



# STS7NF60L

N-CHANNEL 60V - 0.017  $\Omega$  - 7.5A SO-8

STripFET™ II POWER MOSFET

| TYPE      | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|-----------|------------------|---------------------|----------------|
| STS7NF60L | 60 V             | < 0.0195 $\Omega$   | 7.5 A          |

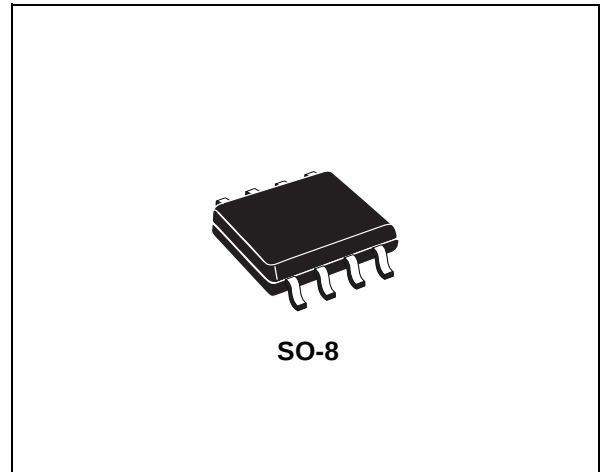
- TYPICAL R<sub>DS(on)</sub> = 0.017  $\Omega$
- STANDARD OUTLINE FOR EASY AUTOMATED SURFACE MOUNT ASSEMBLY
- LOW THRESHOLD DRIVE

## DESCRIPTION

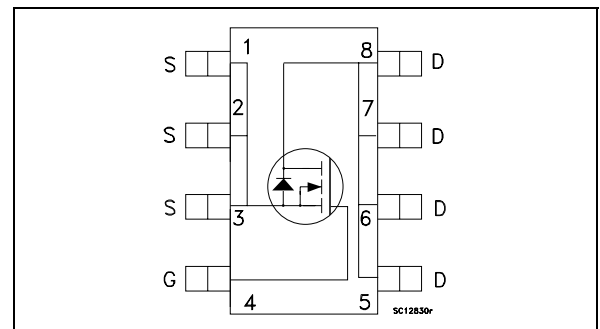
This Power MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing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

## APPLICATIONS

- DC MOTOR DRIVE
- DC-DC CONVERTERS
- BATTERY MANAGEMENT IN NOMADIC EQUIPMENT
- POWER MANAGEMENT IN PORTABLE/DESKTOP PCs



## INTERNAL SCHEMATIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                             | Value | Unit |
|---------------------|-------------------------------------------------------|-------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)            | 60    | V    |
| V <sub>DGR</sub>    | Drain-gate Voltage (R <sub>GS</sub> = 20 k $\Omega$ ) | 60    | V    |
| V <sub>GS</sub>     | Gate- source Voltage                                  | ± 16  | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 25°C   | 7.5   | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 100°C  | 4.7   | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                                | 30    | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>C</sub> = 25°C            | 2.5   | W    |
| E <sub>AS</sub> (1) | Single Pulse Avalanche Energy                         | 350   | mJ   |

(●) Pulse width limited by safe operating area.

(1) Starting T<sub>J</sub> = 25 °C, I<sub>D</sub> = 7.5 A V<sub>DD</sub> = 30 V

## STS7NF60L

### THERMAL DATA

|                                                   |                                                                                                      |     |                         |                  |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------|-----|-------------------------|------------------|
| Rthj-amb(#)<br>T <sub>j</sub><br>T <sub>stg</sub> | Thermal Resistance Junction-ambient<br>Maximum Operating Junction Temperature<br>Storage Temperature | Max | 50<br>150<br>-55 to 150 | °C/W<br>°C<br>°C |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------|-----|-------------------------|------------------|

(#) When Mounted on 1 inch<sup>2</sup> FR-4 board, 2 oz of Cu and t ≤ 10 sec.

### 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                                        | 60   |      |         | 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> = ± 16 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                                     | 1    |                |                  | V      |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10 V I <sub>D</sub> = 3.5 A<br>V <sub>GS</sub> = 5 V I <sub>D</sub> = 3.5 A |      | 0.017<br>0.019 | 0.0195<br>0.0215 | Ω<br>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> = 3.5 A         |      | 13                 |      | S              |
| C <sub>iss</sub><br>C <sub>oss</sub><br>C <sub>rss</sub> | Input Capacitance<br>Output Capacitance<br>Reverse Transfer Capacitance | V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0 |      | 1700<br>300<br>100 |      | 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                              | $V_{DD} = 30\text{ V}$ $I_D = 3.5\text{ A}$<br>$R_G = 4.7\ \Omega$ $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, Figure 1) |      | 15<br>27       |      | ns<br>ns       |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD} = 48\text{ V}$ $I_D = 7.5\text{ A}$ $V_{GS} = 4.5\text{ V}$<br>(see test circuit, Figure 2)                      |      | 25<br>4.5<br>7 | 34   | nC<br>nC<br>nC |

**SWITCHING OFF** (\*)

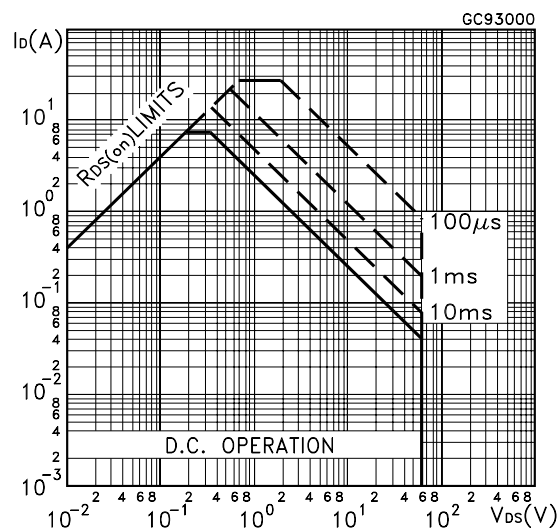
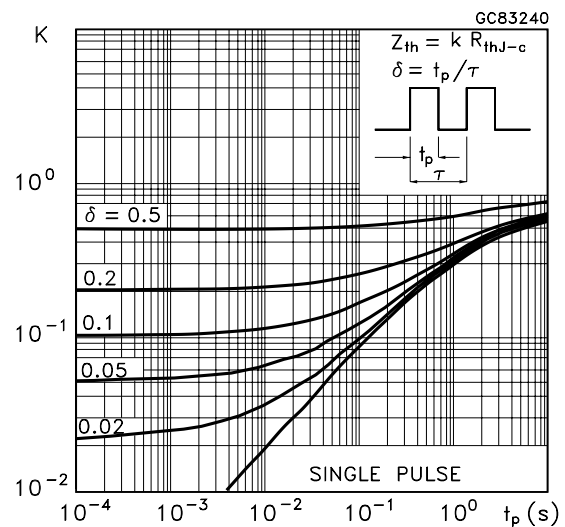
| Symbol                | Parameter                        | Test Conditions                                                                                                            | Min. | Typ.     | Max. | Unit     |
|-----------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------|------|----------|------|----------|
| $t_{d(off)}$<br>$t_f$ | Turn-off Delay Time<br>Fall Time | $V_{DD} = 30\text{ V}$ $I_D = 3.5\text{ A}$<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 4.5\text{ V}$<br>(Resistive Load, Figure 1) |      | 47<br>20 |      | ns<br>ns |

**SOURCE DRAIN DIODE** (\*)

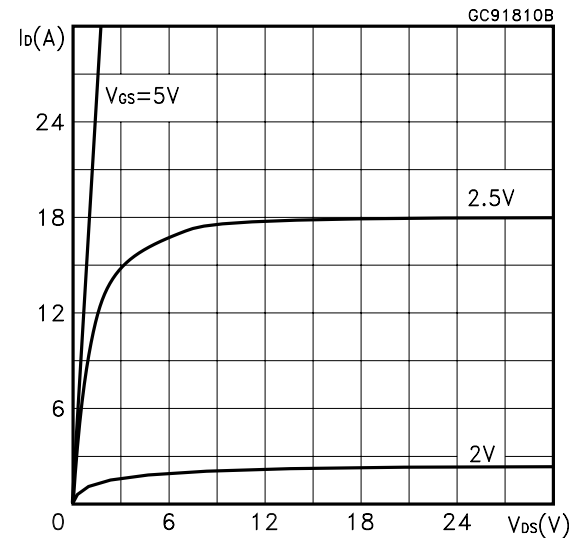
| Symbol                            | Parameter                                                                    | Test Conditions                                                                                                                                | Min. | Typ.             | Max.      | Unit          |
|-----------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|-----------|---------------|
| $I_{SD}$<br>$I_{SDM}(\bullet)$    | Source-drain Current<br>Source-drain Current (pulsed)                        |                                                                                                                                                |      |                  | 7.5<br>30 | A<br>A        |
| $V_{SD}$                          | Forward On Voltage                                                           | $I_{SD} = 7.5\text{ A}$ $V_{GS} = 0$                                                                                                           |      |                  | 1.2       | V             |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD} = 7.5\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 20\text{ V}$ $T_j = 150^\circ\text{C}$<br>(see test circuit, Figure 3) |      | 55<br>110<br>3.9 |           | ns<br>nC<br>A |

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

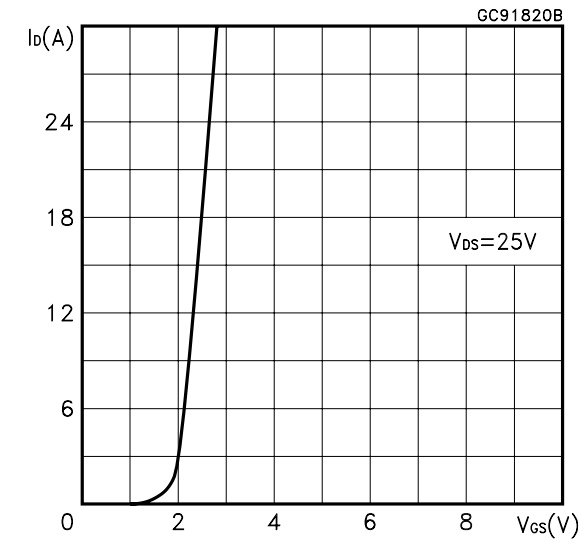
(●) Pulse width limited by safe operating area.

**Safe Operating Area****Thermal Impedance**

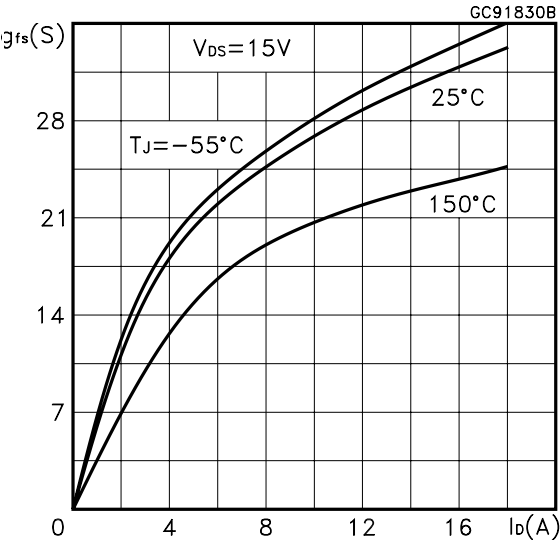
Output Characteristics



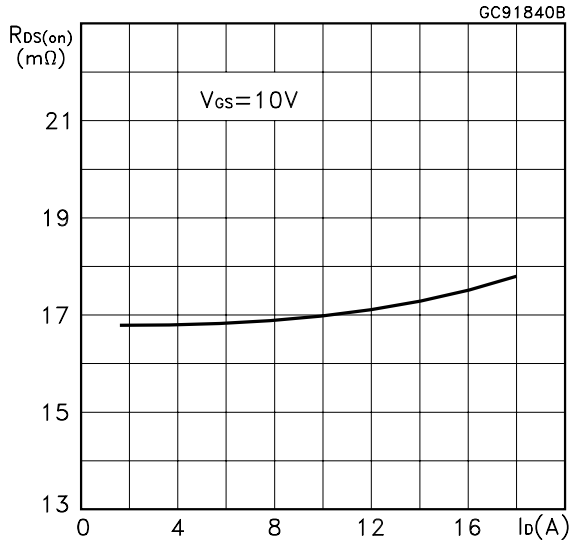
Transfer Characteristics



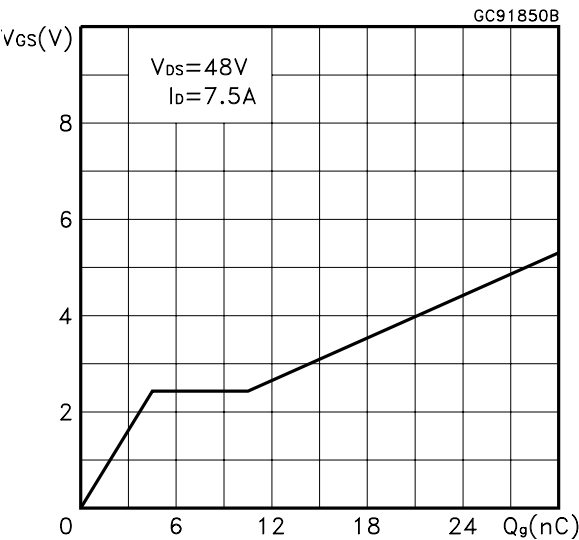
Transconductance



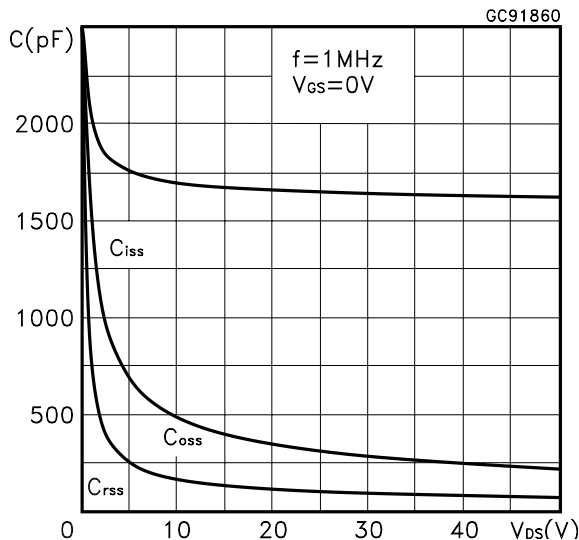
Static Drain-source On Resistance



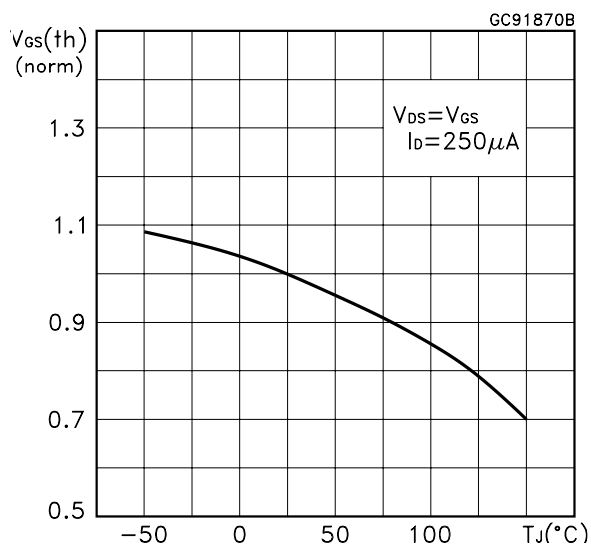
Gate Charge vs Gate-source Voltage



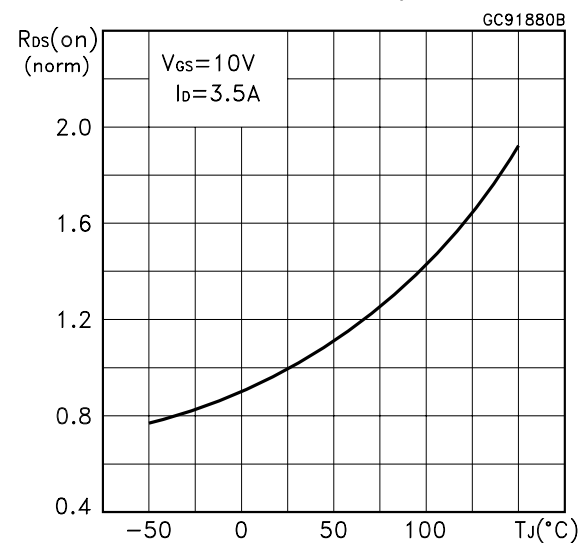
Capacitance Variations



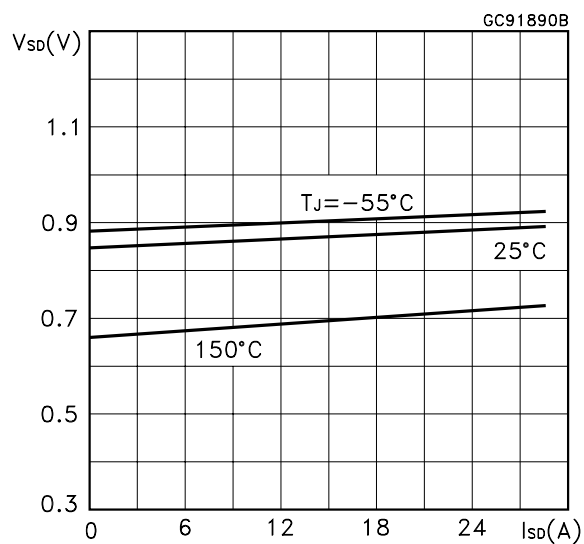
Normalized Gate Threshold Voltage vs Temperature



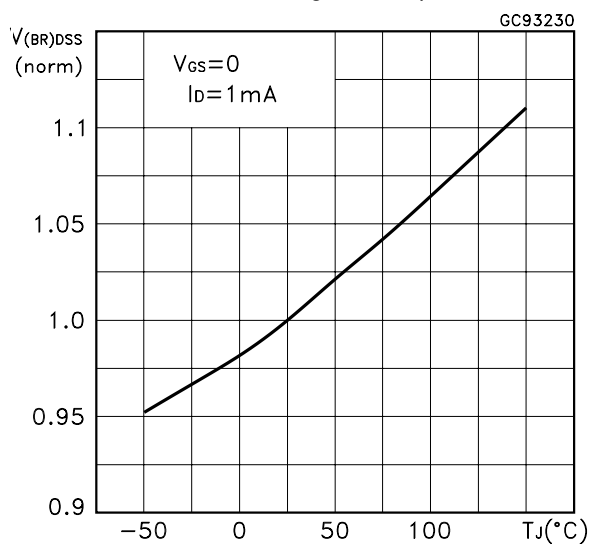
Normalized on Resistance vs Temperature



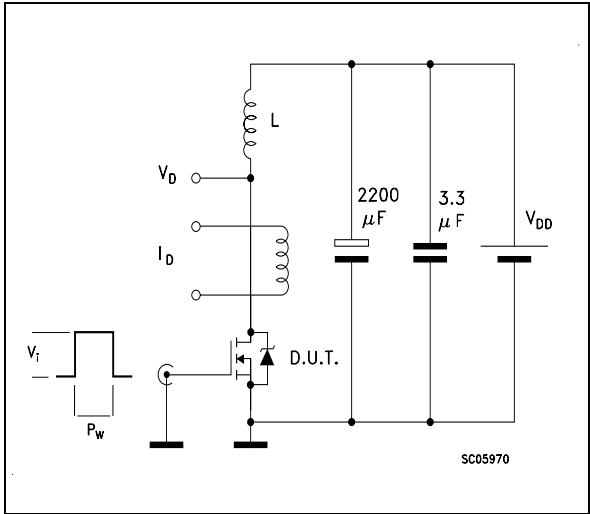
Source-drain Diode Forward Characteristics



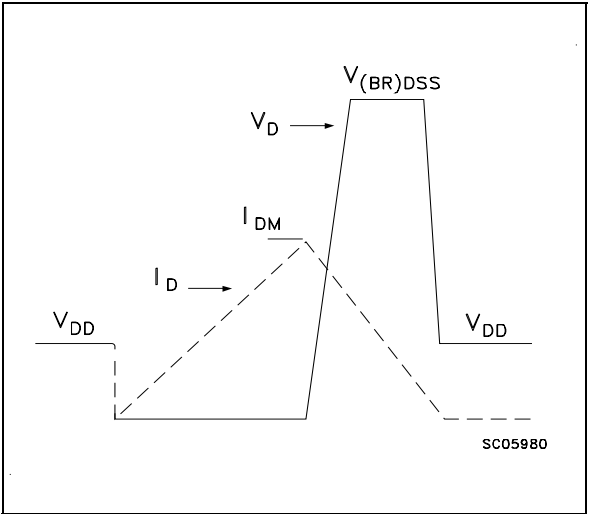
Normalized Breakdown Voltage vs Temperature



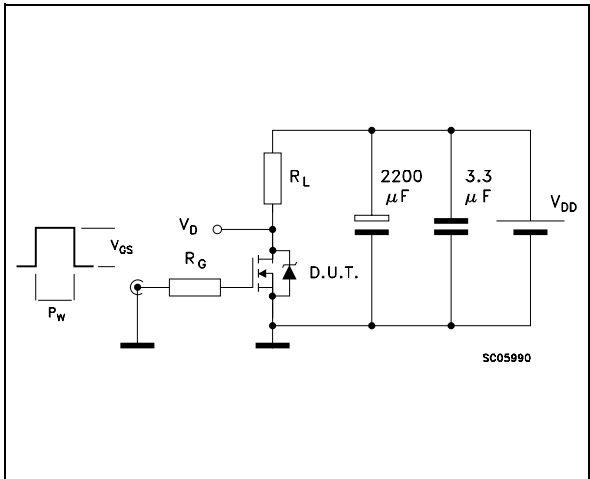
**Fig. 1: Unclamped Inductive Load Test Circuit**



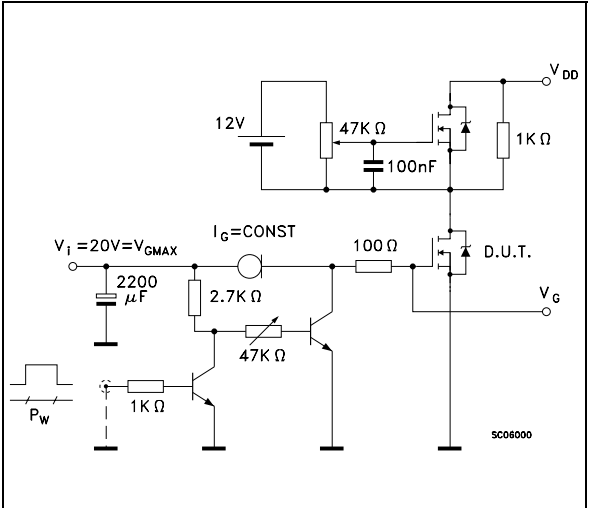
**Fig. 2: Unclamped Inductive Waveform**



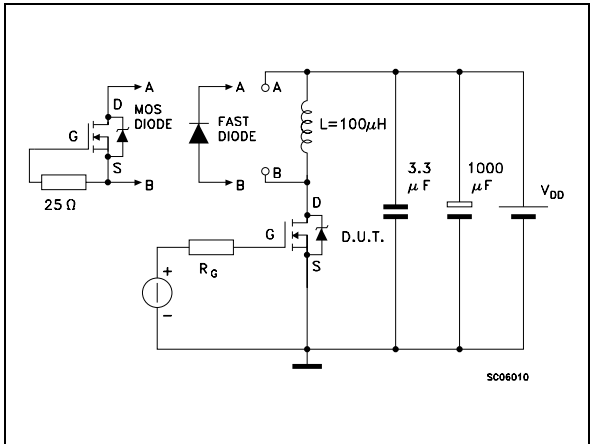
**Fig. 3: Switching Times Test Circuits For Resistive Load**



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

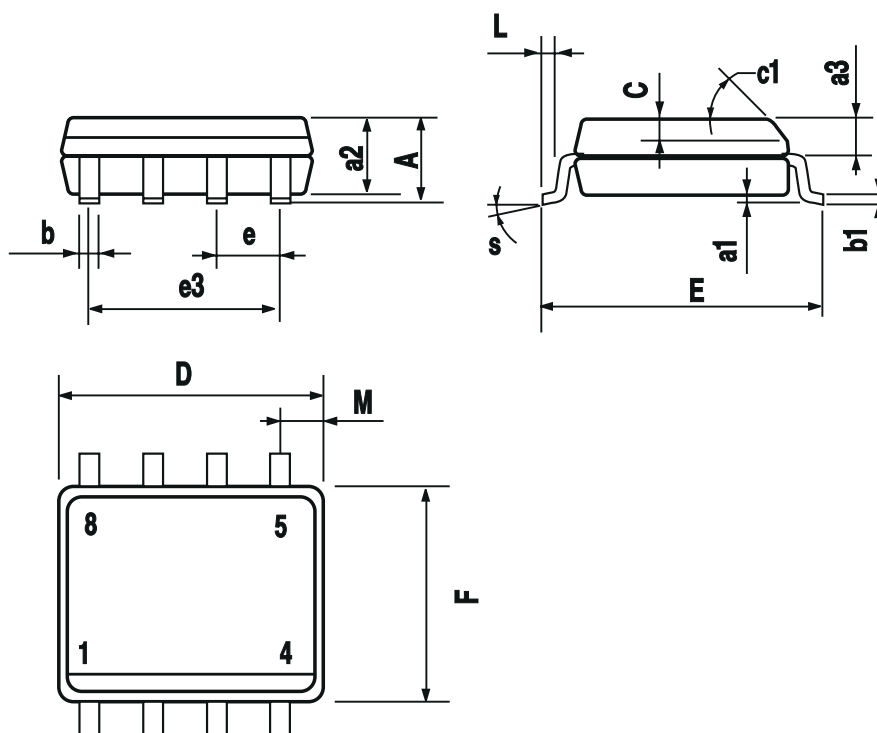


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



## SO-8 MECHANICAL DATA

| DIM. | mm        |      |      | inch  |       |       |
|------|-----------|------|------|-------|-------|-------|
|      | MIN.      | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    |           |      | 1.75 |       |       | 0.068 |
| a1   | 0.1       |      | 0.25 | 0.003 |       | 0.009 |
| a2   |           |      | 1.65 |       |       | 0.064 |
| a3   | 0.65      |      | 0.85 | 0.025 |       | 0.033 |
| b    | 0.35      |      | 0.48 | 0.013 |       | 0.018 |
| b1   | 0.19      |      | 0.25 | 0.007 |       | 0.010 |
| C    | 0.25      |      | 0.5  | 0.010 |       | 0.019 |
| c1   | 45 (typ.) |      |      |       |       |       |
| D    | 4.8       |      | 5.0  | 0.188 |       | 0.196 |
| E    | 5.8       |      | 6.2  | 0.228 |       | 0.244 |
| e    |           | 1.27 |      |       | 0.050 |       |
| e3   |           | 3.81 |      |       | 0.150 |       |
| F    | 3.8       |      | 4.0  | 0.14  |       | 0.157 |
| L    | 0.4       |      | 1.27 | 0.015 |       | 0.050 |
| M    |           |      | 0.6  |       |       | 0.023 |
| S    | 8 (max.)  |      |      |       |       |       |



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