



# STW200NF03

## N-CHANNEL 30V - 0.002 Ω - 120A TO-247 ULTRA LOW ON-RESISTANCE STripFET™ II MOSFET

| TYPE       | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|------------|------------------|---------------------|----------------|
| STW200NF03 | 30V              | <0.0028Ω            | 120A           |

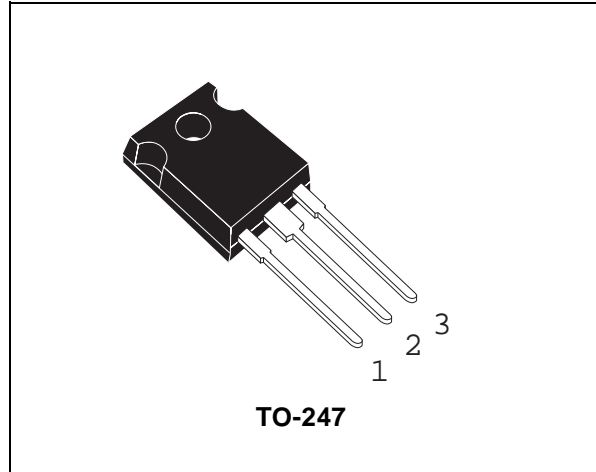
- TYPICAL R<sub>DS(on)</sub> = 0.002 Ω
- 100% AVALANCHE TESTED

### DESCRIPTION

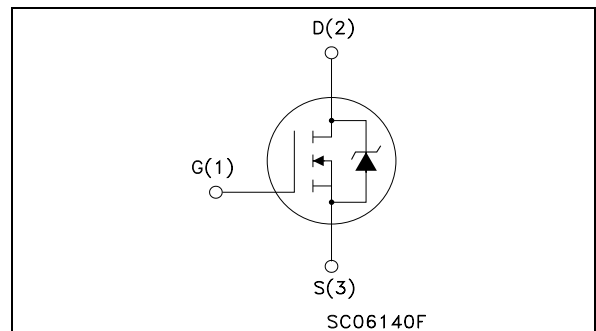
This Power MOSFET series realized with STMicroelectronics unique STripFET process has specifically been designed to minimize input capacitance and gate charge. It is particularly suitable in OR-ing function circuits and synchronous rectification.

### APPLICATIONS

- HIGH-EFFICIENCY DC-DC CONVERTERS
- HIGH CURRENT, HIGH SWITCHING SPEED
- OR-ING FUNCTION



### 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 kΩ)         | 30         | V    |
| V <sub>GS</sub>      | Gate- source Voltage                                 | ± 20       | V    |
| I <sub>D</sub> (●)   | Drain Current (continuous) at T <sub>C</sub> = 25°C  | 120        | A    |
| I <sub>D</sub>       | Drain Current (continuous) at T <sub>C</sub> = 100°C | 120        | A    |
| I <sub>DM</sub> (●●) | Drain Current (pulsed)                               | 480        | A    |
| P <sub>tot</sub>     | Total Dissipation at T <sub>C</sub> = 25°C           | 350        | W    |
|                      | Derating Factor                                      | 2.33       | W/°C |
| dv/dt (1)            | Peak Diode Recovery voltage slope                    | 1.5        | V/ns |
| E <sub>AS</sub> (2)  | Single Pulse Avalanche Energy                        | 4          | J    |
| T <sub>stg</sub>     | Storage Temperature                                  | -55 to 175 | °C   |
| T <sub>j</sub>       | Operating Junction Temperature                       |            |      |

(●●) Pulse width limited by safe operating area.  
(●) Current limited by package

(1) I<sub>SD</sub> ≤ 120A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ V(BR)<sub>DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>.  
(2) Starting T<sub>j</sub> = 25 °C, I<sub>D</sub> = 60 A, V<sub>DD</sub> = 15V

**STW200NF03****THERMAL DATA**

|                |  |     |      |      |
|----------------|--|-----|------|------|
| Rthj-case      | Thermal Resistance Junction-case               | Max | 0.43 | °C/W |
| Rthj-amb       | Thermal Resistance Junction-ambient            | Max | 50   | °C/W |
| T <sub>I</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> = ± 20V   |      |      | ±100    | nA       |

ON (1)

| 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> = 60 A              |      | 0.002 | 0.0028 | 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> = 60 A          |      | 200  |      | S    |
| C <sub>iSS</sub>    | Input Capacitance            | V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0 |      | 10   |      | nF   |
| C <sub>oSS</sub>    | Output Capacitance           |   |      | 3.35 |      | nF   |
| C <sub>rSS</sub>    | Reverse Transfer Capacitance |   |      | 385  |      | 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                              | $V_{DD} = 15\text{ V}$ $I_D = 60\text{ A}$<br>$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$<br>(Resistive Load, Figure 3) |      | 50<br>300           |      | ns<br>ns       |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD}=15\text{V}$ $I_D=120\text{A}$ $V_{GS}= 10\text{ V}$<br>(see test circuit, Figure 4)                            |      | 210<br>63.5<br>63.5 | 280  | nC<br>nC<br>nC |

**SWITCHING OFF**

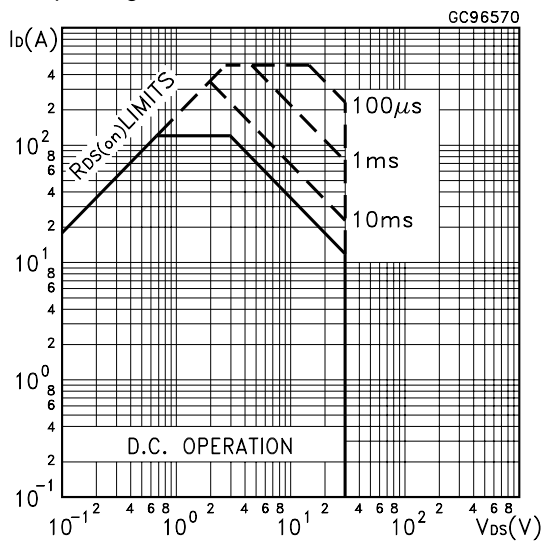
| Symbol                | Parameter                        | Test Conditions  | Min. | Typ.      | Max. | Unit     |
|-----------------------|----------------------------------|--|------|-----------|------|----------|
| $t_{d(off)}$<br>$t_f$ | Turn-off Delay Time<br>Fall Time | $V_{DD} = 15\text{ V}$ $I_D = 60\text{ A}$<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$<br>(Resistive Load, Figure 3) |      | 100<br>80 |      | ns<br>ns |

**SOURCE DRAIN DIODE**

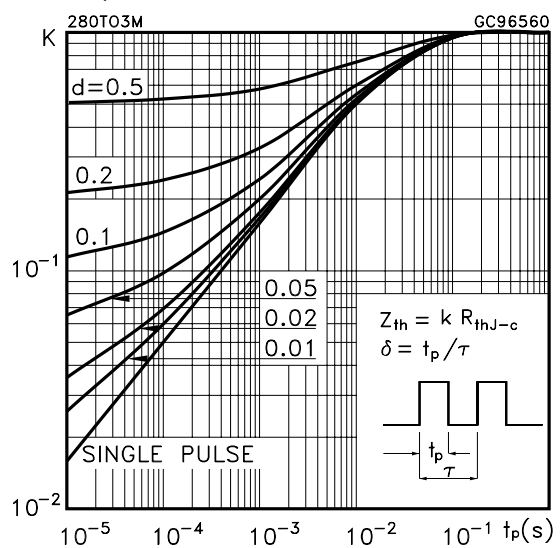
| Symbol                            | Parameter  | Test Conditions   | Min. | Typ.             | Max.       | Unit          |
|-----------------------------------|--|---|------|------------------|------------|---------------|
| $I_{SD}$<br>$I_{SDM} (\bullet)$   | Source-drain Current<br>Source-drain Current (pulsed)                        |   |      |                  | 120<br>480 | A<br>A        |
| $V_{SD} (*)$                      | Forward On Voltage   | $I_{SD} = 120\text{ A}$ $V_{GS} = 0$  |      |                  | 1.3        | V             |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD} = 120\text{ A}$ $di/dt = 100\text{A}/\mu\text{s}$<br>$V_{DD} = 20\text{ V}$ $T_j = 150^\circ\text{C}$<br>(see test circuit, Figure 5) |      | 90<br>250<br>5.5 |            | ns<br>nC<br>A |

(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.  
 (•) Pulse width limited by safe operating area.

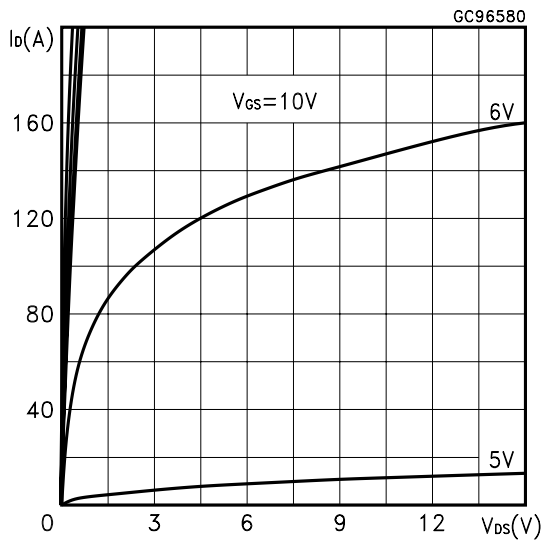
**Safe Operating Area**



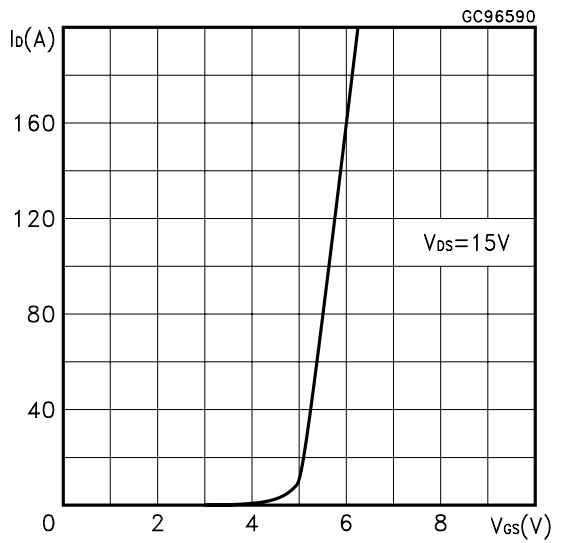
**Thermal Impedance**



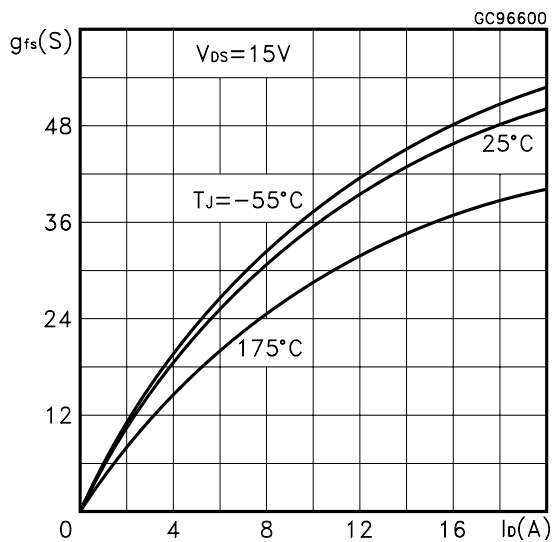
Output Characteristics



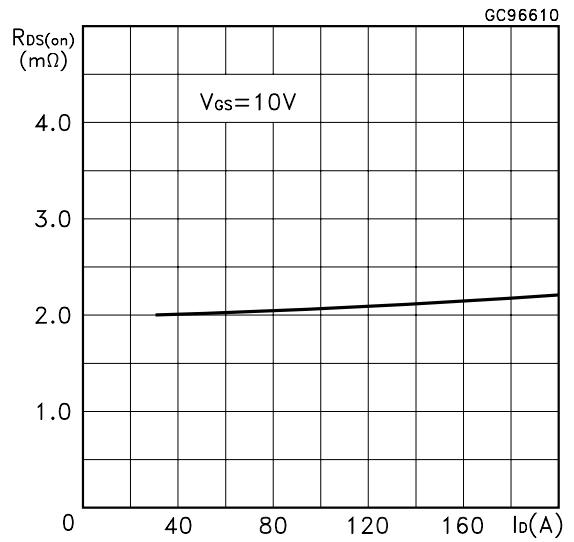
Transfer Characteristics



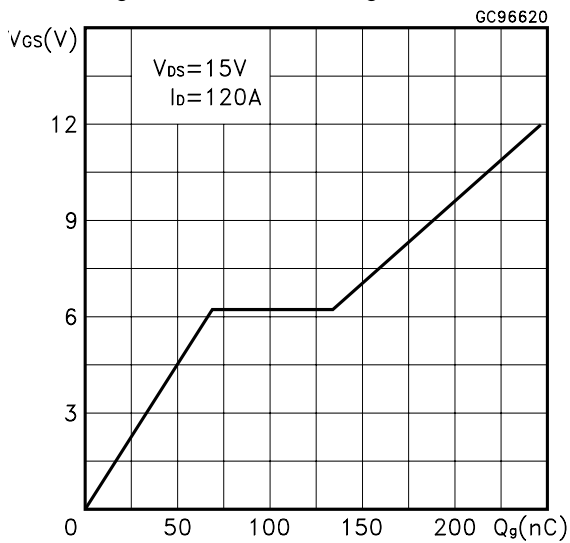
Transconductance



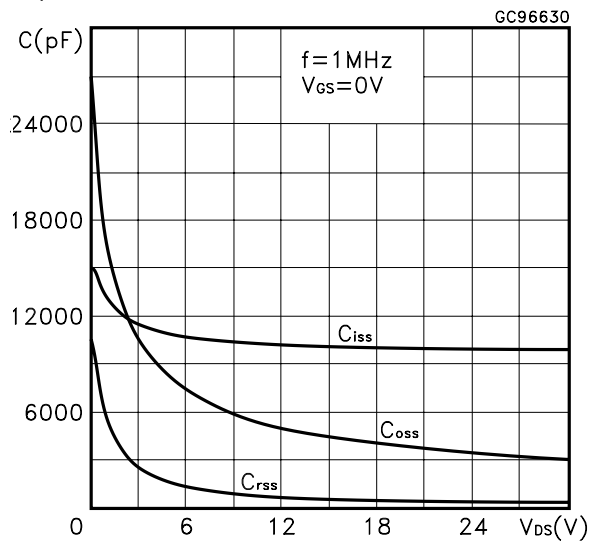
Static Drain-source On Resistance



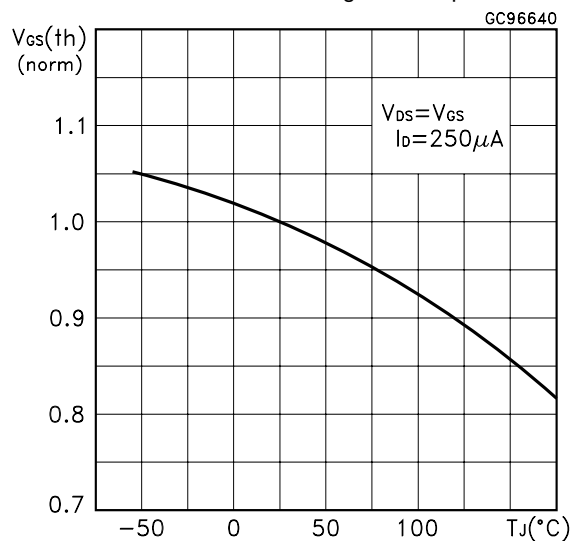
Gate Charge vs Gate-source Voltage



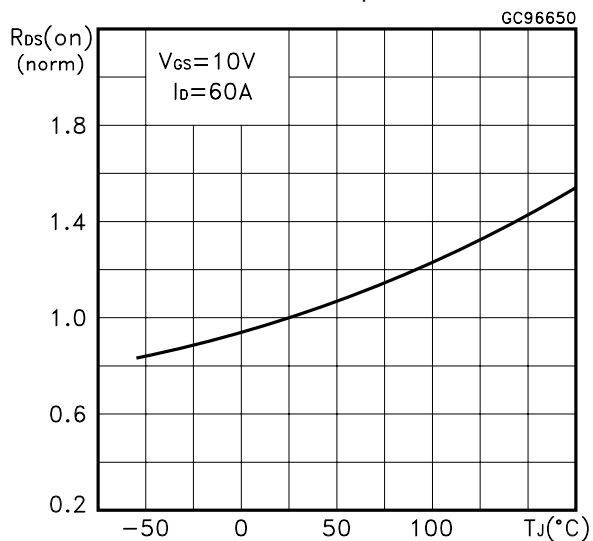
Capacitance Variations



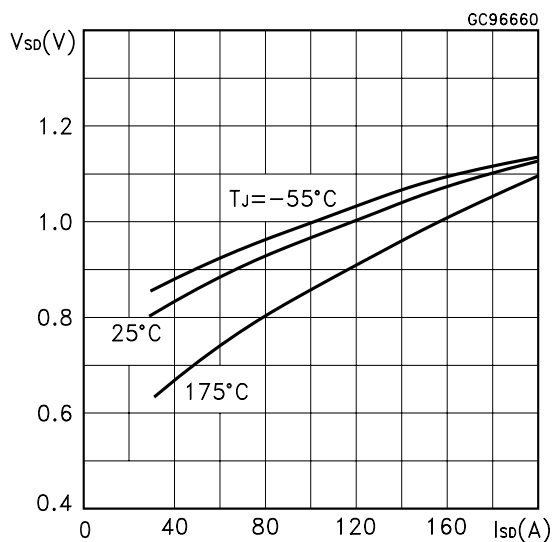
Normalized Gate Threshold Voltage vs Temperature



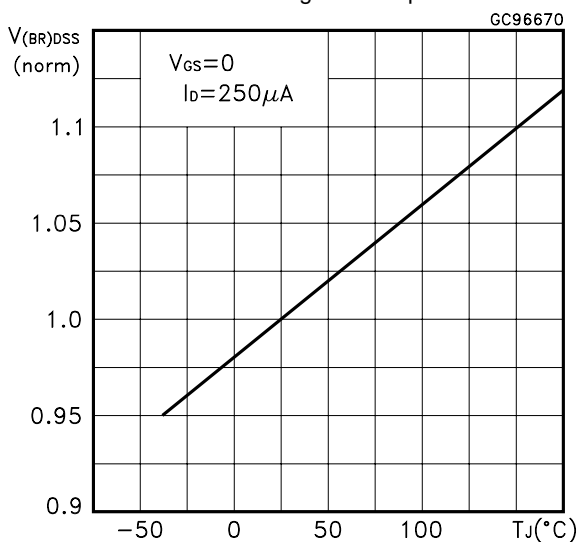
Normalized on Resistance vs Temperature



Source-drain Diode Forward Characteristics



Normalized Breakdown Voltage vs Temperature.



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



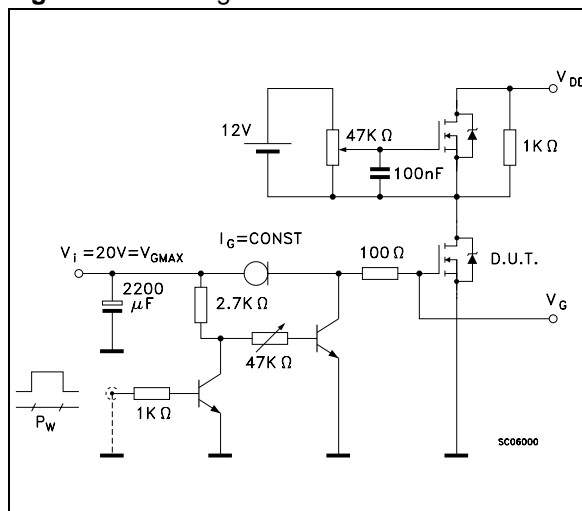
**Fig. 2: Unclamped Inductive Waveform**



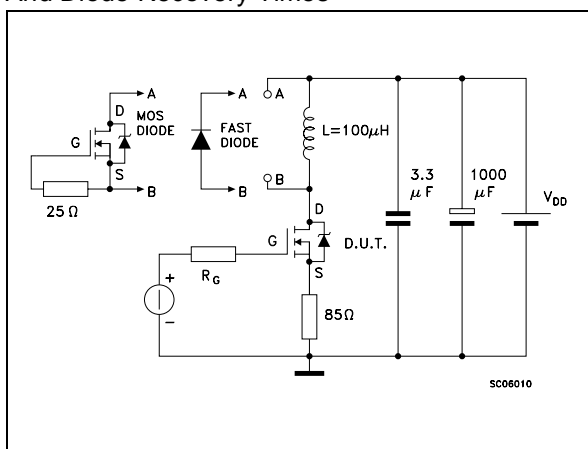
**Fig. 3: Switching Times Test Circuits For Resistive Load**



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

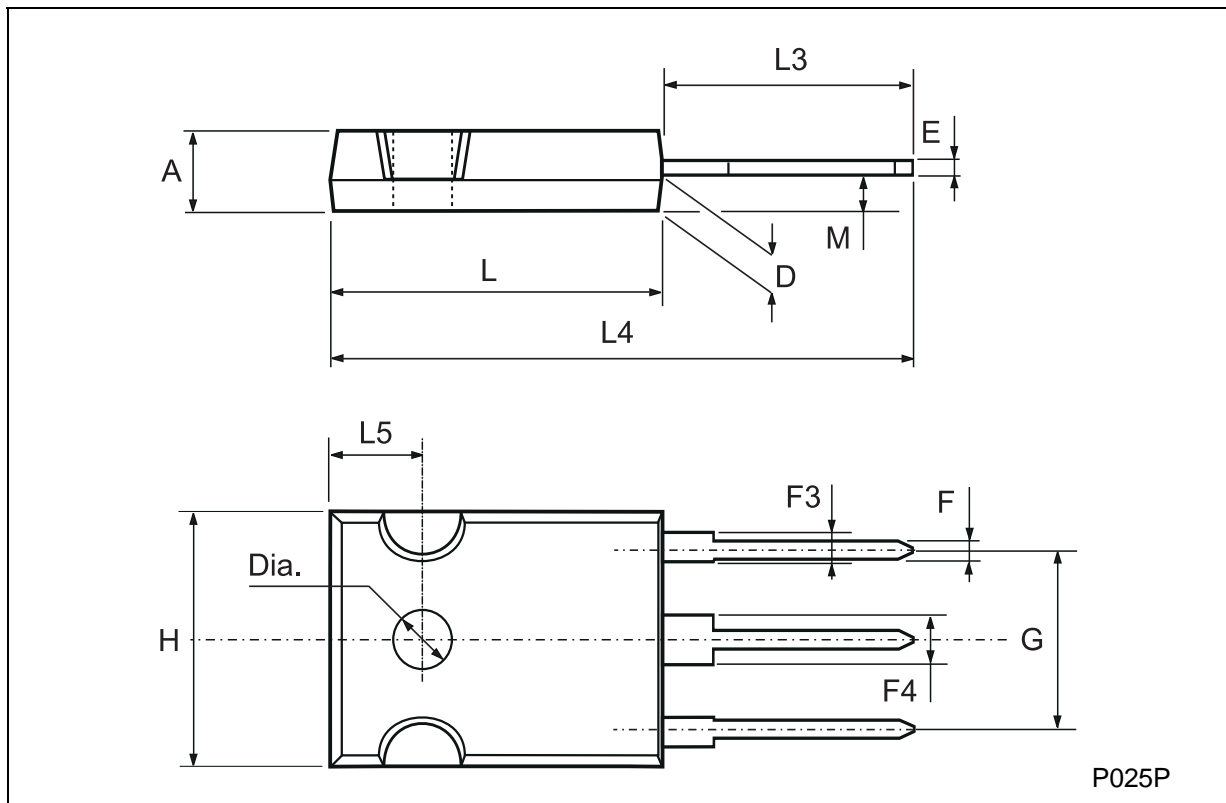


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



## 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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