



# STE250NS10

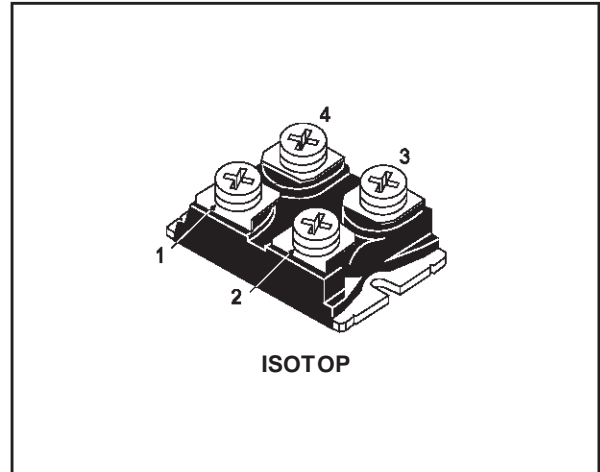
## N-CHANNEL 100V - 0.0045 Ω - 220A ISOTOP STripFET™ POWER MOSFET

| TYPE       | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|------------|------------------|---------------------|----------------|
| STE250NS10 | 100 V            | <0.0055 Ω           | 220A           |

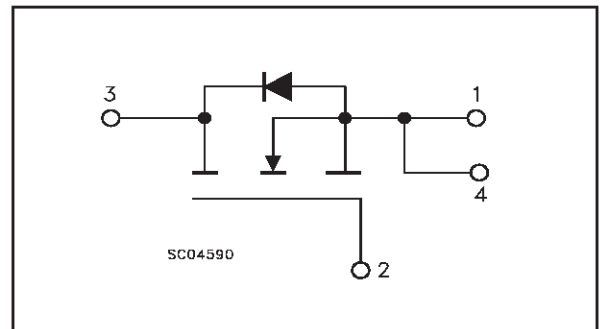
- TYPICAL R<sub>DS(on)</sub> = 0.0045Ω
- STANDARD THRESHOLD DRIVE
- 100% AVALANCHE TESTED

### APPLICATIONS

- SMPS & UPS
- MOTOR CONTROL
- WELDING EQUIPMENT
- OUTPUT STAGE FOR PWM, ULTRASONIC CIRCUITS



### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter  | Value      | Unit |
|---------------------|--|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)           | 100        | V    |
| V <sub>DGR</sub>    | Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 100        | V    |
| V <sub>GS</sub>     | Gate- source Voltage                                 | ± 20       | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 25°C  | 220        | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>C</sub> = 100°C | 156        | A    |
| I <sub>DM</sub> (●) | Drain Current (pulsed)                               | 880        | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>C</sub> = 25°C           | 500        | W    |
|                     | Derating Factor                                      | 4          | W/°C |
| dv/dt (1)           | Peak Diode Recovery voltage slope                    | 3.5        | V/ns |
| V <sub>ISO</sub>    | Insulation Withstand Voltage (AC-RMS)                | 2500       | V    |
| T <sub>stg</sub>    | Storage Temperature                                  | -55 to 150 | °C   |
| T <sub>j</sub>      | Operating Junction Temperature                       | 150        | °C   |

(●) Pulse width limited by safe operating area.

(1) I<sub>SD</sub> ≤ 220A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ V(BR)DSS, T<sub>j</sub> ≤ T<sub>JMAX</sub>.

## STE250NS10

### THERMAL DATA

|           |                                     |     |      |      |
|-----------|-------------------------------------|-----|------|------|
| Rthj-case | Thermal Resistance Junction-case    | Max | 0.25 | °C/W |
| Rthj-amb  | Thermal Resistance Junction-ambient | Max | 50   | °C/W |

### AVALANCHE CHARACTERISTICS

| Symbol          | Parameter  | Max Value | Unit |
|-----------------|--|-----------|------|
| I <sub>AR</sub> | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max)                                | 220       | A    |
| E <sub>AS</sub> | Single Pulse Avalanche Energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 64 V) | 800       | mJ   |

### 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> = 1 mA    V <sub>GS</sub> = 0   | 100  |      |           | 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 |      |      | 50<br>500 | μA<br>μA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ± 20V  |      |      | ±400      | 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 | 2    | 3      | 4      | V    |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10 V    I <sub>D</sub> = 125 A          |      | 0.0045 | 0.0055 | Ω    |

#### DYNAMIC

| Symbol   | Parameter   | Test Conditions                                       | Min. | Typ.             | Max. | Unit           |
|--|---|---|------|------------------|------|----------------|
| g <sub>fs</sub>  | Forward Transconductance  | V <sub>DS</sub> = 20 V    I <sub>D</sub> = 70 A       |      | 60               |      | 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 |      | 31<br>4.3<br>1.2 |      | nF<br>nF<br>nF |

**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                              | $V_{DD} = 50\text{ V}$ $I_D = 125\text{ A}$<br>$R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$<br>(Resistive Load, Figure 3) |      | 110<br>380        |      | ns<br>ns       |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD} = 50\text{ V}$ $I_D = 220\text{ A}$ $V_{GS} = 10\text{ V}$  |      | 900<br>160<br>330 |      | nC<br>nC<br>nC |

**SWITCHING OFF**

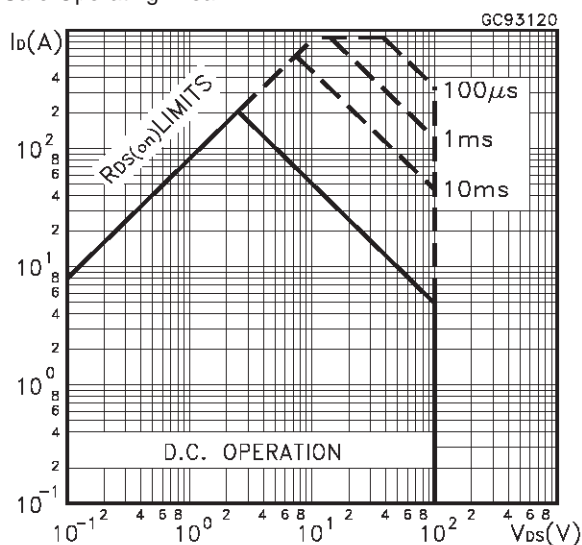
| Symbol                           | Parameter   | Test Conditions  | Min. | Typ.              | Max. | Unit           |
|----------------------------------|---|--|------|-------------------|------|----------------|
| $t_{d(off)}$<br>$t_f$            | Turn-off Delay Time<br>Fall Time                      | $V_{DD} = 50\text{ V}$ $I_D = 125\text{ A}$<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$<br>(Resistive Load, Figure 3)    |      | 1100<br>330       |      | ns<br>ns       |
| $t_r(V_{off})$<br>$t_f$<br>$t_c$ | Off-voltage Rise Time<br>Fall Time<br>Cross-over Time | $V_{clamp} = 80\text{ V}$ $I_D = 220\text{ A}$<br>$R_G = 4.7\ \Omega$ , $V_{GS} = 10\text{ V}$<br>(Inductive Load, Figure 5) |      | 950<br>330<br>600 |      | ns<br>ns<br>ns |

**SOURCE DRAIN DIODE**

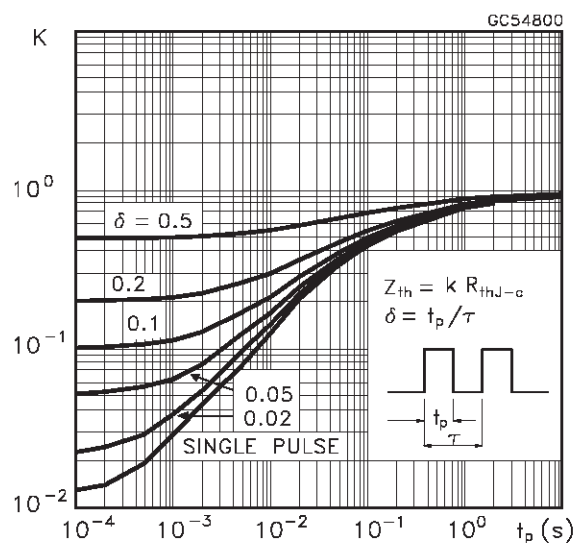
| Symbol                            | Parameter  | Test Conditions  | Min. | Typ.                | Max.       | Unit                     |
|-----------------------------------|--|--|------|---------------------|------------|--------------------------|
| $I_{SD}$<br>$I_{SDM} (*)$         | Source-drain Current<br>Source-drain Current (pulsed)                        |  |      |                     | 220<br>880 | A<br>A                   |
| $V_{SD} (*)$                      | Forward On Voltage   | $I_{SD} = 220\text{ A}$ $V_{GS} = 0$   |      |                     | 1.5        | V                        |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD} = 220\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 30\text{ V}$ $T_j = 150^\circ\text{C}$<br>(see test circuit, Figure 5) |      | 200<br>1.35<br>13.5 |            | ns<br>$\mu\text{C}$<br>A |

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

**Safe Operating Area**

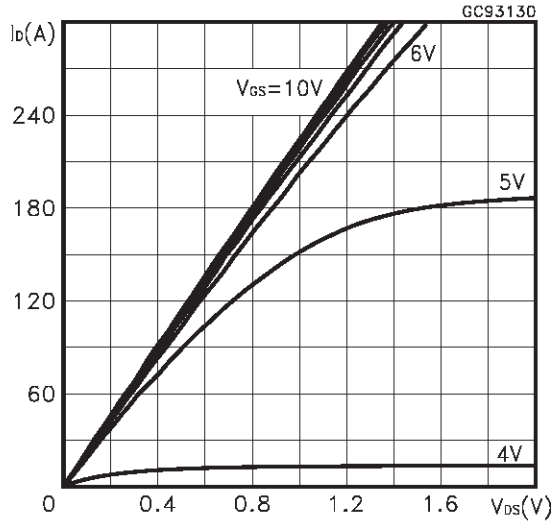


**Thermal Impedance**

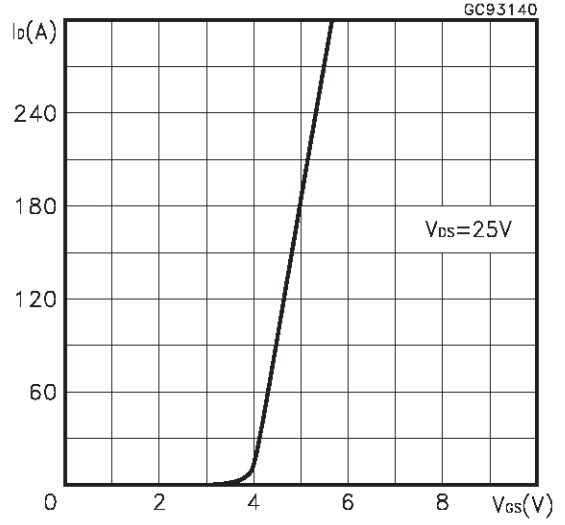


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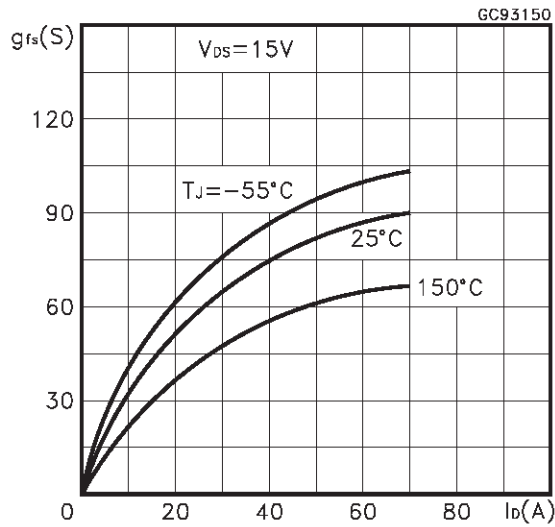
Output Characteristics



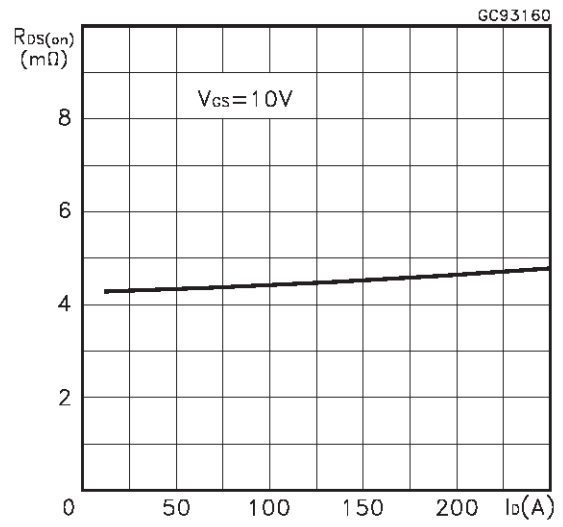
Transfer Characteristics



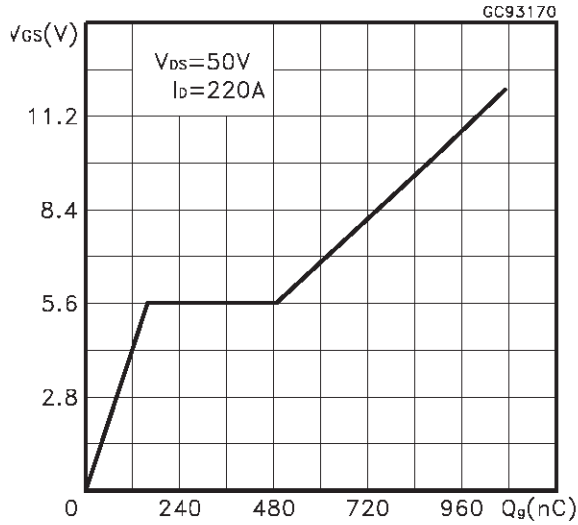
Transconductance



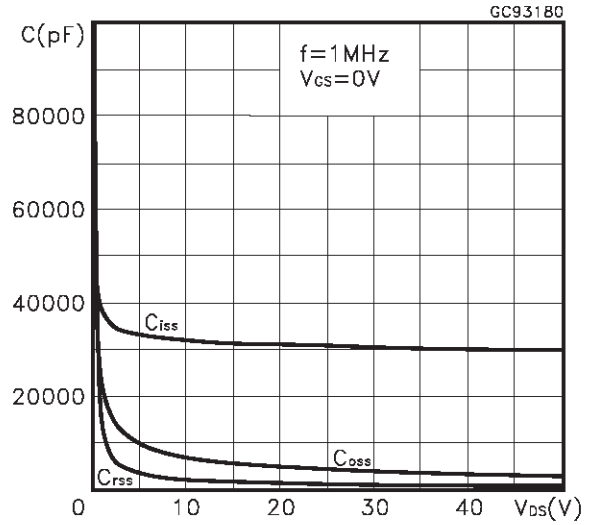
Static Drain-source On Resistance



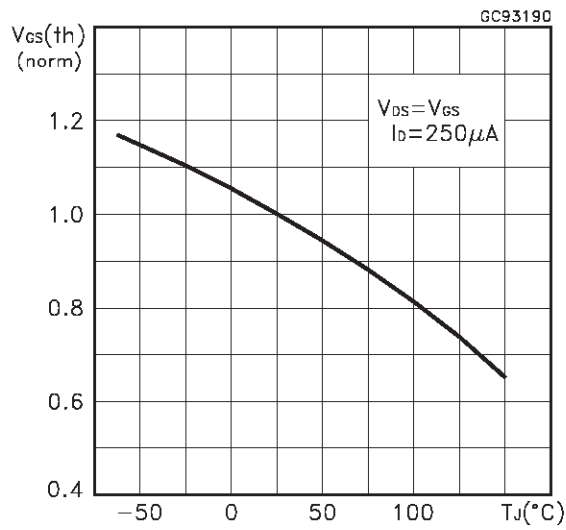
Gate Charge vs Gate-source Voltage



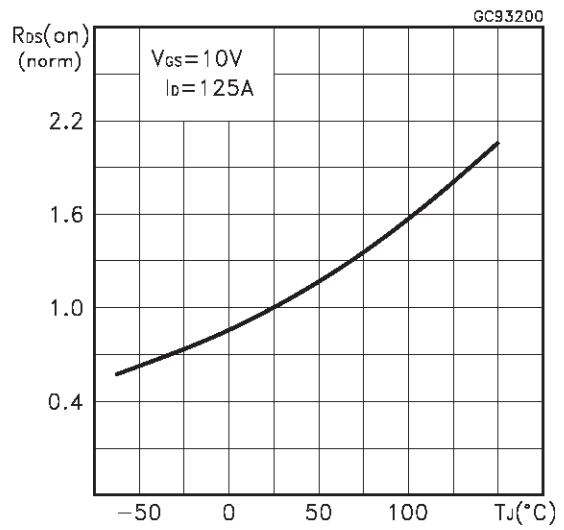
Capacitance Variations



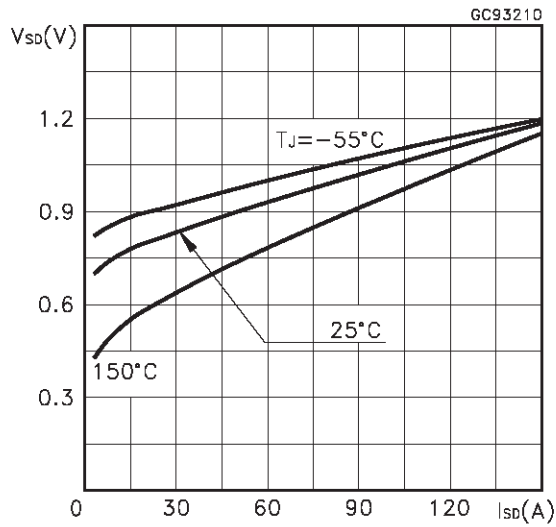
Normalized Gate Threshold Voltage vs Temperature



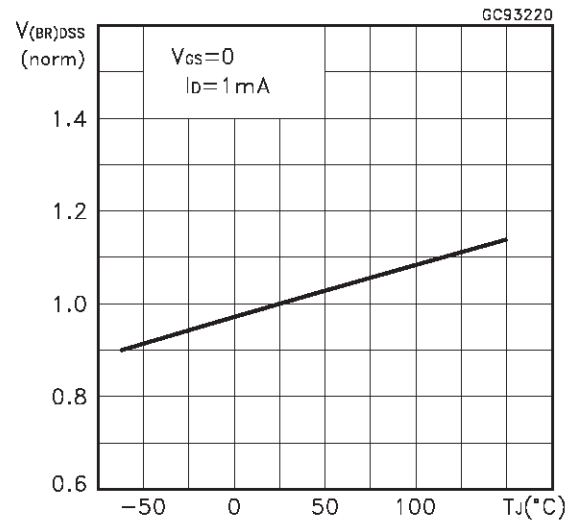
Normalized on Resistance vs Temperature



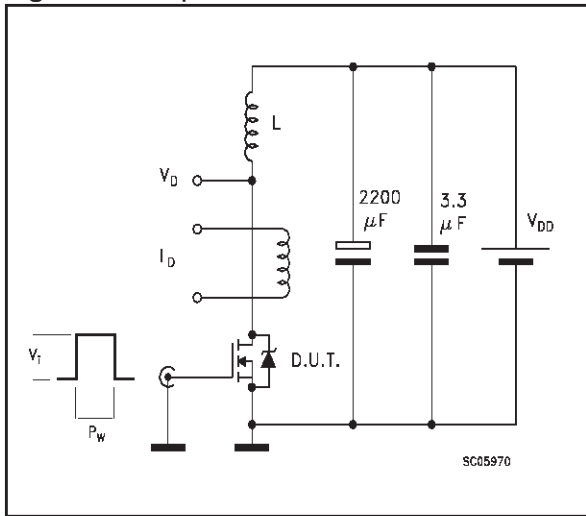
Source-drain Diode Forward Characteristics



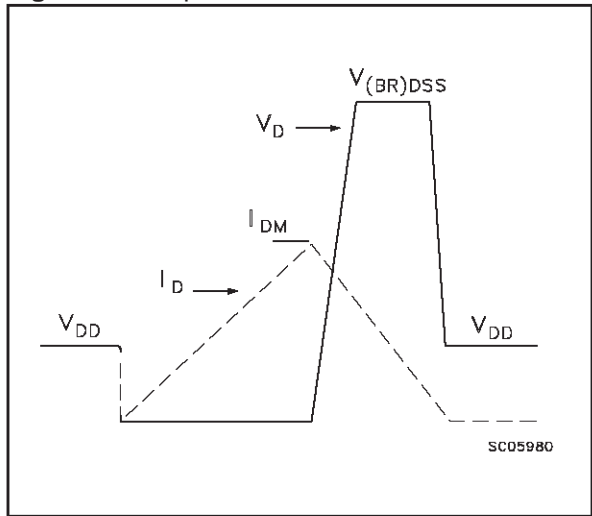
Normalized Breakdown Voltage vs Temperature.



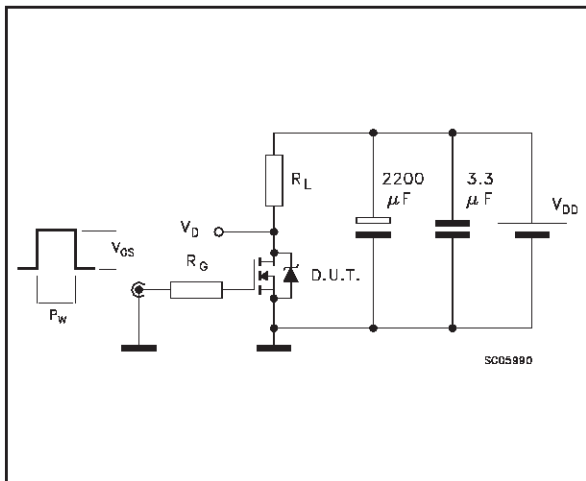
**Fig. 1: Unclamped Inductive Load Test Circuit**



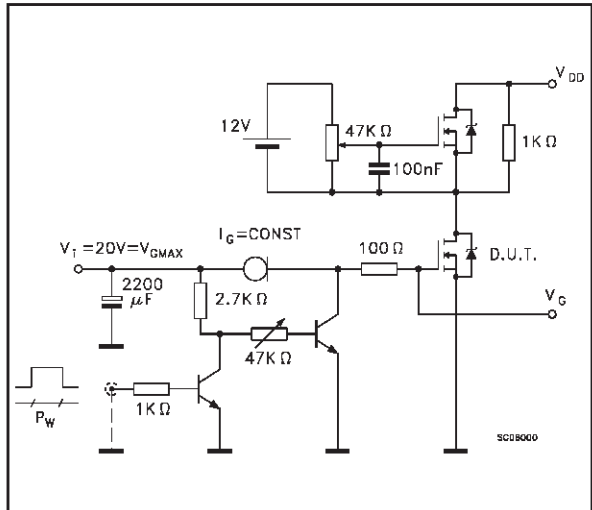
**Fig. 2: Unclamped Inductive Waveform**



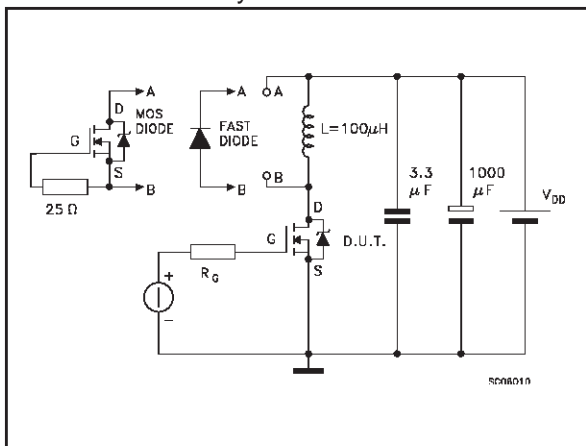
**Fig. 3: Switching Times Test Circuits For Resistive Load**



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

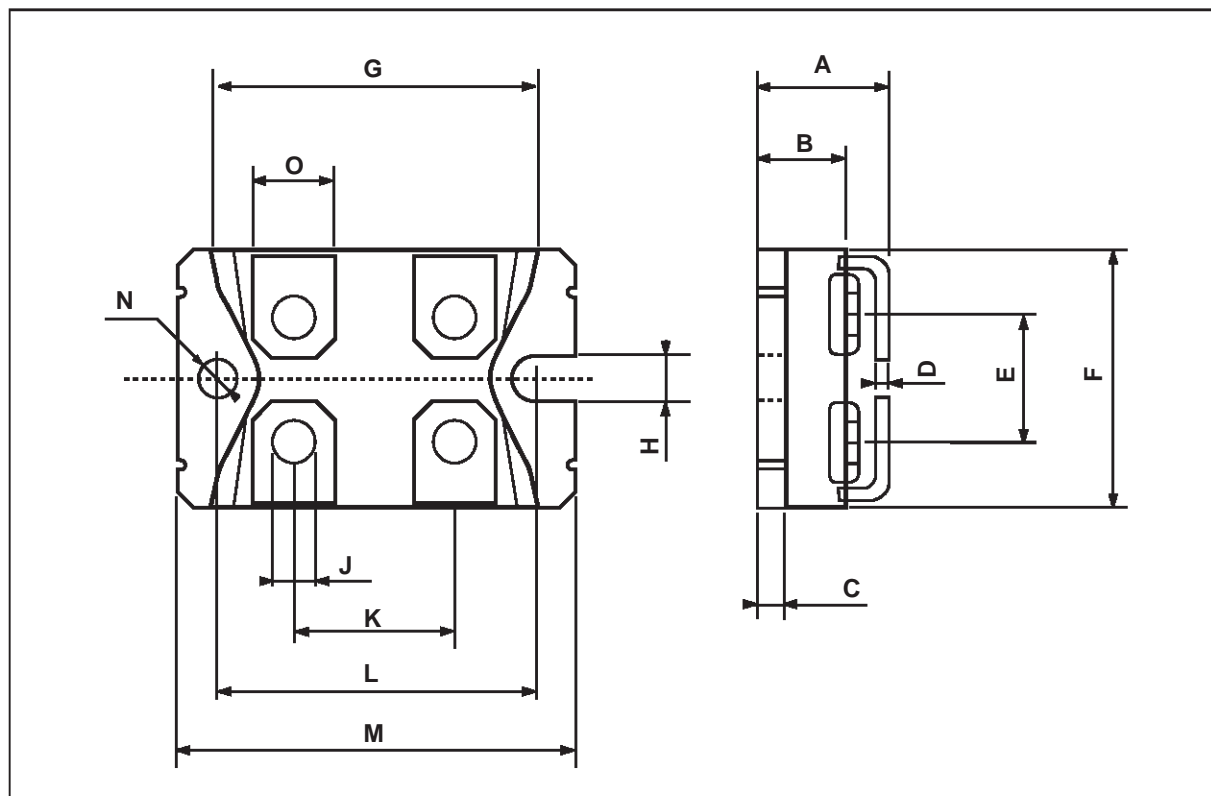


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



## ISOTOP MECHANICAL DATA

| DIM. | mm    |      |      | inch  |      |       |
|------|-------|------|------|-------|------|-------|
|      | MIN.  | TYP. | MAX. | MIN.  | TYP. | MAX.  |
| A    | 11.8  |      | 12.2 | 0.466 |      | 0.480 |
| B    | 8.9   |      | 9.1  | 0.350 |      | 0.358 |
| C    | 1.95  |      | 2.05 | 0.076 |      | 0.080 |
| D    | 0.75  |      | 0.85 | 0.029 |      | 0.033 |
| E    | 12.6  |      | 12.8 | 0.496 |      | 0.503 |
| F    | 25.15 |      | 25.5 | 0.990 |      | 1.003 |
| G    | 31.5  |      | 31.7 | 1.240 |      | 1.248 |
| H    | 4     |      |      | 0.157 |      |       |
| J    | 4.1   |      | 4.3  | 0.161 |      | 0.169 |
| K    | 14.9  |      | 15.1 | 0.586 |      | 0.594 |
| L    | 30.1  |      | 30.3 | 1.185 |      | 1.193 |
| M    | 37.8  |      | 38.2 | 1.488 |      | 1.503 |
| N    | 4     |      |      | 0.157 |      |       |
| O    | 7.8   |      | 8.2  | 0.307 |      | 0.322 |



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