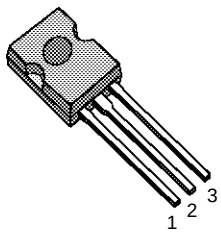
SGS-THOMSON MICROELECTRONICS

# STK12N05L
# STK12N06L

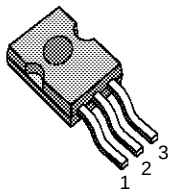
## N - CHANNEL ENHANCEMENT MODE LOW THRESHOLD POWER MOS TRANSISTOR

| TYPE | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STK12N05L | 50 V | < 0.15 Ω | 12 A |
| STK12N06L | 60 V | < 0.15 Ω | 12 A |

- TYPICAL $R_{DS(on)}$ = 0.115 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- LOGIC LEVEL COMPATIBLE INPUT
- 175°C OPERATING TEMPERATURE FOR STANDARD PACKAGE
- APPLICATION ORIENTED CHARACTERIZATION




**SOT-82**

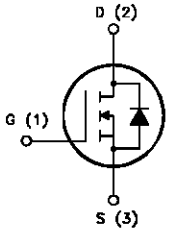



**SOT-194 (option)**

### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- REGULATORS
- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- AUTOMOTIVE ENVIRONMENT (INJECTION, ABS, AIR-BAG, LAMPDRIVERS, Etc.)

### INTERNAL SCHEMATIC DIAGRAM




### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | STK12N05L | STK12N06L | |
| $V_{DS}$ | Drain-source Voltage ($V_{GS}$ = 0) | 50 | 60 | V |
| $V_{DGR}$ | Drain- gate Voltage ($R_{GS}$ = 20 kΩ) | 50 | 60 | V |
| $V_{GS}$ | Gate-source Voltage | ± 15 | | V |
| $I_D$ | Drain Current (continuous) at $T_c$ = 25 °C | 12 | | A |
| $I_D$ | Drain Current (continuous) at $T_c$ = 100 °C | 8 | | A |
| $I_{DM}$(•) | Drain Current (pulsed) | 48 | | A |
| $P_{tot}$ | Total Dissipation at $T_c$ = 25 °C | 50 | | W |
| | Derating Factor | 0.33 | | W/°C |
| $T_{stg}$ | Storage Temperature | -65 to 175 | | °C |
| $T_j$ | Max. Operating Junction Temperature | 175 | | °C |

(•) Pulse width limited by safe operating area

## THERMAL DATA

| | | | | |
|---|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal Resistance Junction-case | Max | 3 | °C/W |
| $R_{thj\text{-}amb}$ | Thermal Resistance Junction-ambient | Max | 80 | °C/W |
| $R_{thj\text{-}amb}$ | Thermal Resistance Case-sink | Typ | 0.7 | °C/W |
| $T_l$ | Maximum Lead Temperature For Soldering Purpose | | 275 | °C |

## AVALANCHE CHARACTERISTICS

| Symbol | Parameter | Max Value | Unit |
|---|---|---|---|
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max, $\delta < 1\%$) | 12 | A |
| $E_{AS}$ | Single Pulse Avalanche Energy (starting $T_j = 25\ ^oC$, $I_D = I_{AR}$, $V_{DD} = 25$ V) | 30 | mJ |
| $E_{AR}$ | Repetitive Avalanche Energy (pulse width limited by $T_j$ max, $\delta < 1\%$) | 7 | mJ |
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\ ^oC$, pulse width limited by $T_j$ max, $\delta < 1\%$) | 8 | A |

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

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage | $I_D = 250\ \mu A$ $V_{GS} = 0$ for **STK12N05L** | 50 | | | V |
| | | for **STK12N06L** | 60 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current ($V_{GS} = 0$) | $V_{DS}$ = Max Rating | | | 1 | µA |
| | | $V_{DS}$ = Max Rating x 0.8 $T_c = 125\ ^oC$ | | | 10 | µA |
| $I_{GSS}$ | Gate-body Leakage Current ($V_{DS} = 0$) | $V_{GS} = \pm 15$ V | | | ± 100 | nA |

ON (*)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}$ $I_D = 250\ \mu A$ | 1 | 1.6 | 2.5 | V |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS} = 5$ V $I_D = 6$ A | | 0.115 | 0.15 | Ω |
| $I_{D(on)}$ | On State Drain Current | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10$ V | 15 | | | A |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (*) | Forward Transconductance | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 6$ A | 4 | 8 | | S |
| $C_{iss}$ | Input Capacitance | $V_{DS} = 25$ V f = 1 MHz $V_{GS} = 0$ | | 350 | 500 | pF |
| $C_{oss}$ | Output Capacitance | | | 150 | 200 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 50 | 80 | pF |

**ELECTRICAL CHARACTERISTICS** (continued)

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$<br>$t_r$ | Turn-on Time<br>Rise Time | $V_{DD}$ = 25 V $I_D$ = 6 A<br>$R_G$ = 50 Ω $V_{GS}$ = 5 V<br>(see test circuit, figure 3) | | 55<br>180 | 80<br>260 | ns<br>ns |
| $(di/dt)_{on}$ | Turn-on Current Slope | $V_{DD}$ = 40 V $I_D$ = 12 A<br>$R_G$ = 50 Ω $V_{GS}$ = 5 V<br>(see test circuit, figure 5) | | 120 | | A/µs |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD}$ = 40 V $I_D$ = 12 A $V_{GS}$ = 5 V | | 12<br>6<br>4 | 18 | nC<br>nC<br>nC |

SWITCHING OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{r(Voff)}$<br>$t_f$<br>$t_c$ | Off-voltage Rise Time<br>Fall Time<br>Cross-over Time | $V_{DD}$ = 40 V $I_D$ = 12 A<br>$R_G$ = 50 Ω $V_{GS}$ = 5 V<br>(see test circuit, figure 5) | | 40<br>60<br>110 | 60<br>90<br>160 | ns<br>ns<br>ns |

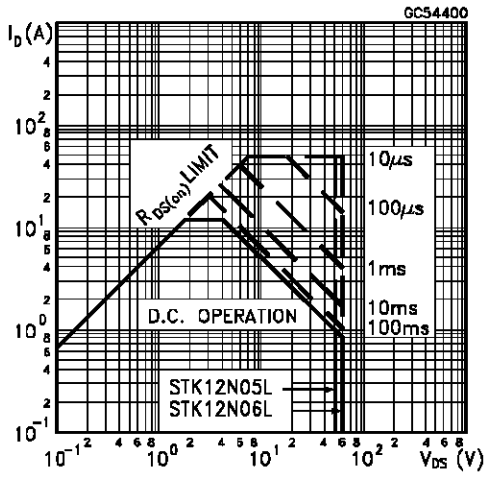
SOURCE DRAIN DIODE

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$<br>$I_{SDM}$(•) | Source-drain Current<br>Source-drain Current (pulsed) | | | | 12<br>48 | A<br>A |
| $V_{SD}$ (*) | Forward On Voltage | $I_{SD}$ = 12 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 | $I_{SD}$ = 12 A di/dt = 100 A/µs<br>$V_{DD}$ = 25 V $T_j$ = 150 °C<br>(see test circuit, figure 5) | | 75<br>0.15<br>4 | | ns<br>µC<br>A |

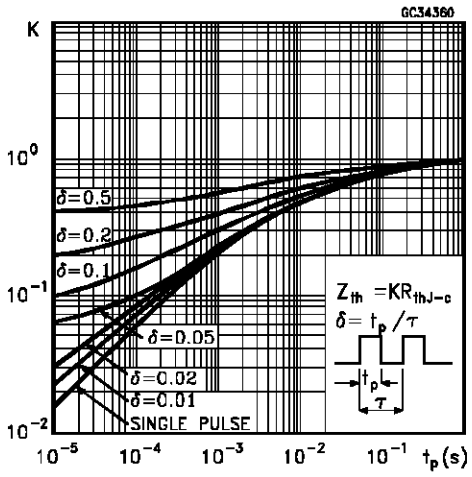
(*) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

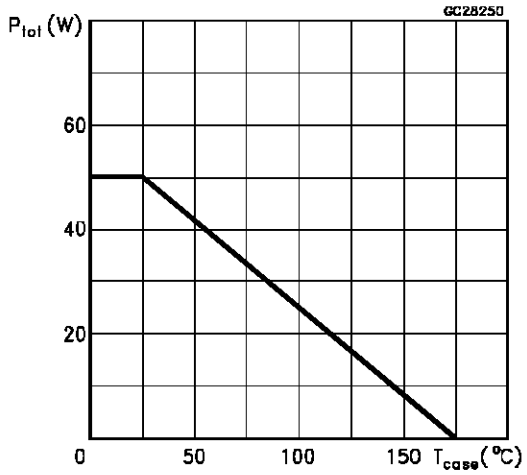
Safe Operating Areas



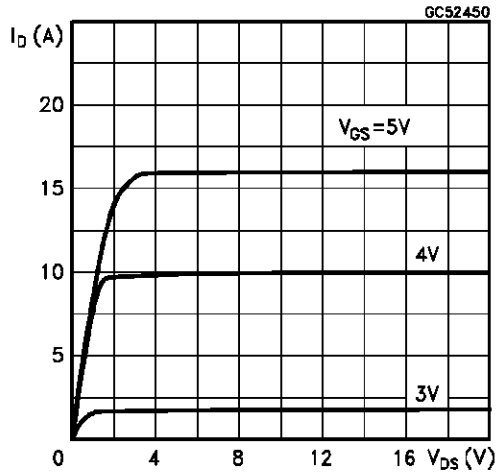

Thermal Impedance



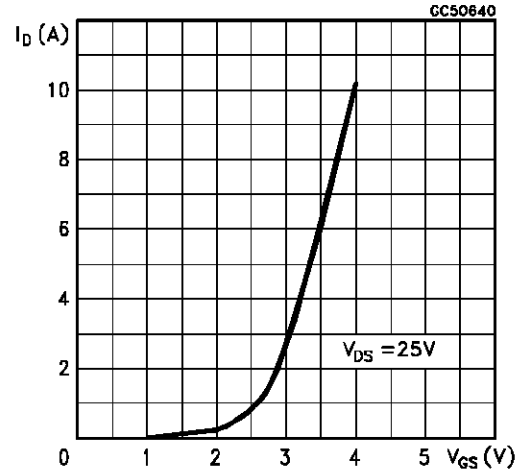
Derating Curve



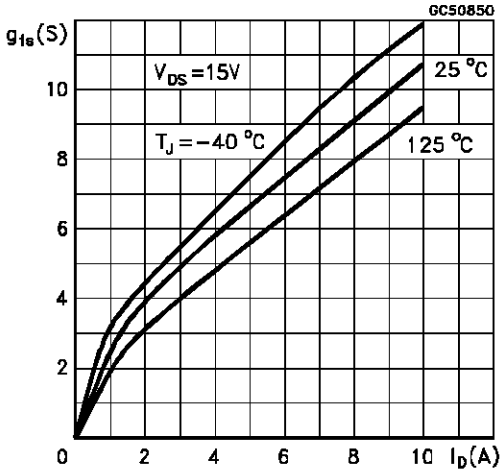

Output Characteristics



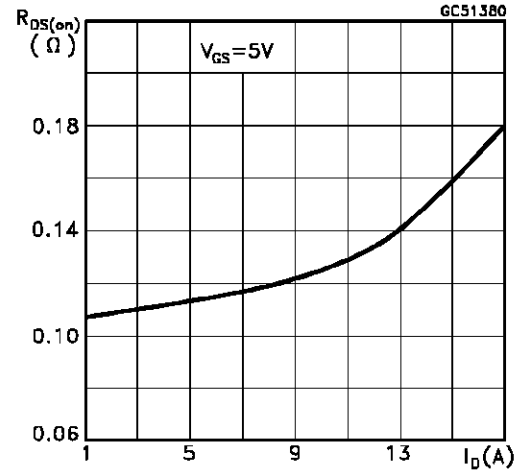

Transfer Characteristics



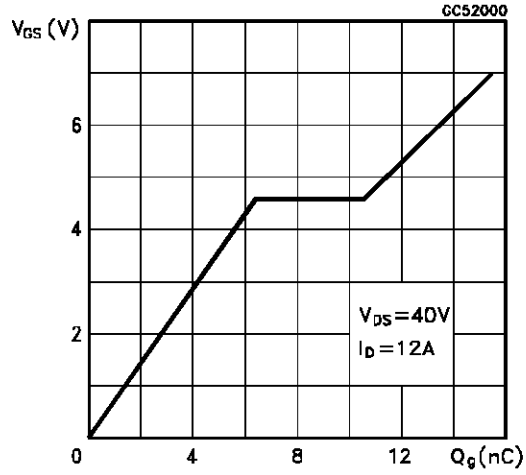

Transconductance



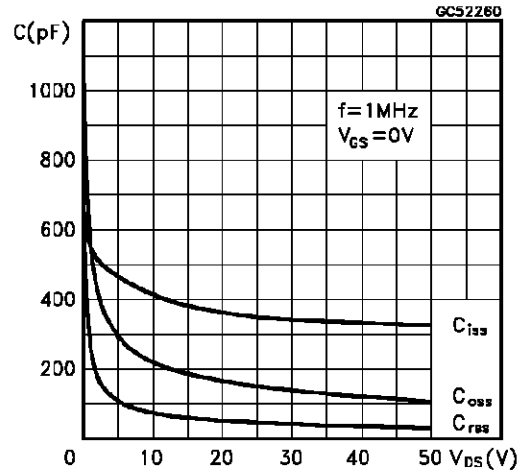

Static Drain-source On Resistance



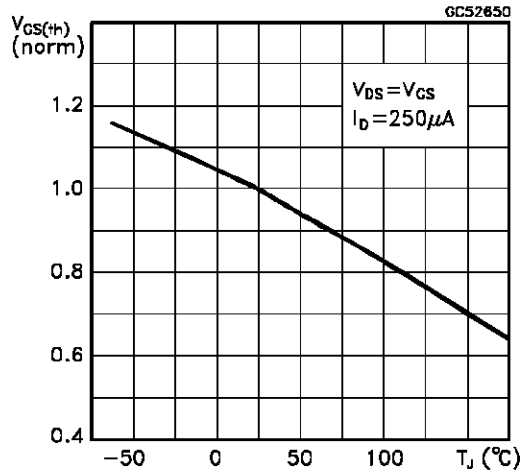

Gate Charge vs Gate-source Voltage



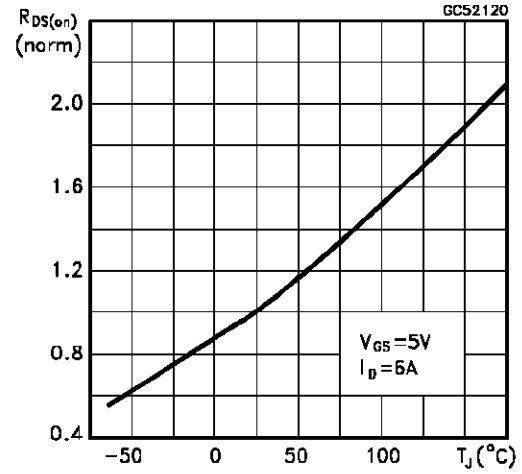
Capacitance Variations



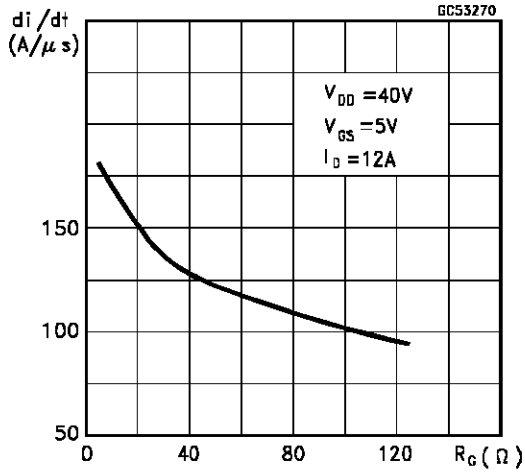

Normalized Gate Threshold Voltage vs Temperature



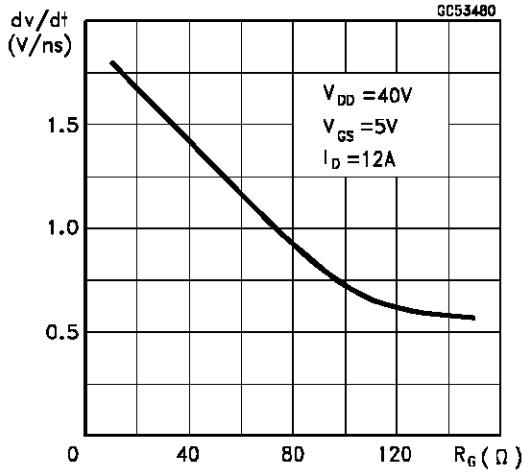

Normalized On Resistance vs Temperature



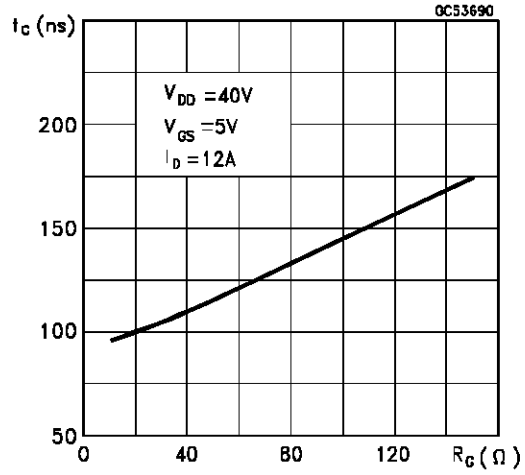

Turn-on Current Slope



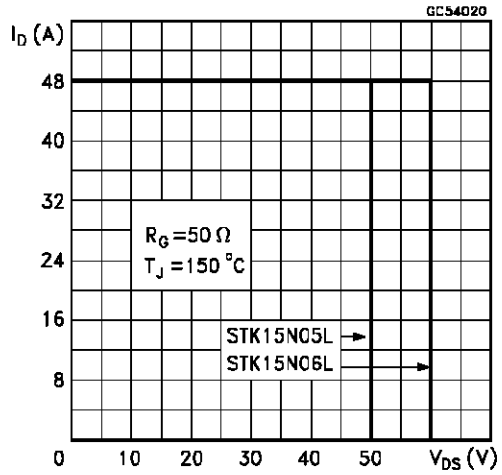

Turn-off Drain-source Voltage Slope



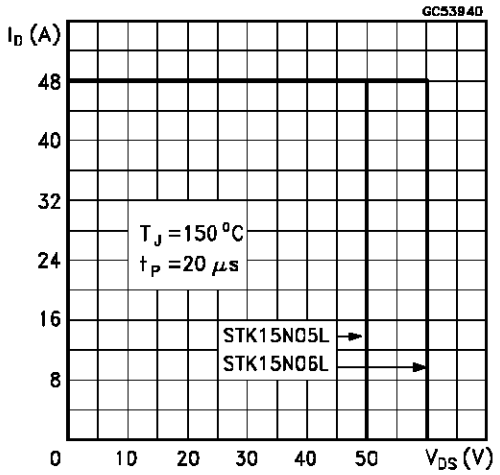

Cross-over Time



Switching Safe Operating Area




Accidental Overload Area




Source-drain Diode Forward Characteristics

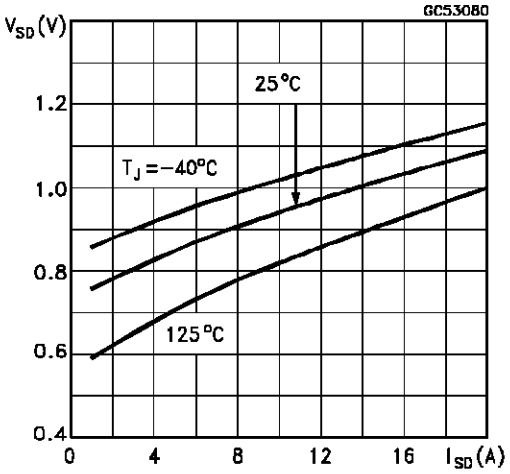



**Fig. 1:** Unclamped Inductive Load Test Circuits

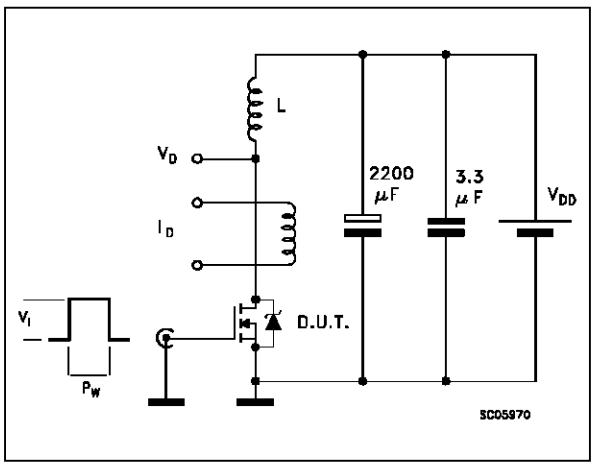



**Fig. 2:** Unclamped Inductive Waveforms

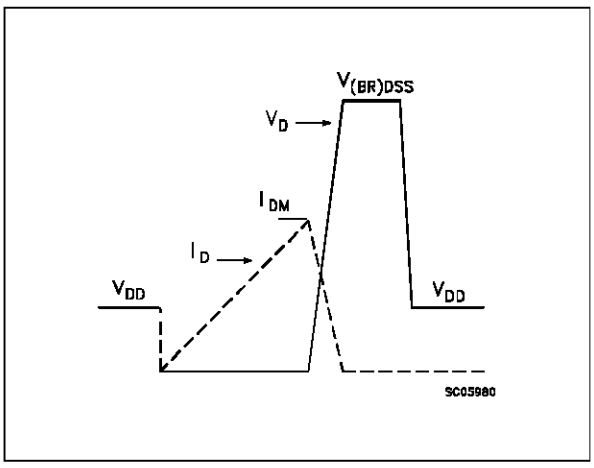


**Fig. 3:** Switching Times Test Circuits For Resistive Load

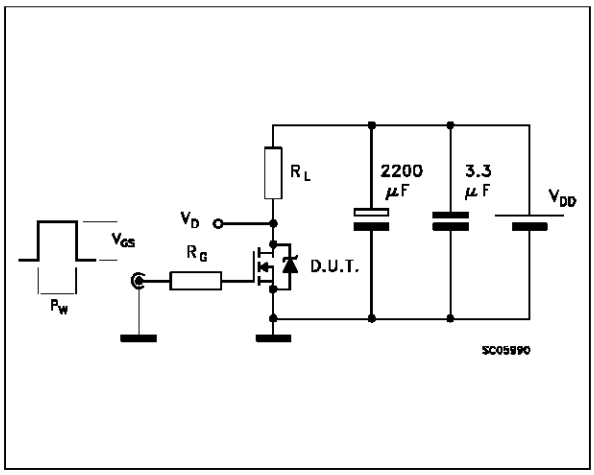



**Fig. 4:** Gate Charge Test Circuit

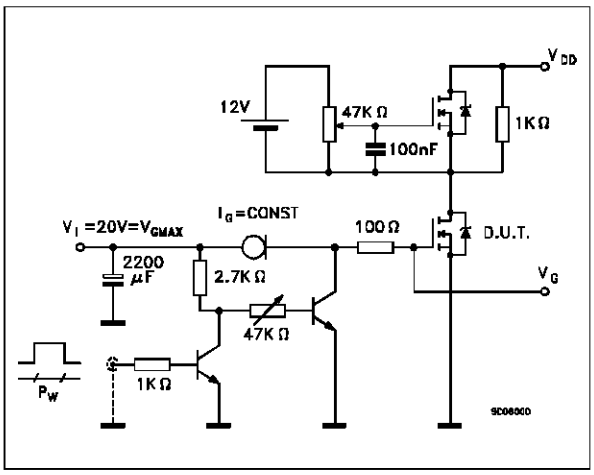
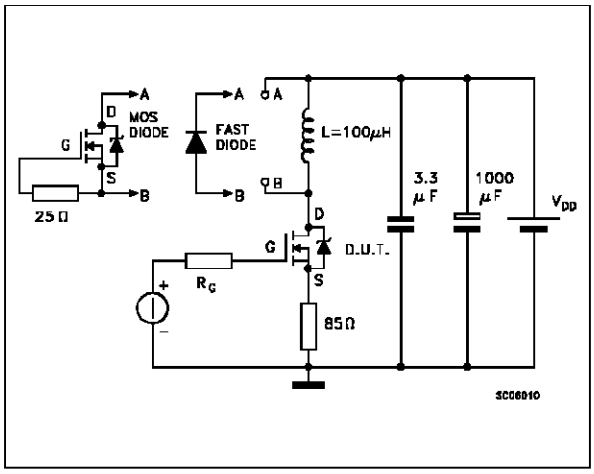
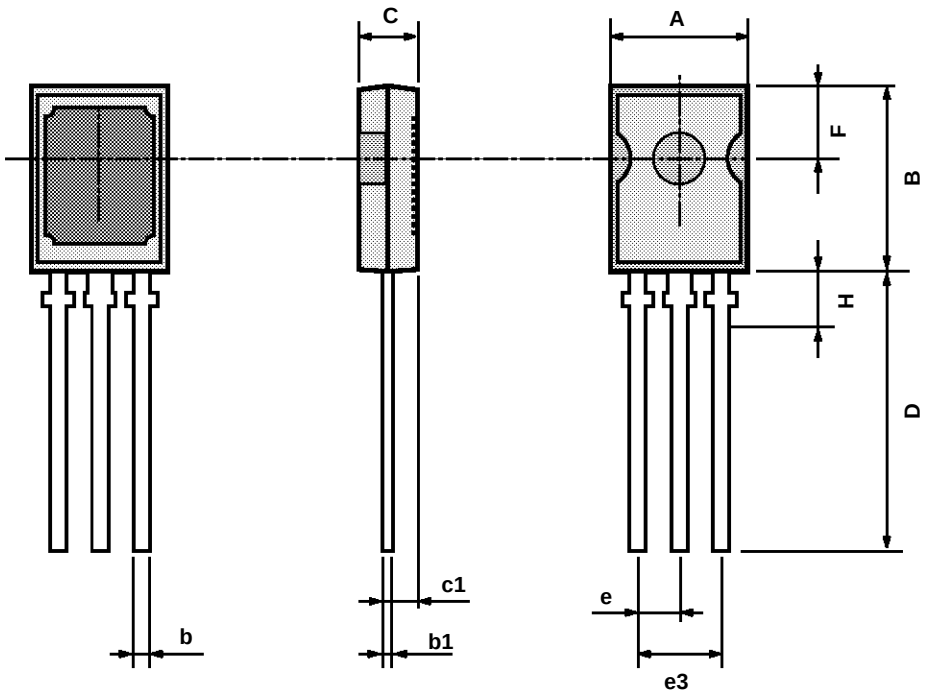



**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Reverse Recovery Time



## SOT-82 MECHANICAL DATA

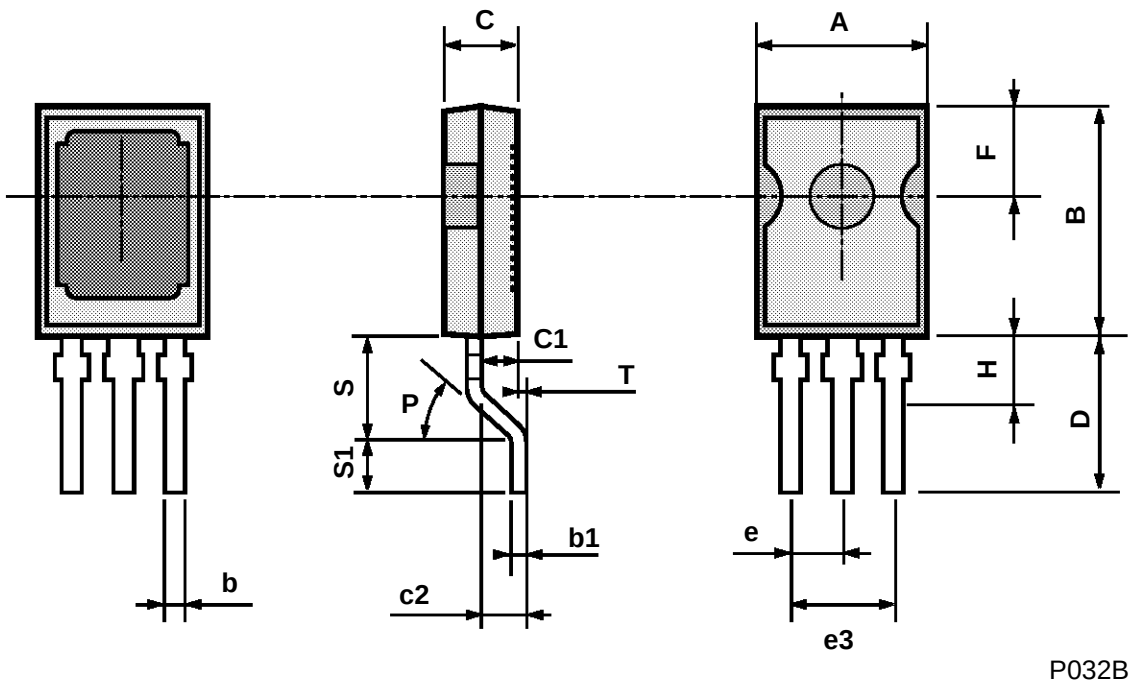
| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 7.4 | | 7.8 | 0.291 | | 0.307 |
| B | 10.5 | | 11.3 | 0.413 | | 0.445 |
| b | 0.7 | | 0.9 | 0.028 | | 0.035 |
| b1 | 0.49 | | 0.75 | 0.019 | | 0.030 |
| C | 2.4 | | 2.7 | 0.04 | | 0.106 |
| c1 | | 1.2 | | | 0.047 | |
| D | | 15.7 | | | 0.618 | |
| e | | 2.2 | | | 0.087 | |
| e3 | | 4.4 | | | 0.173 | |
| F | | 3.8 | | | 0.150 | |
| H | | | 2.54 | | 0.100 | |




P032A

## SOT-194 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 7.4 | | 7.8 | 0.291 | | 0.307 |
| B | 10.5 | | 11.3 | 0.413 | | 0.445 |
| b | 0.7 | | 0.9 | 0.028 | | 0.035 |
| b1 | 0.49 | | 0.75 | 0.019 | | 0.030 |
| C | 2.4 | | 2.7 | 0.094 | | 0.106 |
| c1 | | 1.2 | | | 0.047 | |
| c2 | | 1.3 | | | 0.051 | |
| D | | 6 | | | 0.236 | |
| e | | 2.2 | | | 0.087 | |
| e3 | | 4.4 | | | 0.173 | |
| F | | 3.8 | | | 0.150 | |
| H | | | 2.54 | | | 0.100 |
| P | 45° (typ.) | | | | | |
| S | | 4 | | | 0.157 | |
| S1 | | 2 | | | 0.079 | |
| T | | 0.1 | | | 0.004 | |




P032B