



STW9NB90

N-CHANNEL 900V - 0.85Ω - 9.7A - TO-247 PowerMESH™ MOSFET

| TYPE | V _{DSS} | R _{DS(on)} | I _D |
|----------|------------------|---------------------|----------------|
| STW9NB90 | 900 V | < 1 Ω | 9.7 A |

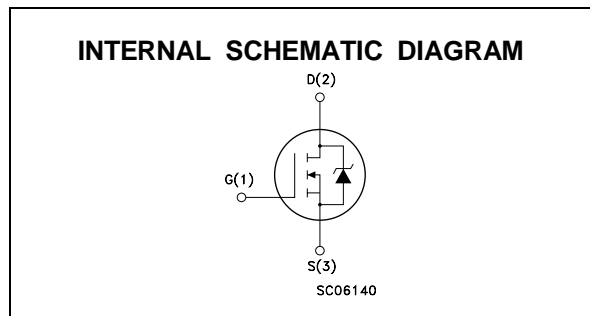
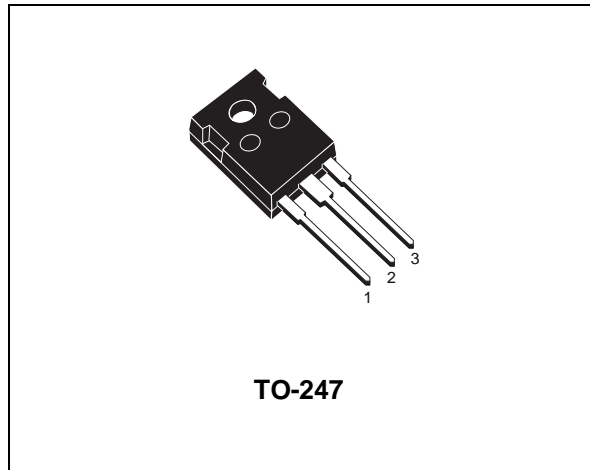
- TYPICAL R_{DS(on)} = 0.85 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- ± 30V GATE TO SOURCE VOLTAGE RATING
- 100% AVALANCHE TESTED
- VERY LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED

DESCRIPTION

Using the latest high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of power MOSFETs with outstanding performances. The new patent pending strip layout coupled with the Company's proprietary edge termination structure, gives the lowest R_{DS(on)} per area, exceptional avalanche and dv/dt capabilities and unrivalled gate charge and switching characteristics.

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---------------------|---|------------|------|
| V _{DS} | Drain-source Voltage (V _{GS} = 0) | 900 | V |
| V _{DGR} | Drain- gate Voltage (R _{GS} = 20 kΩ) | 900 | V |
| V _{GS} | Gate-source Voltage | ± 30 | V |
| I _D | Drain Current (continuous) at T _c = 25 °C | 9.7 | A |
| I _D | Drain Current (continuous) at T _c = 100 °C | 6 | A |
| I _{DM} (•) | Drain Current (pulsed) | 38 | A |
| P _{tot} | Total Dissipation at T _c = 25 °C | 190 | W |
| | Derating Factor | 1.52 | W/°C |
| dv/dt(1) | Peak Diode Recovery voltage slope | 4 | V/ns |
| T _{stg} | Storage Temperature | -65 to 150 | °C |
| T _j | Max. Operating Junction Temperature | 150 | °C |

(•) Pulse width limited by safe operating area

(1) I_{SD} ≤ 9.7A, di/dt ≤ 200A/μs, V_{DD} ≤ V_{(BR)DSS}, T_j ≤ T_{JMAX}

THERMAL DATA

| | | | | |
|-----------------------|--|-----|------|------|
| R _{thj-case} | Thermal Resistance Junction-case | Max | 0.66 | °C/W |
| R _{thj-amb} | Thermal Resistance Junction-ambient | Max | 30 | °C/W |
| R _{thc-sink} | Thermal Resistance Case-sink | Typ | 0.1 | °C/W |
| T _l | Maximum Lead Temperature For Soldering Purpose | | 300 | °C |

AVALANCHE CHARACTERISTICS

| Symbol | Parameter | Max Value | Unit |
|-----------------|--|-----------|------|
| I _{AR} | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max) | 9.7 | A |
| E _{AS} | Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V) | 600 | mJ |

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

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------------|---|---|------|------|---------|----------|
| V _{(BR)DSS} | Drain-source Breakdown Voltage | I _D = 250 μA V _{GS} = 0 | 900 | | | V |
| I _{DSS} | Zero Gate Voltage Drain Current (V _{GS} = 0) | V _{DS} = Max Rating V _{DS} = Max Rating T _c = 125 °C | | | 1 50 | μA μA |
| I _{GSS} | Gate-body Leakage Current (V _{DS} = 0) | V _{GS} = ± 30 V | | | ± 100 | nA |

ON (*)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------------|-----------------------------------|---|------|------|------|--------|
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} = V _{GS} I _D = 250 μA | 3 | 4 | 5 | V |
| R _{DS(on)} | Static Drain-source On Resistance | V _{GS} = 10 V I _D = 4.8 A | | 0.85 | 1 | Ω Ω |
| I _{D(on)} | On State Drain Current | V _{DS} > I _{D(on)} × R _{DS(on)max} V _{GS} = 10 V | 9.7 | | | A |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|--|------|------|------|------|
| g _{fs} (*) | Forward Transconductance | V _{DS} > I _{D(on)} × R _{DS(on)max} I _D = 4.8 A | | 8.8 | | S |
| C _{iss} | Input Capacitance | V _{DS} = 25 V f = 1 MHz V _{GS} = 0 | | 2800 | | pF |
| C _{oss} | Output Capacitance | | | 290 | | pF |
| C _{rss} | Reverse Transfer Capacitance | | | 25 | | pF |

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-------------|--------------------|---|------|------|------|------|
| $t_{d(on)}$ | Turn-on Time | $V_{DD} = 450\text{ V}$ $I_D = 4.5\text{ A}$ | | 30 | | ns |
| t_r | Rise Time | $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ | | 13 | | ns |
| Q_g | Total Gate Charge | $V_{DD} = 720\text{ V}$ $I_D = 9\text{ A}$ $V_{GS} = 10\text{ V}$ | | 64 | 90 | nC |
| Q_{gs} | Gate-Source Charge | $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ | | 16 | | nC |
| Q_{gd} | Gate-Drain Charge | | | 26 | | nC |

SWITCHING OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------|-----------------------|--|------|------|------|------|
| $t_{r(off)}$ | Off-voltage Rise Time | $V_{DD} = 720\text{ V}$ $I_D = 9\text{ A}$ | | 26 | | ns |
| t_f | Fall Time | $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$ | | 26 | | ns |
| t_c | Cross-over Time | | | 35 | | ns |

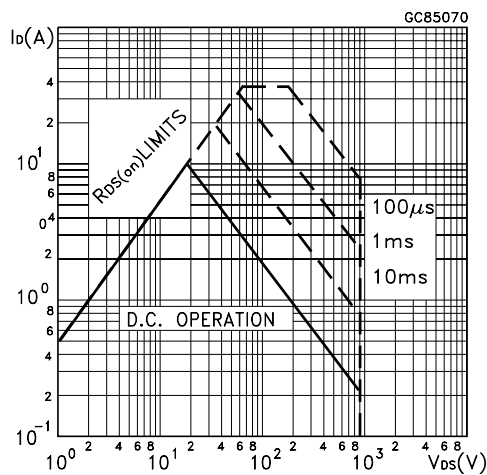
SOURCE DRAIN DIODE

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------------|-------------------------------|---|------|------|------|---------------|
| I_{SD} | Source-drain Current | | | | 9.7 | A |
| $I_{SDM}(\bullet)$ | Source-drain Current (pulsed) | | | | 38 | A |
| $V_{SD} (*)$ | Forward On Voltage | $I_{SD} = 9.7\text{ A}$ $V_{GS} = 0$ | | | 1.6 | V |
| t_{rr} | Reverse Recovery Time | $I_{SD} = 9\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$ | | 1000 | | ns |
| Q_{rr} | Reverse Recovery Charge | | | 11 | | μC |
| I_{RRM} | Reverse Recovery Current | | | 23 | | A |

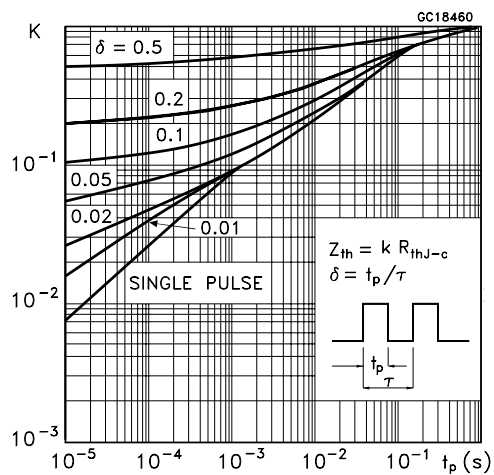
(*) Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %

(\bullet) Pulse width limited by safe operating area

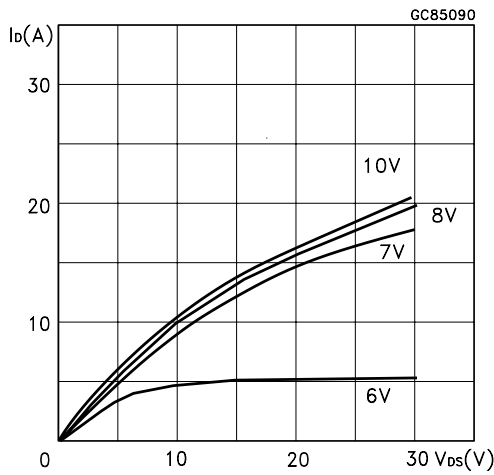
Safe Operating Area



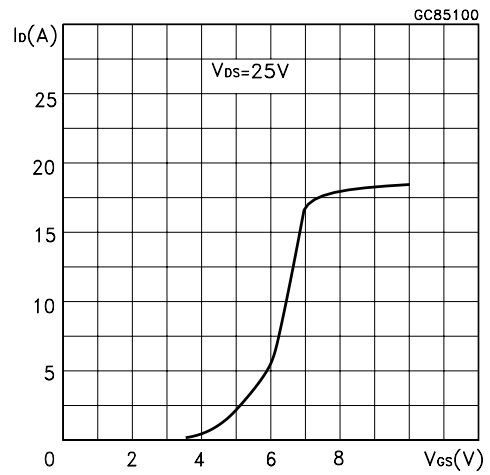
Thermal Impedance



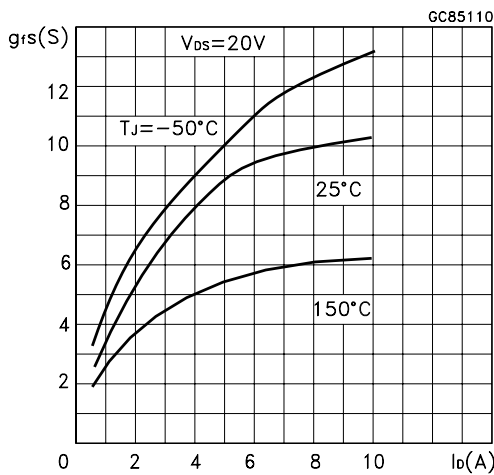
Output Characteristics



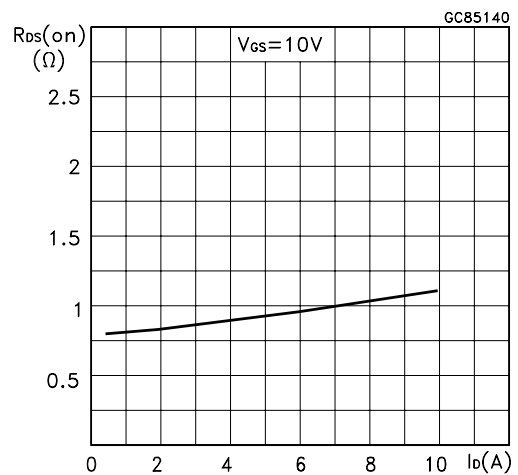
Transfer Characteristics



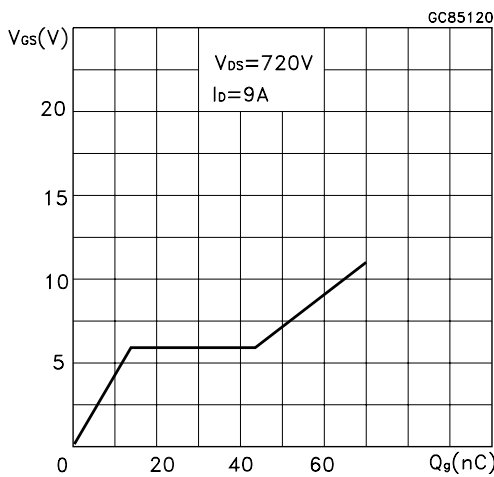
Transconductance



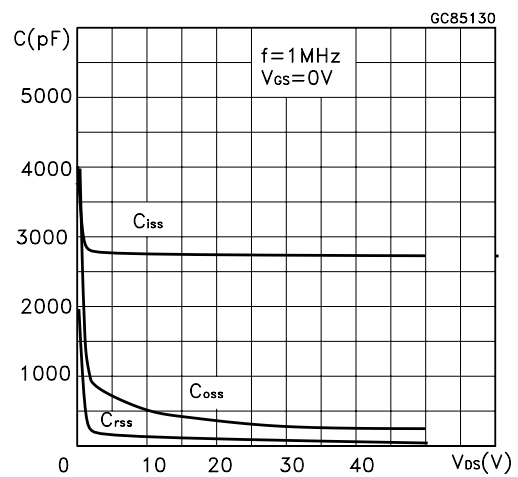
Static Drain-source On Resistance



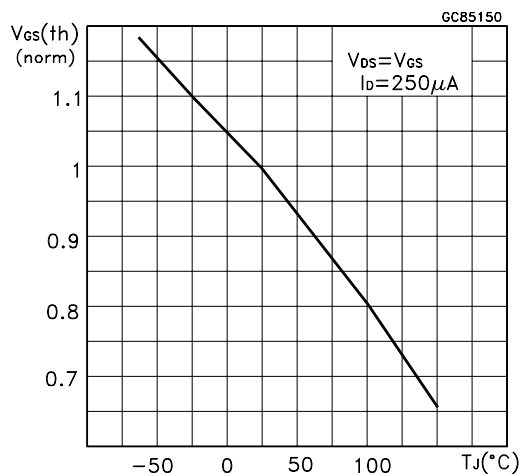
Gate Charge vs Gate-source Voltage



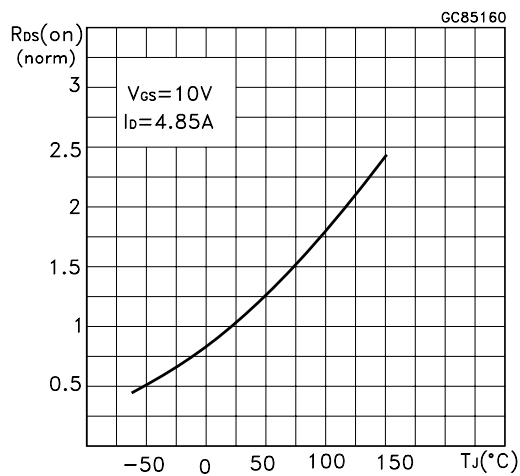
Capacitance Variations



Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

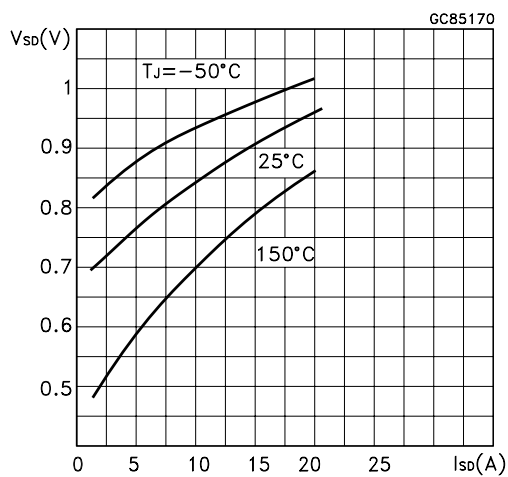


Fig. 1: Unclamped Inductive Load Test Circuit

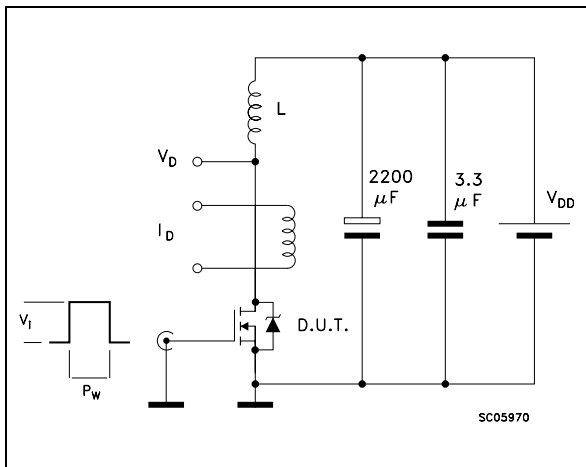


Fig. 2: Unclamped Inductive Waveform

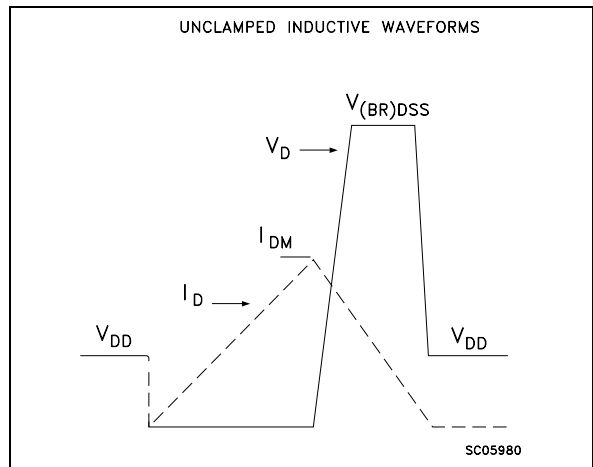


Fig. 3: Switching Times Test Circuits For Resistive Load

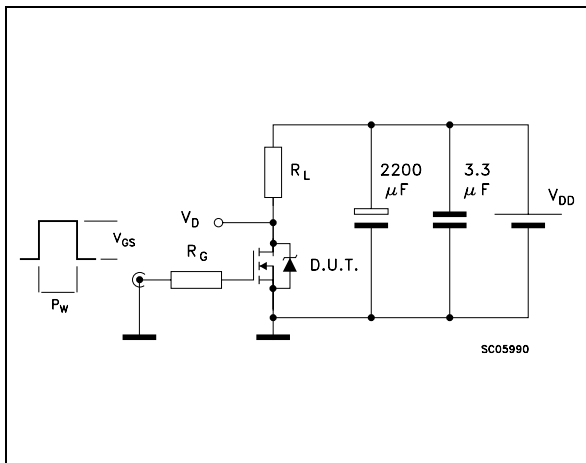


Fig. 4: Gate Charge test Circuit

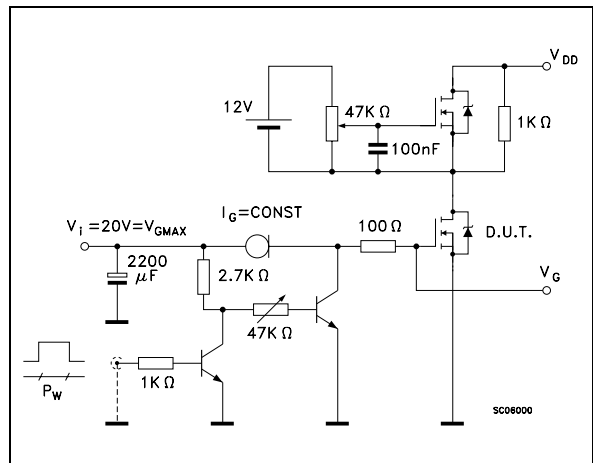
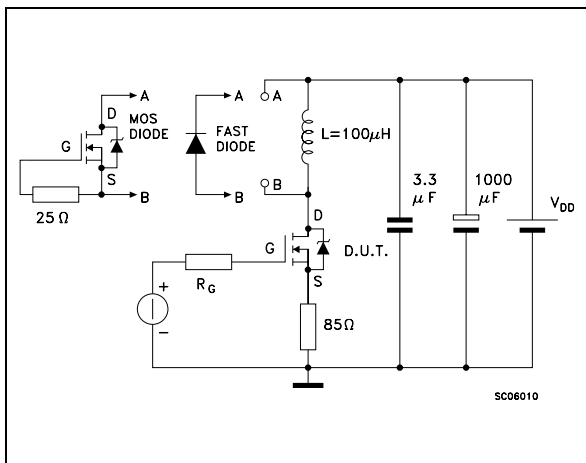
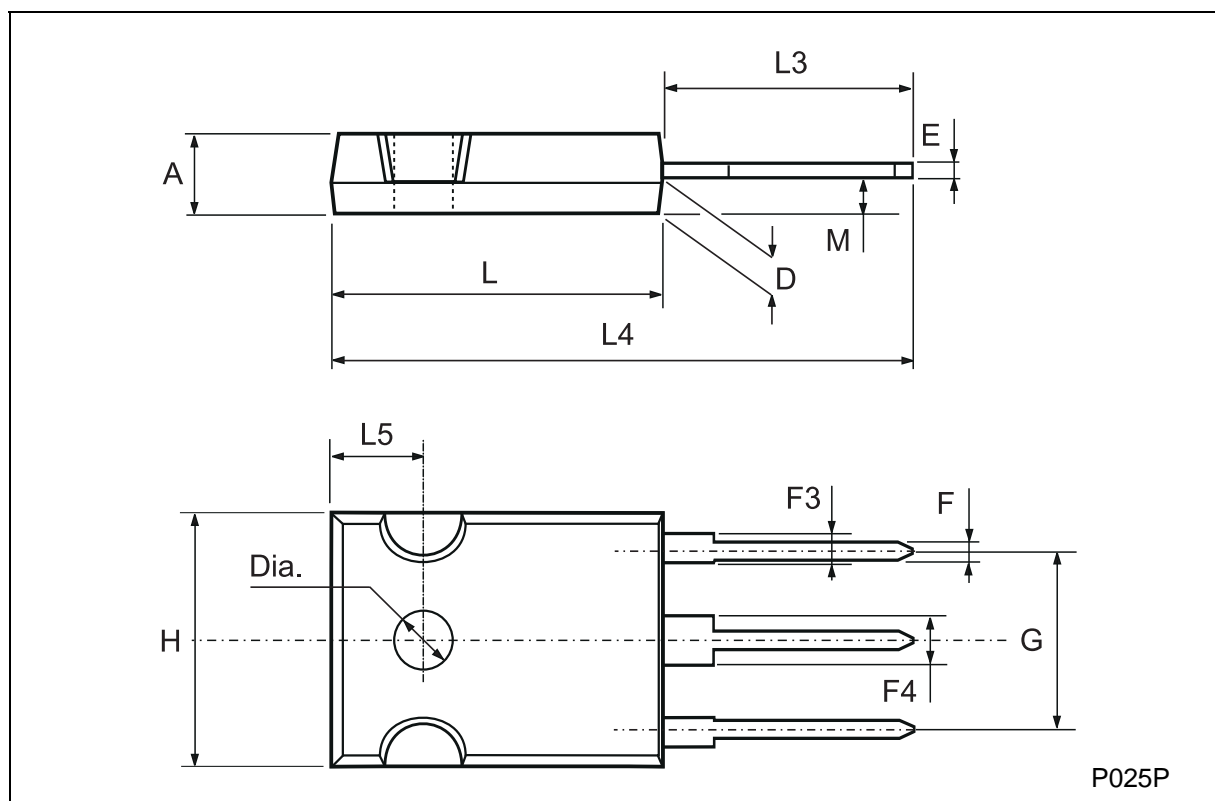


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



TO-247 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.7 | | 5.3 | 0.185 | | 0.209 |
| D | 2.2 | | 2.6 | 0.087 | | 0.102 |
| E | 0.4 | | 0.8 | 0.016 | | 0.031 |
| F | 1 | | 1.4 | 0.039 | | 0.055 |
| F3 | 2 | | 2.4 | 0.079 | | 0.094 |
| F4 | 3 | | 3.4 | 0.118 | | 0.134 |
| G | | 10.9 | | | 0.429 | |
| H | 15.3 | | 15.9 | 0.602 | | 0.626 |
| L | 19.7 | | 20.3 | 0.776 | | 0.779 |
| L3 | 14.2 | | 14.8 | 0.559 | | 0.582 |
| L4 | | 34.6 | | | 1.362 | |
| L5 | | 5.5 | | | 0.217 | |
| M | 2 | | 3 | 0.079 | | 0.118 |



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