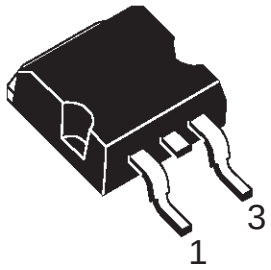
# STGB10NB37LZ

## N-CHANNEL CLAMPED 10A - D PAK
## INTERNALLY CLAMPED PowerMesh™ IGBT

| TYPE | $V_{CES}$ | $V_{CE(sat)}$ | $I_C$ |
|---|---|---|---|
| STGB10NB37LZ | CLAMPED | < 1.8 V | 10 A |

- POLYSILICON GATE VOLTAGE DRIVEN
- LOW THRESHOLD VOLTAGE
- LOW ON-VOLTAGE DROP
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- HIGH VOLTAGE CLAMPING FEATURE
- SURFACE-MOUNTING D PAK (TO-263) POWER PACKAGE IN TUBE (NO SUFFIX) OR IN TAPE & REEL (SUFFIX "T4")

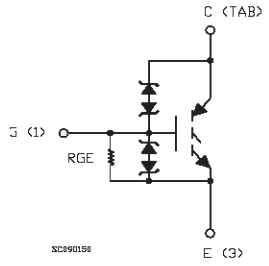



**D PAK**

### DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The built in collector-gate zener exhibits a very precise active clamping while the gate-emitter zener supplies an ESD protection.

### INTERNAL SCHEMATIC DIAGRAM




### APPLICATIONS

- AUTOMOTIVE IGNITION

### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage ($V_{GS}$ = 0) | CLAMPED | V |
| $V_{ECR}$ | Reverse Battery Protection | 18 | V |
| $V_{GE}$ | Gate-Emitter Voltage | CLAMPED | V |
| $I_C$ | Collector Current (continuos) at $T_C$ = 25°C | 20 | A |
| $I_C$ | Collector Current (continuos) at $T_C$ = 100°C | 20 | A |
| $I_{CM}$ (•) | Collector Current (pulsed) | 60 | A |
| $P_{TOT}$ | Total Dissipation at $T_C$ = 25°C | 125 | W |
| | Derating Factor | 0.83 | W/°C |
| $E_{SD}$ | ESD (Human Body Model) | 4 | KV |
| $T_{stg}$ | Storage Temperature | –65 to 175 | °C |
| $T_j$ | Max. Operating Junction Temperature | 175 | °C |

(•)Pulse width limited by safe operating area

## THERMAL DATA

| | | | |
|---|---|---|---|
| Rthj-case | Thermal Resistance Junction-case Max | 1.2 | °C/W |
| Rthj-amb | Thermal Resistance Junction-ambient Max | 62.5 | °C/W |
| Rthc-sink | Thermal Resistance Case-sink Typ | 0.2 | °C/W |

## ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $BV_{(CES)}$ | Clamped Voltage | $I_C$ = 2 mA, $V_{GE}$ = 0, Tj= - 40°C to 150°C | 375 | 400 | 425 | V |
| $BV_{(ECR)}$ | Emitter Collector Break-down Voltage | $I_{EC}$ = 75 mA, $V_{GE}$ = 0, Tj= - 40°C to 150°C | 18 | | | V |
| $BV_{GE}$ | Gate Emitter Break-down Voltage | $I_G$ = ± 2 mA Tj= - 40°C to 150°C | 12 | | 16 | V |
| $I_{CES}$ | Collector cut-off Current ($V_{GE}$ = 0) | $V_{CE}$ = 15 V, $V_{GE}$ =0 ,$T_j$ =150 °C | | | 10 | µA |
| | | $V_{CE}$ =200 V, $V_{GE}$=0 ,$T_C$ =150°C | | | 100 | µA |
| $I_{GES}$ | Gate-Emitter Leakage Current ($V_{CE}$ = 0) | $V_{GE}$ = ± 10V , $V_{CE}$ = 0 | | | ± 700 | µA |
| $R_{GE}$ | Gate Emitter Resistance | | | 20 | | KΩ |

ON (1)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{GE(th)}$ | Gate Threshold Voltage | $V_{CE}$ = $V_{GE}$, $I_C$ = 250µA, Tj= - 40°C to 150°C | 0.6 | | 2.4 | V |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | $V_{GE}$ =4.5V, $I_C$ = 10 A, Tj= 25°C | | 1.2 | 1.8 | V |
| | | $V_{GE}$ =4.5V, $I_C$ = 10 A, Tc= -40°C | | 1.3 | | V |
| $I_C$ | Collector Current | $V_{GE}$ = 4.5V, $V_{CE}$ = 9 V | 20 | | | A |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ | Forward Transconductance | $V_{CE}$ = 25 V , $I_C$ =20 A | 10 | 18 | | S |
| $C_{ies}$ | Input Capacitance | $V_{CE}$ = 25V, f = 1 MHz, $V_{GE}$ = 0 | | 1250 | 1700 | pF |
| $C_{oes}$ | Output Capacitance | | | 103 | 140 | pF |
| $C_{res}$ | Reverse Transfer Capacitance | | | 18 | 28 | pF |
| $Q_g$ | Gate Charge | $V_{CE}$ = 320V, $I_C$ = 10 A, $V_{GE}$ = 5V | | 28 | | nC |

FUNCTIONAL CHARACTERISTICS

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_L$ | Latching Current | $V_{Clamp}$ = 320 V, $T_C$ = 125 °C<br>$R_{GOFF}$ = 1KΩ , $V_{GE}$ = 5 V | 20 | | | A |
| U.I.S. | Unclamped Inductive Switching Current | $R_{GOFF}$ = 1KΩ , L = 200 µH ,<br>Tj= 125°C | 15 | | | A |
| | Functional Test | $R_{GOFF}$ =1KΩ , L = 3mH ,<br>$T_{start}$ = 55°C | 12 | | | A |
| $E_{AS}$ | Single Pulse Avalanche Energy | $T_{start}$ = 55°C<br>$T_{start}$ = 150°C | | | 215<br>150 | mJ<br>mJ |
| $E_{AR}$ | Repetitive Avalanche Energy | $T_c$= 125°C duty cycle <1%<br>Pulse with limited by $T_{jMAX}$ | | | 10 | mJ |

SWITCHING ON

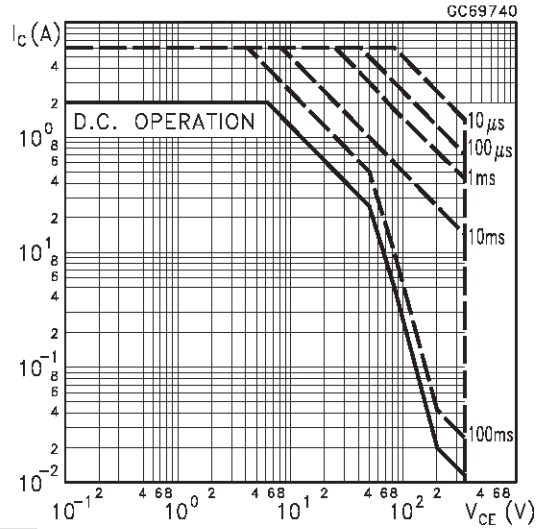
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CC}$ = 320 V, $I_C$ = 10 A<br>$R_G$ = 1KΩ , $V_{GE}$ = 5 V | | 520 | | ns |
| $t_r$ | Rise Time | | | 340 | | ns |
| $(di/dt)_{on}$ | Turn-on Current Slope | $V_{CC}$= 320 V, $I_C$ = 10 A<br>$R_G$=1KΩ, $V_{GE}$ = 5 V | | 17 | | A/µs |
| Eon | Turn-on Switching Losses | | | 180 | | µJ |

SWITCHING OFF

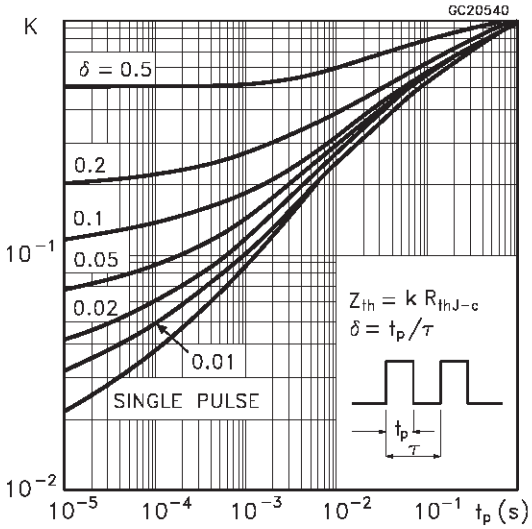
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_c$ | Cross-over Time | $V_{clamp}$ = 320 V, $I_C$ = 10 A,<br>$R_{GE}$ = 1K Ω , $V_{GE}$ = 5 V | | 4 | | µs |
| $t_r(V_{off})$ | Off Voltage Rise Time | | | 2.2 | | µs |
| $t_{d(off)}$ | Delay Time | | | 14.8 | | µs |
| $t_f$ | Fall Time | | | 1.5 | | µs |
| $E_{off}$(**) | Turn-off Switching Loss | | | 4.0 | | mJ |
| $t_c$ | Cross-over Time | $V_{clamp}$ = 320 V, $I_C$ = 10 A,<br>$R_{GE}$ = 1KΩ , $V_{GE}$ = 5 V<br>Tj = 125 °C | | 5.2 | | µs |
| $t_r(V_{off})$ | Off Voltage Rise Time | | | 2.8 | | µs |
| $t_{d(off)}$ | Delay Time | | | 15.8 | | µs |
| $t_f$ | Fall Time | | | 2 | | µs |
| $E_{off}$(**) | Turn-off Switching Loss | | | 6.5 | | mJ |

(●)Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %. (1)Pulse width limited by max. junction temperature. (**)Losses Include Also the Tail

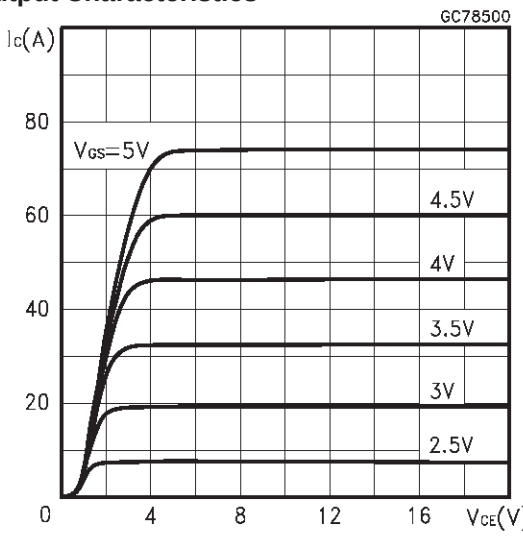
**Safe Operating Area**



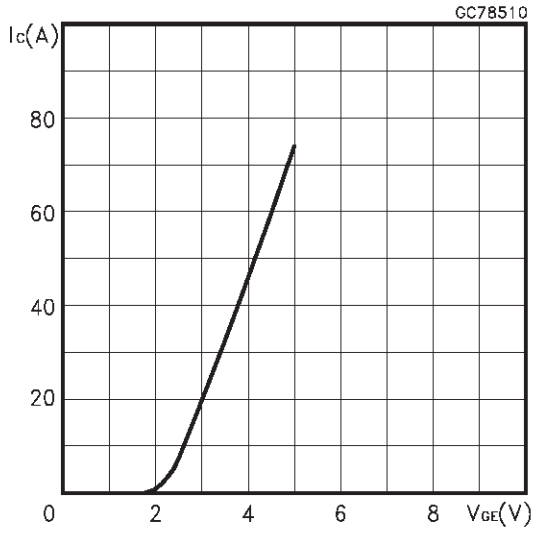

**Thermal Impedance**



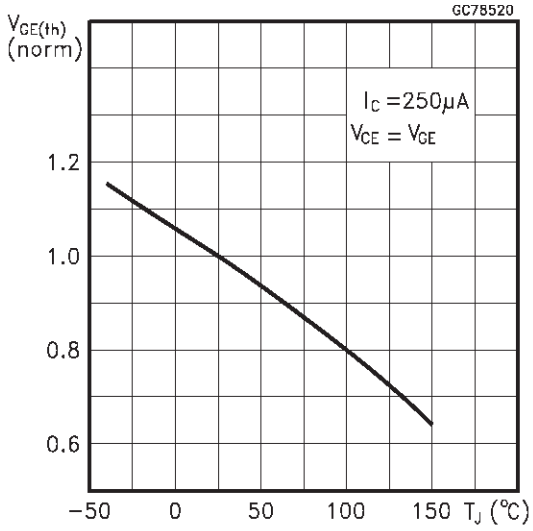
**Output Characteristics**



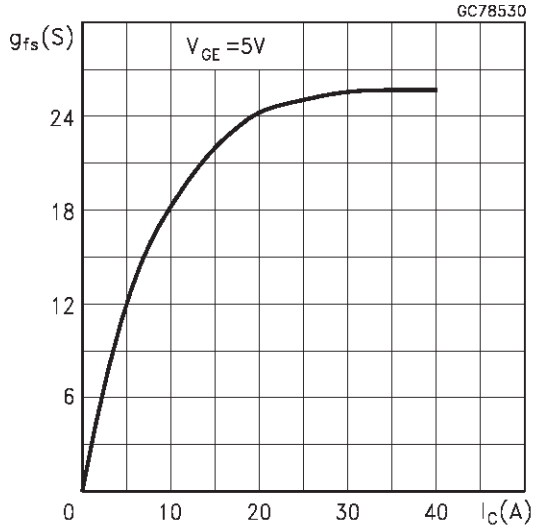

**Transfer Characteristics**



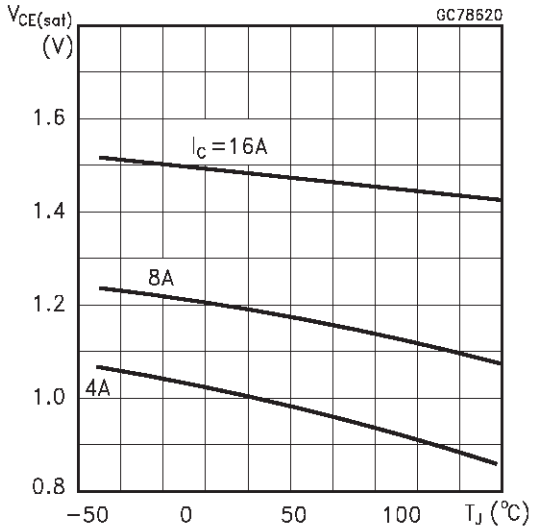

**Normalized Gate Threshold Voltage vs Temp.**



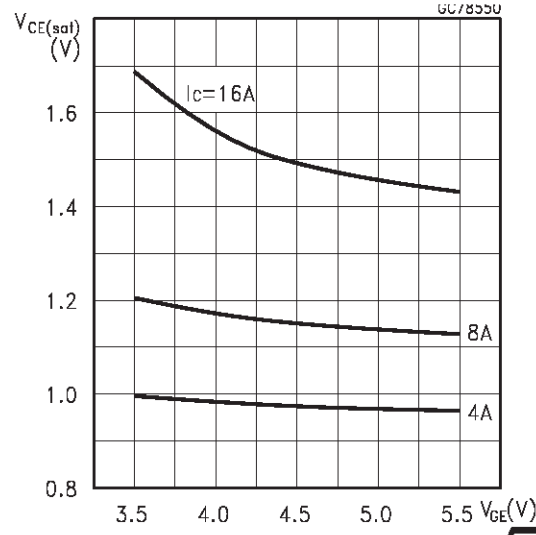

**Transconductance**



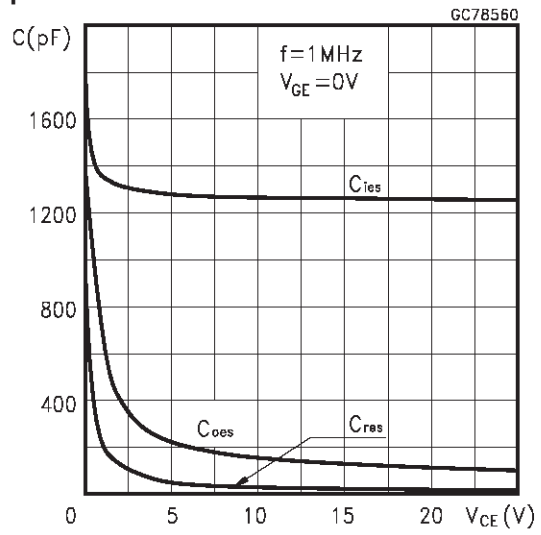

**Collector-Emitter On Voltage vs Temperature**



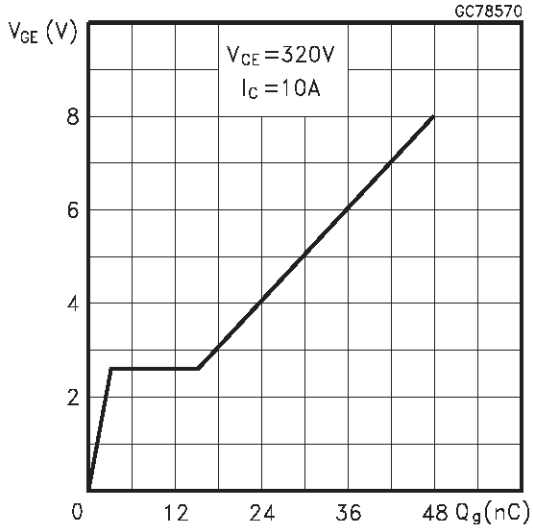

**Collector-Emitter On Voltage vs Gate-Emitter Voltage**



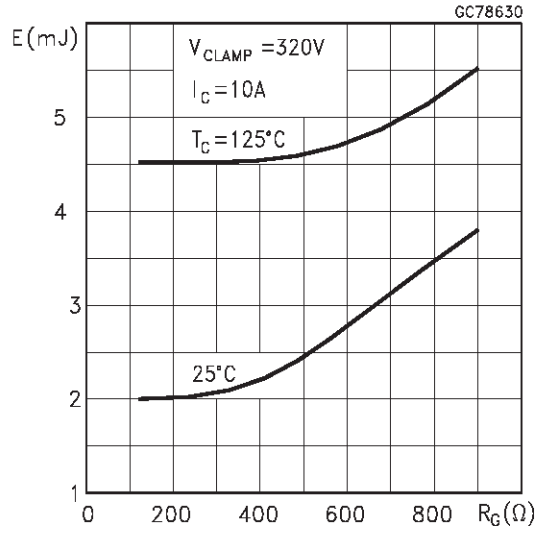
**Capacitance Variations**



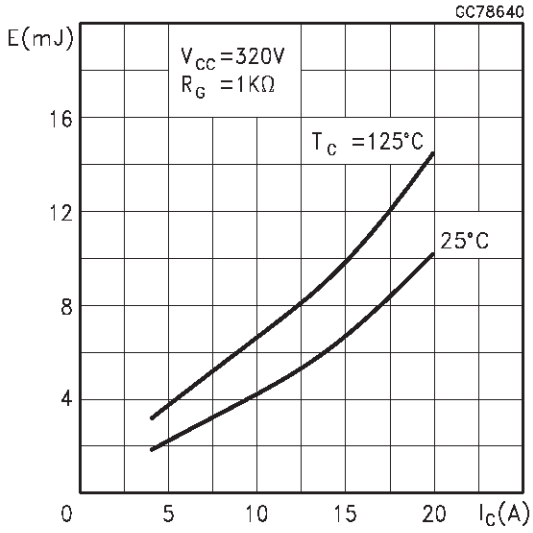

**Gate Charge vs Gate-Emitter Voltage**



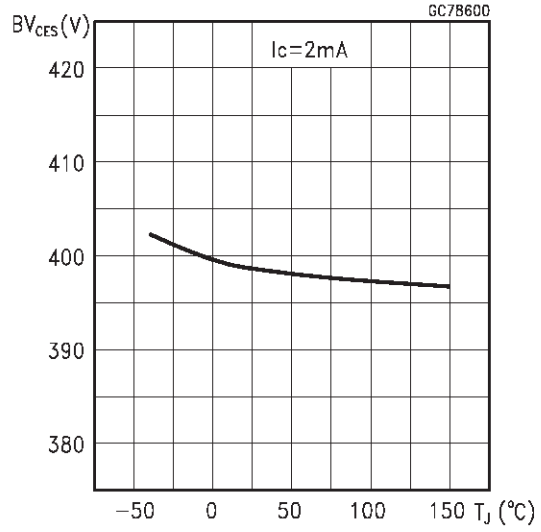

**Off Losses vs Gate Resistance**




**Off Losses vs Collector Current**




**B**reak-down Voltage vs Temperature




**Clamping Voltage vs Gate Resistance**

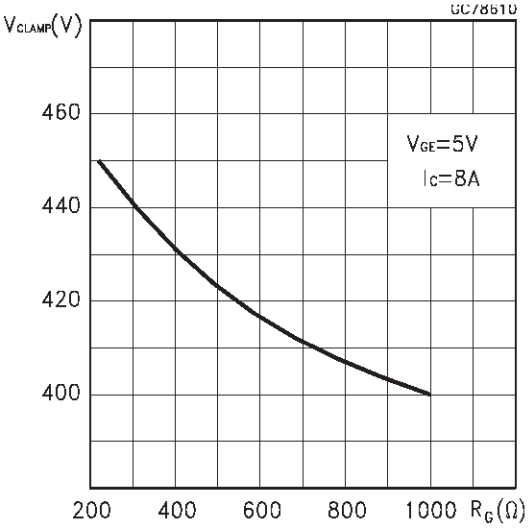


**Fig. 1:** Unclamped Inductive Load Test Circuit

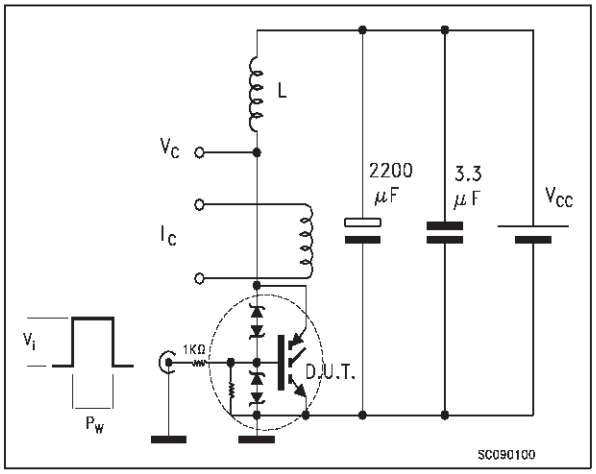



**Fig. 2:** Unclamped Inductive Waveform

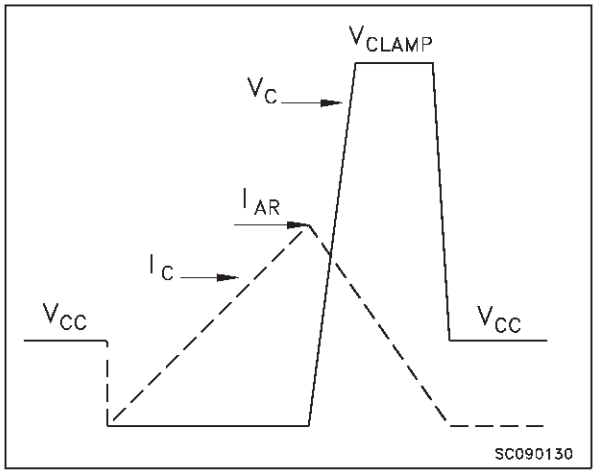



**Fig. 3:** Switching Times Test Circuit For Resistive Load

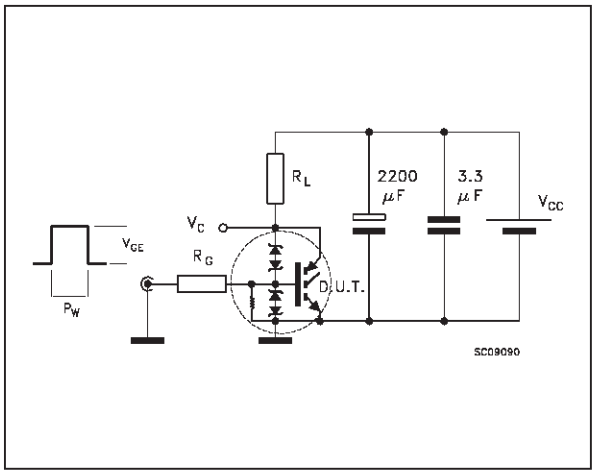



**Fig. 4:** Gate Charge test Circuit

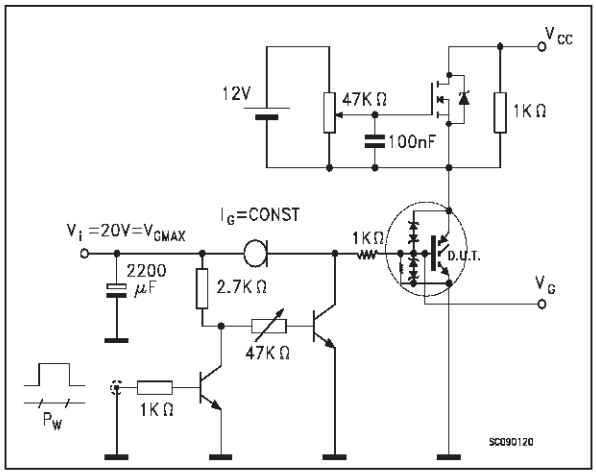
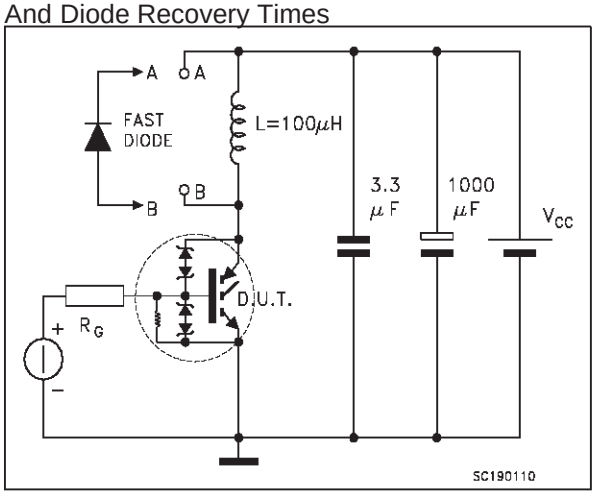



**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Recovery Times



# $D^2PAK$ MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| A1 | 2.49 | | 2.69 | 0.098 | | 0.106 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.7 | | 0.93 | 0.027 | | 0.036 |
| B2 | 1.14 | | 1.7 | 0.044 | | 0.067 |
| C | 0.45 | | 0.6 | 0.017 | | 0.023 |
| C2 | 1.23 | | 1.36 | 0.048 | | 0.053 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| D1 | | 8 | | | 0.315 | |
| E | 10 | | 10.4 | 0.393 | | |
| E1 | | 8.5 | | | 0.334 | |
| G | 4.88 | | 5.28 | 0.192 | | 0.208 |
| L | 15 | | 15.85 | 0.590 | | 0.625 |
| L2 | 1.27 | | 1.4 | 0.050 | | 0.055 |
| L3 | 1.4 | | 1.75 | 0.055 | | 0.068 |
| M | 2.4 | | 3.2 | 0.094 | | 0.126 |
| R | | 0.4 | | | 0.015 | |
| V2 | 0º | | 8º | | | |