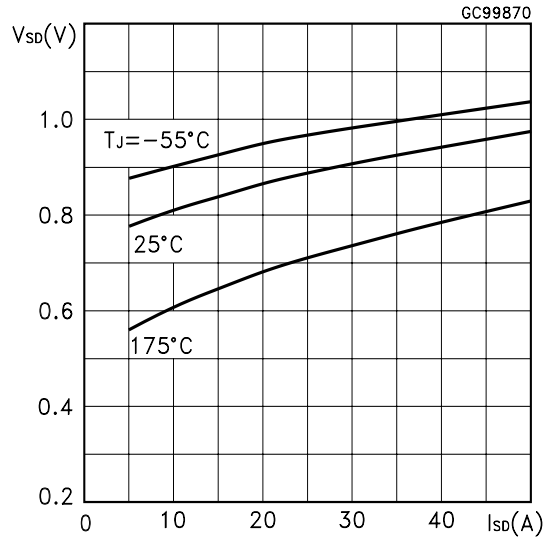
Normalized Gate Threshold Voltage vs Temperature




Normalized on Resistance vs Temperature




Source-drain Diode Forward Characteristics

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Normalized Breakdown Voltage Temperature.

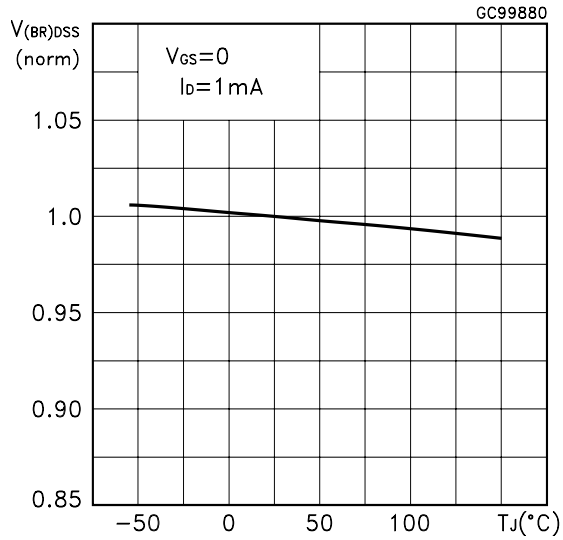


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**Fig. 1:** Unclamped Inductive Load Test Circuit

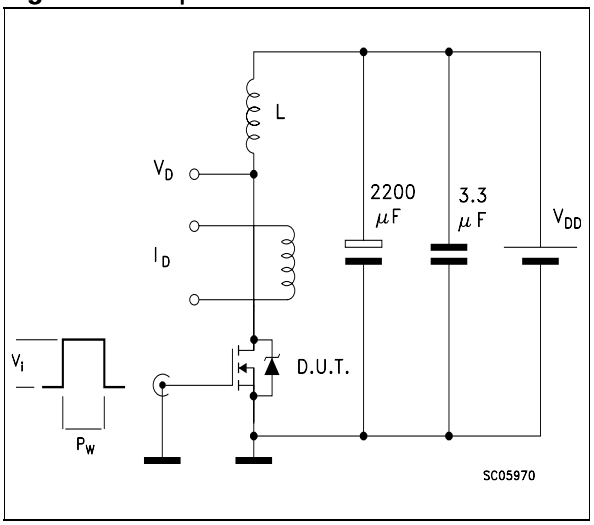



**Fig. 2:** Unclamped Inductive Waveform

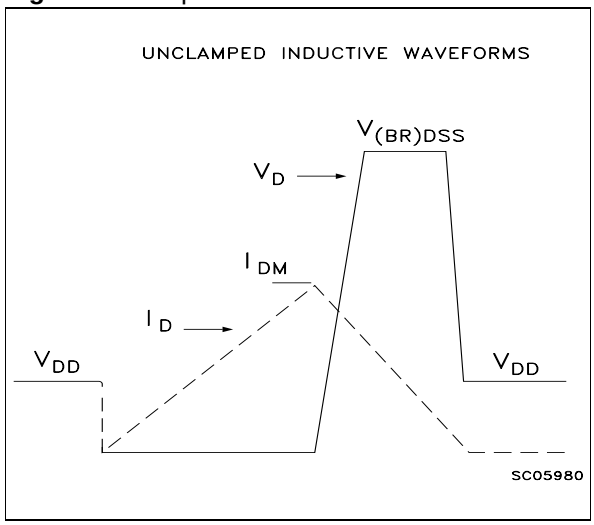



**Fig. 3:** Switching Times Test Circuits For Resistive Load

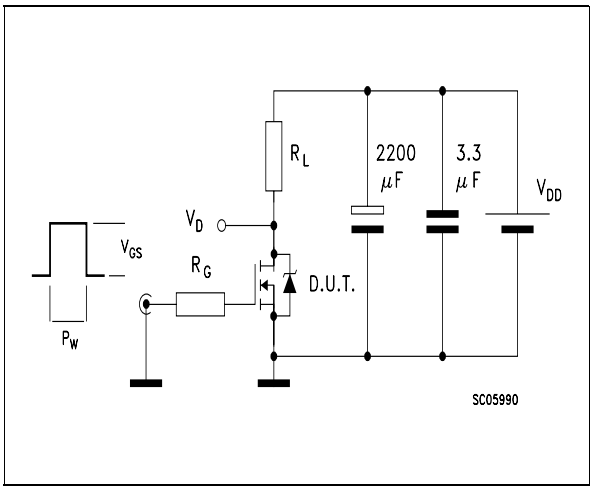



**Fig. 4:** Gate Charge test Circuit

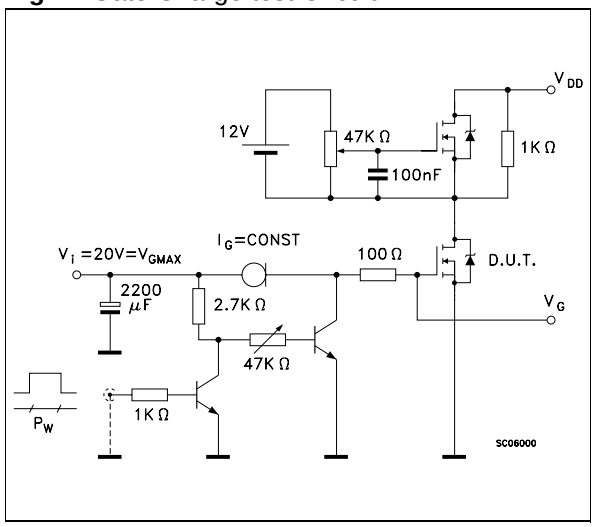
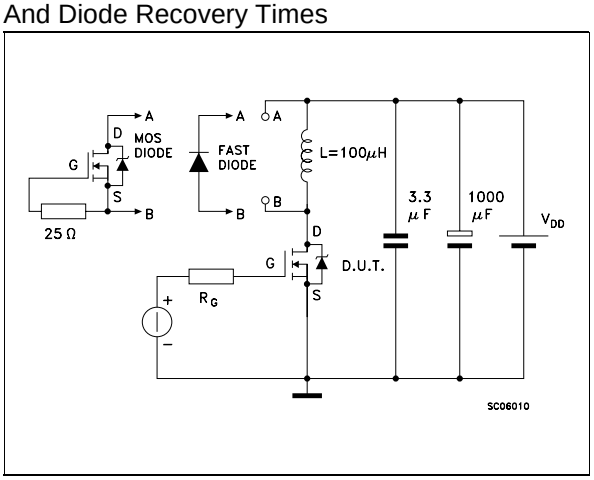



**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Recovery Times



## TO-220 MECHANICAL DATA

| DIM. | mm. | | | inch. | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | TYP. |
| A | 4.4 | | 4.6 | 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 | 2.40 | | 2.70 | 0.094 | | 0.106 |
| H2 | 10 | | 10.40 | 0.393 | | 0.409 |
| L2 | 16.10 | 16.40 | 16.73 | 0.633 | 0.645 | 0.658 |
| L4 | 13 | | 14 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.20 | | 6.60 | 0.244 | | 0.260 |
| L9 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| DIA | 3.75 | | 3.85 | 0.147 | | 0.151 |