



# STP80NF55L-06

## N - CHANNEL 55V - 0.005 Ω - 80A TO-220 STripFET™ POWER MOSFET

| TYPE          | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|---------------|------------------|---------------------|----------------|
| STP80NF55L-06 | 55 V             | < 0.0065 Ω          | 80 A           |

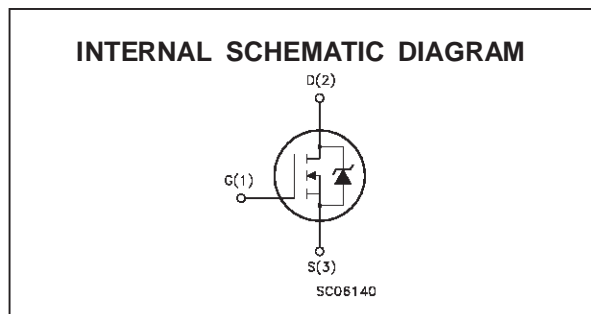
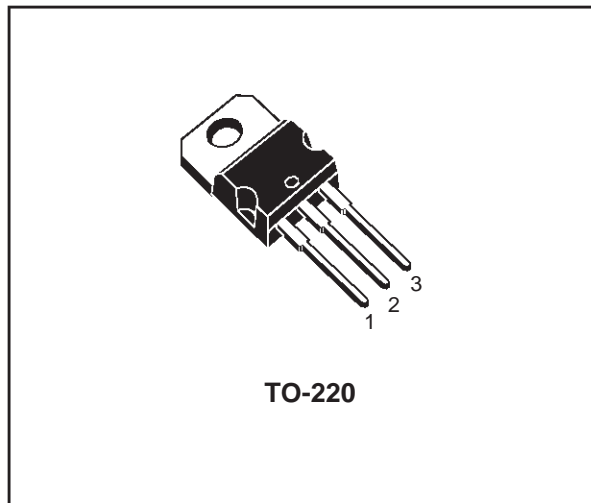
- TYPICAL R<sub>DS(on)</sub> = 0.005 Ω
- LOW THRESHOLD DRIVE
- LOGIC LEVEL DEVICE

### 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

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- DC-DC & DC-AC CONVERTERS



### ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter   | Value      | Unit |
|---------------------|---|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)            | 55         | V    |
| V <sub>DGR</sub>    | Drain- gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 55         | V    |
| V <sub>GS</sub>     | Gate-source Voltage                                   | ± 20       | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 25 °C  | 80         | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 100 °C | 57         | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                                | 320        | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>c</sub> = 25 °C           | 210        | W    |
|                     | Derating Factor                                       | 1.4        | W/°C |
| E <sub>AS</sub> (1) | Single Pulse Avalanche Energy                         | 1          | J    |
| T <sub>stg</sub>    | Storage Temperature                                   | -65 to 175 | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                   | 175        | °C   |

(●) Pulse width limited by safe operating area

(1) starting T<sub>j</sub> = 25 °C, I<sub>D</sub> = 40A, V<sub>DD</sub> = 30V

## STP80NF55L-06

### THERMAL DATA

|                |  |     |      |               |
|----------------|--|-----|------|---------------|
| $R_{thj-case}$ | Thermal Resistance Junction-case               | Max | 0.71 | $^{\circ}C/W$ |
| $R_{thj-amb}$  | Thermal Resistance Junction-ambient            | Max | 62.5 | $^{\circ}C/W$ |
| $T_l$          | Maximum Lead Temperature For Soldering Purpose |     | 300  | $^{\circ}C$   |

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

OFF

| Symbol        | Parameter  | Test Conditions   | Min. | Typ. | Max.      | Unit               |
|---------------|--|---|------|------|-----------|--------------------|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage                   | $I_D = 250 \mu A$ $V_{GS} = 0$  | 55   |      |           | V                  |
| $I_{DSS}$     | Zero Gate Voltage Drain Current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max Rating}$<br>$V_{DS} = \text{Max Rating}$ $T_c = 125^{\circ}C$ |      |      | 1<br>10   | $\mu A$<br>$\mu A$ |
| $I_{GSS}$     | Gate-body Leakage Current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 20 V$   |      |      | $\pm 100$ | nA                 |

ON (\*)

| Symbol       | Parameter                         | Test Conditions  | Min. | Typ.            | Max.            | Unit                 |
|--------------|-----------------------------------|--|------|-----------------|-----------------|----------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{DS} = V_{GS}$ $I_D = 250 \mu A$                          | 1    | 1.6             | 2.5             | V                    |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS} = 10 V$ $I_D = 40 A$<br>$V_{GS} = 5 V$ $I_D = 40 A$  |      | 0.005<br>0.0055 | 0.0065<br>0.008 | $\Omega$<br>$\Omega$ |
| $I_{D(on)}$  | On State Drain Current            | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$<br>$V_{GS} = 10 V$ | 80   |                 |                 | A                    |

DYNAMIC

| Symbol       | Parameter                    | Test Conditions  | Min. | Typ. | Max. | Unit |
|--------------|------------------------------|--|------|------|------|------|
| $g_{fs} (*)$ | Forward Transconductance     | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 18 A$ |      | 20   |      | S    |
| $C_{iss}$    | Input Capacitance            | $V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$               |      | 7600 |      | pF   |
| $C_{oss}$    | Output Capacitance           |  |      | 990  |      | pF   |
| $C_{rss}$    | Reverse Transfer Capacitance |  |      | 270  |      | pF   |

**ELECTRICAL CHARACTERISTICS** (continued)

**SWITCHING ON**

| Symbol      | Parameter          | Test Conditions   | Min. | Typ. | Max. | Unit |
|-------------|--------------------|---|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 27\text{ V}$ $I_D = 40\text{ A}$<br>$R_G = 4.7\ \Omega$ $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, see fig. 3) |      | 75   |      | ns   |
| $t_r$       | Rise Time          |   |      | 300  |      | ns   |
| $Q_g$       | Total Gate Charge  | $V_{DD} = 44\text{ V}$ $I_D = 80\text{ A}$ $V_{GS} = 5\text{ V}$  |      | 97   | 100  | nC   |
| $Q_{gs}$    | Gate-Source Charge |   |      | 25   |      | nC   |
| $Q_{gd}$    | Gate-Drain Charge  |   |      | 46   |      | nC   |

**SWITCHING OFF**

| Symbol       | Parameter             | Test Conditions  | Min. | Typ. | Max. | Unit |
|--------------|-----------------------|--|------|------|------|------|
| $t_{d(off)}$ | Turn-off Delay Time   | $V_{DD} = 27\text{ V}$ $I_D = 40\text{ A}$<br>$R_G = 4.7\ \Omega$ $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, see fig. 3)    |      | 210  |      | ns   |
| $t_f$        | Fall Time             |  |      | 160  |      | ns   |
| $t_{d(off)}$ | Off-voltage Rise Time | $V_{clamp} = 44\text{ V}$ $I_D = 80\text{ A}$<br>$R_G = 4.7\ \Omega$ $V_{GS} = 4.5\text{ V}$<br>(Inductive Load, see fig. 5) |      | 90   |      | ns   |
| $t_f$        | Fall Time             |  |      | 230  |      | ns   |
| $t_c$        | Cross-over Time       |  |      | 350  |      | ns   |

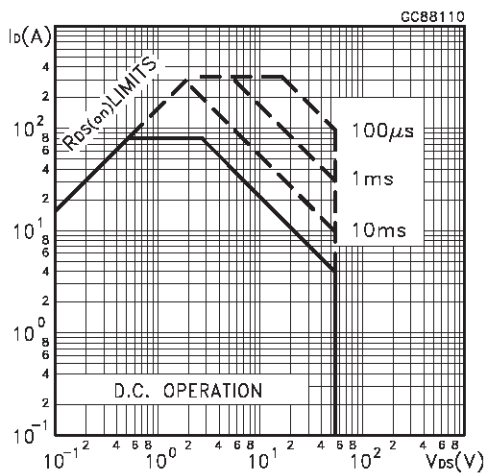
**SOURCE DRAIN DIODE**

| Symbol             | Parameter                     | Test Conditions   | Min. | Typ. | Max. | Unit |
|--------------------|-------------------------------|---|------|------|------|------|
| $I_{SD}$           | Source-drain Current          |   |      |      | 80   | A    |
| $I_{SDM}(\bullet)$ | Source-drain Current (pulsed) |   |      |      | 320  | A    |
| $V_{SD}(\ast)$     | Forward On Voltage            | $I_{SD} = 80\text{ A}$ $V_{GS} = 0$   |      |      | 1.5  | V    |
| $t_{rr}$           | Reverse Recovery Time         | $I_{SD} = 80\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 25\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$<br>(see test circuit, fig. 5) |      | 75   |      | ns   |
| $Q_{rr}$           | Reverse Recovery Charge       |   |      | 190  |      | nC   |
| $I_{RRM}$          | Reverse Recovery Current      |   |      | 5.1  |      | A    |

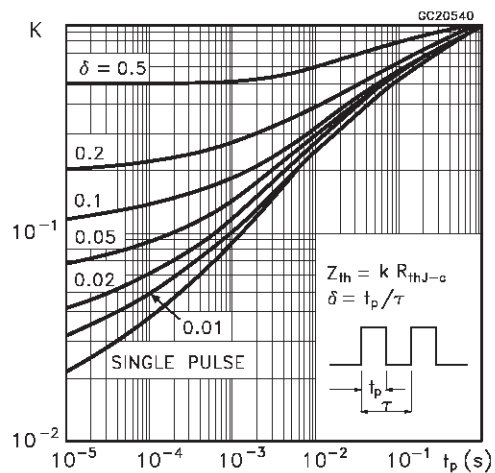
(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

(•) Pulse width limited by safe operating area

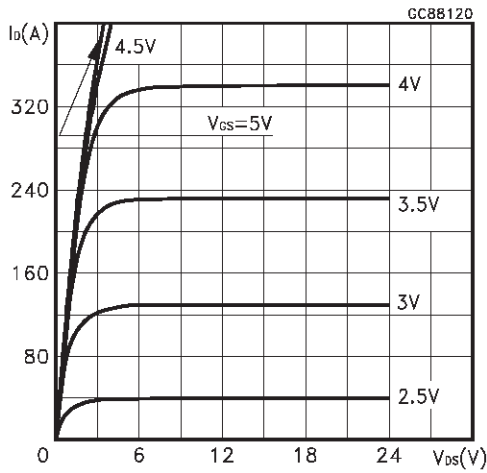
**Safe Operating Area**



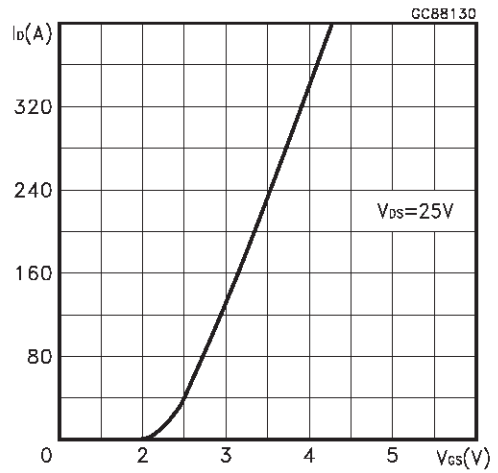
**Thermal Impedance**



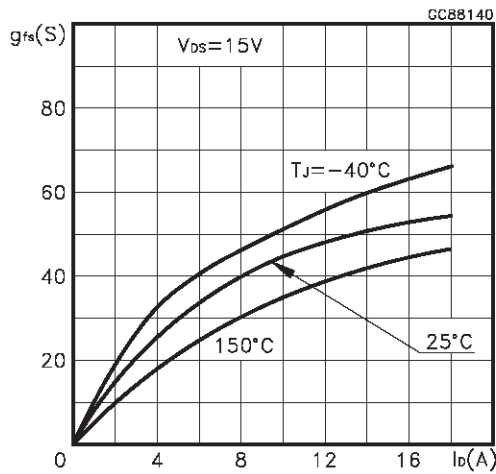
Output Characteristics



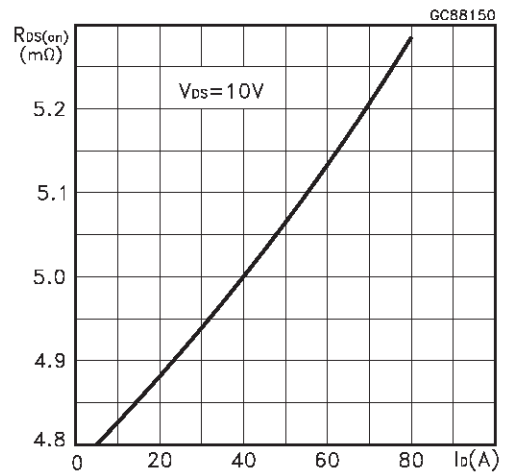
Transfer Characteristics



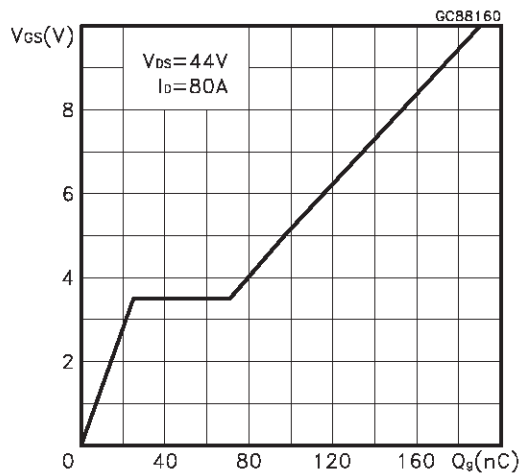
Transconductance



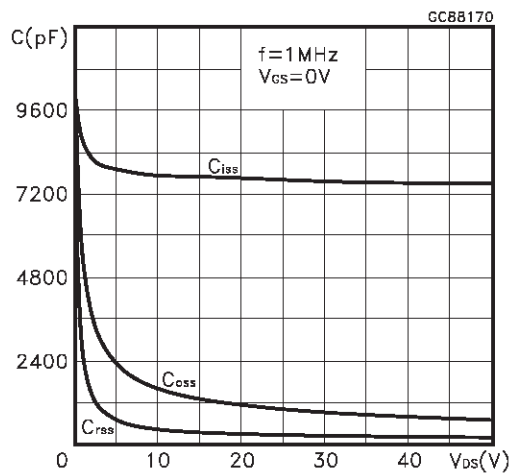
Static Drain-source On Resistance



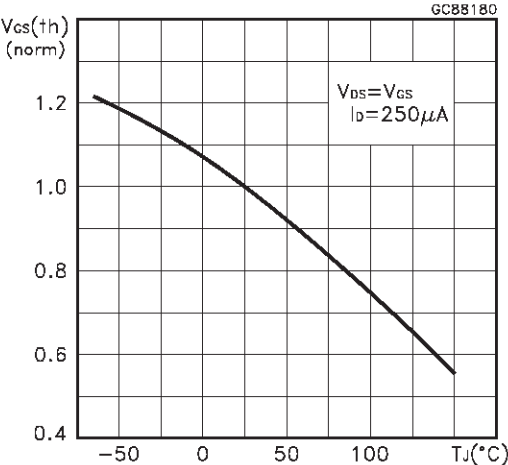
Gate Charge vs Gate-source Voltage



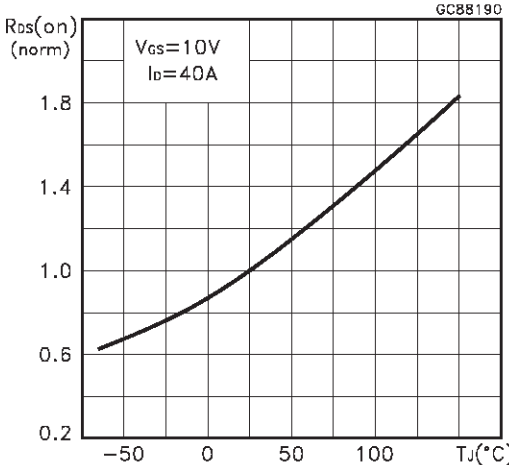
Capacitance Variations



Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

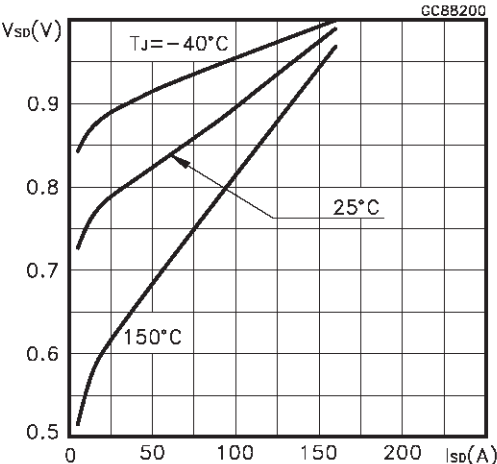


Fig. 1: Unclamped Inductive Load Test Circuit



Fig. 2: Unclamped Inductive Waveform

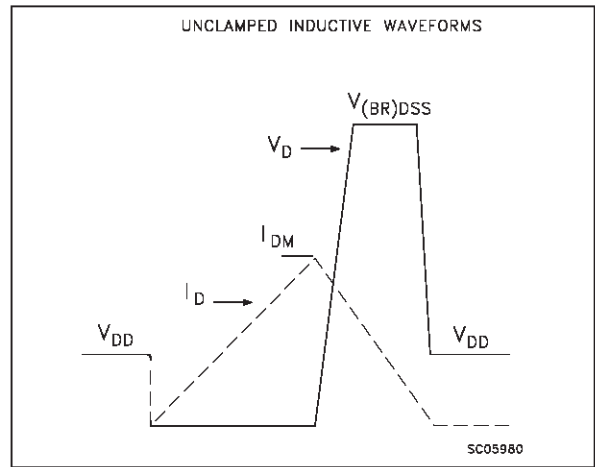


Fig. 3: Switching Times Test Circuits For Resistive Load



Fig. 4: Gate Charge test Circuit

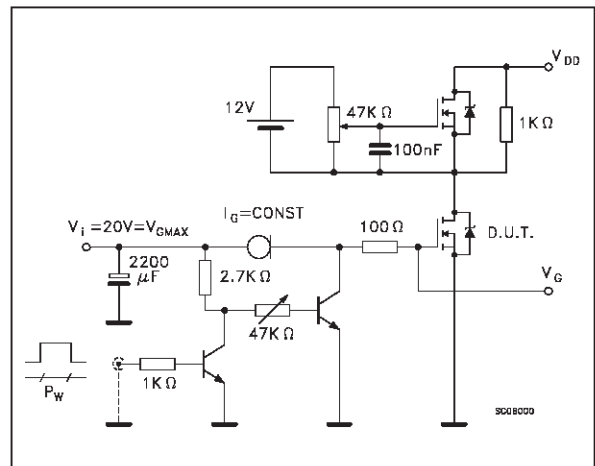
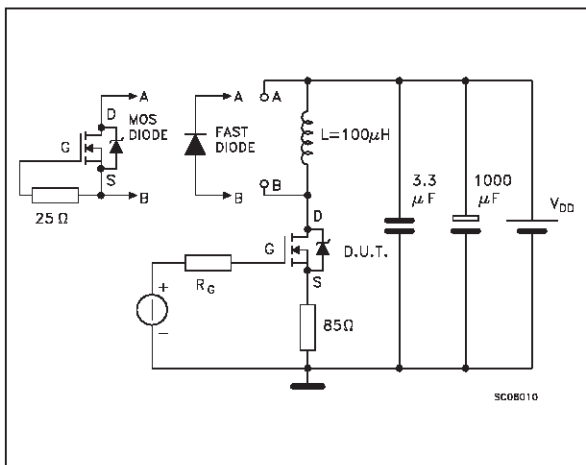
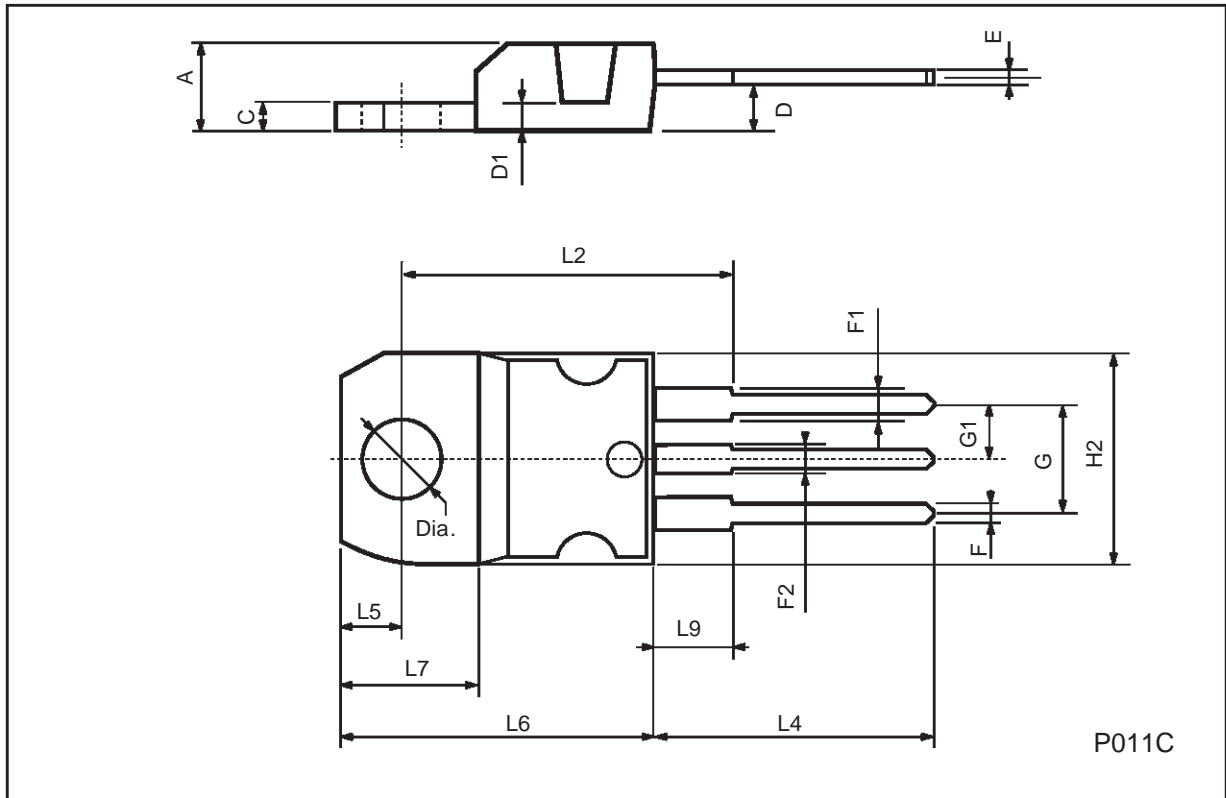


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



**TO-220 MECHANICAL DATA**

| DIM. | mm    |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | 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 |



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