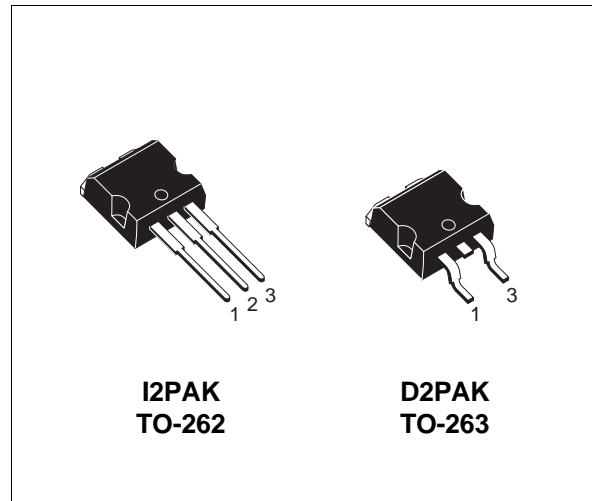


## N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTOR

PRELIMINARY DATA

| TYPE     | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|----------|------------------|---------------------|----------------|
| STB5NA80 | 800 V            | < 2.4 Ω             | 4.7 A          |

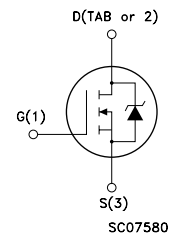
- TYPICAL R<sub>DS(on)</sub> = 1.8 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW GATE CHARGE
- VERY HIGH CURRENT CAPABILITY
- APPLICATION ORIENTED CHARACTERIZATION
- THROUGH-HOLE I2PAK (TO-262) POWER PACKAGE IN TUBE (SUFFIX "-1")
- SURFACE-MOUNTING D2PACK (TO-263) POWER PACKAGE IN TUBE (NO SUFFIX) OR IN TAPE & REEL (SUFFIX "T4")



### 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 |
|---------------------|---|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)            | 800        | V    |
| V <sub>DGR</sub>    | Drain- gate Voltage (R <sub>GS</sub> = 20 kΩ)         | 800        | V    |
| V <sub>GS</sub>     | Gate-source Voltage                                   | ± 30       | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 25 °C  | 4.7        | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 100 °C | 3          | A    |
| I <sub>DM</sub> (•) | Drain Current (pulsed)                                | 19         | A    |
| P <sub>tot</sub>    | Total Dissipation at T <sub>c</sub> = 25 °C           | 125        | W    |
|                     | Derating Factor                                       | 1          | W/°C |
| T <sub>stg</sub>    | Storage Temperature                                   | -65 to 150 | °C   |
| T <sub>j</sub>      | Max. Operating Junction Temperature                   | 150        | °C   |

(•) Pulse width limited by safe operating area

## STB5NA80

### THERMAL DATA

|                       |  |     |      |      |
|-----------------------|--|-----|------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-case               | Max | 1    | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Junction-ambient            | Max | 62.5 | °C/W |
| R <sub>thj-amb</sub>  | Thermal Resistance Case-sink                   | Typ | 0.5  | °C/W |
| T <sub>l</sub>        | Maximum Lead Temperature For Soldering Purpose |     | 300  | °C   |

### 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, δ < 1%)                          | 4.7       | 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> = 25 V)   | 110       | mJ   |
| E <sub>AR</sub> | Repetitive Avalanche Energy (pulse width limited by T <sub>j</sub> max, δ < 1%)  | 4.5       | mJ   |
| I <sub>AR</sub> | Avalanche Current, Repetitive or Not-Repetitive (T <sub>c</sub> = 100 °C, pulse width limited by T <sub>j</sub> max, δ < 1%) | 3         | A    |

### 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  | 800  |      |             | 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 x 0.8 T <sub>c</sub> = 125 °C |      |      | 250<br>1000 | μA<br>μA |
| I <sub>GSS</sub>     | Gate-body Leakage Current (V <sub>DS</sub> = 0)       | V <sub>GS</sub> = ± 30 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  | 2.5  | 3    | 3.75       | V      |
| R <sub>DS(on)</sub> | Static Drain-source On Resistance | V <sub>GS</sub> = 10 V I <sub>D</sub> = 2.5 A<br>V <sub>GS</sub> = 10 V I <sub>D</sub> = 2.5 A T <sub>c</sub> = 100 °C |      | 1.8  | 2.4<br>4.8 | Ω<br>Ω |
| I <sub>D(on)</sub>  | On State Drain Current            | V <sub>DS</sub> > I <sub>D(on)</sub> x R <sub>DS(on)max</sub> V <sub>GS</sub> = 10 V                                   | 4.7  |      |            | A      |

### DYNAMIC

| Symbol              | Parameter                    | Test Conditions  | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|--|------|------|------|------|
| g <sub>fs</sub> (*) | Forward Transconductance     | V <sub>DS</sub> > I <sub>D(on)</sub> x R <sub>DS(on)max</sub> I <sub>D</sub> = 2.5 A | 2.7  | 5.2  |      | S    |
| C <sub>iss</sub>    | Input Capacitance            | V <sub>DS</sub> = 25 V f = 1 MHz V <sub>GS</sub> = 0                                 |      | 1250 | 1700 | pF   |
| C <sub>oss</sub>    | Output Capacitance           |  |      | 140  | 190  | pF   |
| C <sub>rss</sub>    | Reverse Transfer Capacitance |  |      | 35   | 50   | 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                                    | $V_{DD} = 400\text{ V}$<br>$R_G = 4.7\ \Omega$<br>(see test circuit, figure 3)<br>$I_D = 2.5\text{ A}$<br>$V_{GS} = 10\text{ V}$ |      | 40<br>100     | 55<br>135 | ns<br>ns         |
| $(di/dt)_{on}$                | Turn-on Current Slope  | $V_{DD} = 640\text{ V}$<br>$R_G = 47\ \Omega$<br>(see test circuit, figure 5)<br>$I_D = 5\text{ A}$<br>$V_{GS} = 10\text{ V}$    |      | 180           |           | A/ $\mu\text{s}$ |
| $Q_g$<br>$Q_{gs}$<br>$Q_{gd}$ | Total Gate Charge<br>Gate-Source Charge<br>Gate-Drain Charge | $V_{DD} = 640\text{ V}$<br>$I_D = 5\text{ A}$<br>$V_{GS} = 10\text{ V}$  |      | 55<br>8<br>24 | 75        | 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 | $V_{DD} = 640\text{ V}$<br>$R_G = 47\ \Omega$<br>$I_D = 5\text{ A}$<br>$V_{GS} = 10\text{ V}$ |      | 75<br>25<br>110 | 100<br>35<br>150 | ns<br>ns<br>ns |

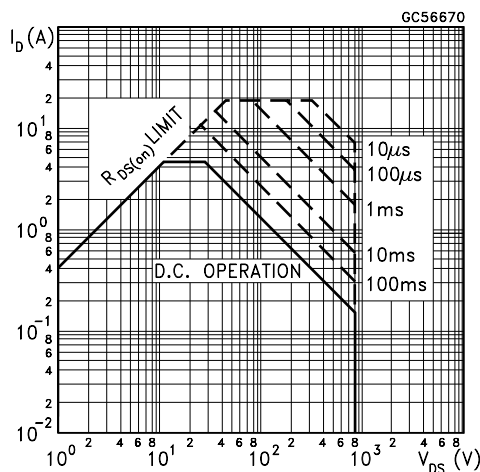
**SOURCE DRAIN DIODE**

| Symbol                            | Parameter  | Test Conditions   | Min. | Typ.              | Max.      | Unit                     |
|-----------------------------------|--|---|------|-------------------|-----------|--------------------------|
| $I_{SD}$<br>$I_{SDM}(\bullet)$    | Source-drain Current<br>Source-drain Current (pulsed)                        |   |      |                   | 4.7<br>19 | A<br>A                   |
| $V_{SD} (*)$                      | Forward On Voltage   | $I_{SD} = 4.7\text{ A}$<br>$V_{GS} = 0$   |      |                   | 1.6       | V                        |
| $t_{rr}$<br>$Q_{rr}$<br>$I_{RRM}$ | Reverse Recovery Time<br>Reverse Recovery Charge<br>Reverse Recovery Current | $I_{SD} = 5\text{ A}$<br>$V_{DD} = 100\text{ V}$<br>$di/dt = 100\text{ A}/\mu\text{s}$<br>$T_j = 150\text{ }^\circ\text{C}$ |      | 800<br>15.2<br>38 |           | ns<br>$\mu\text{C}$<br>A |

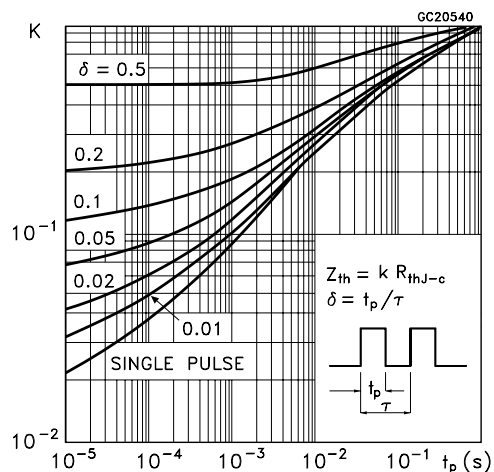
(\*) Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %

(•) Pulse width limited by safe operating area

**Safe Operating Area**

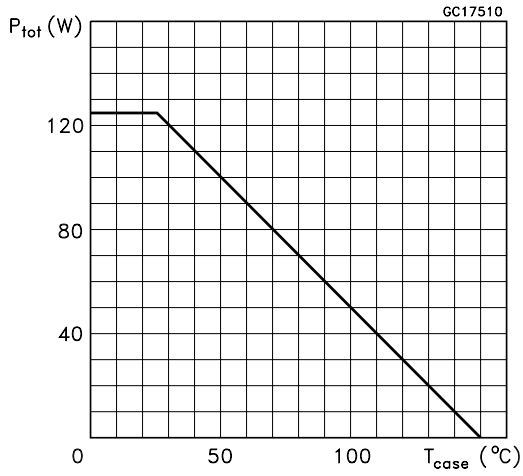


**Thermal Impedance**

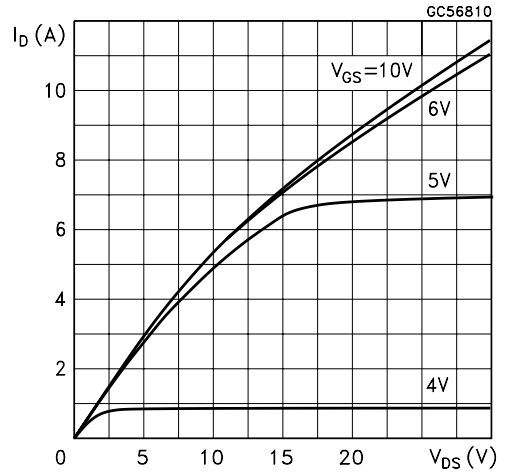


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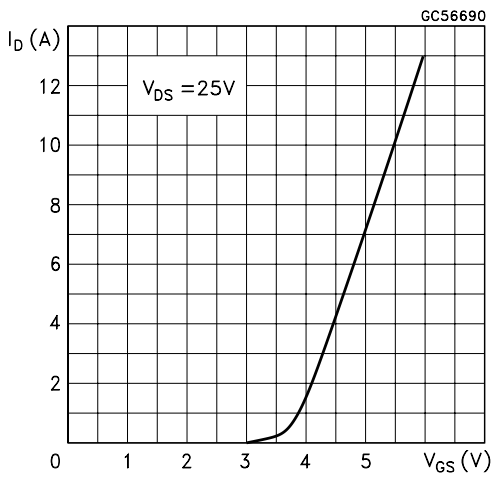
Derating Curve



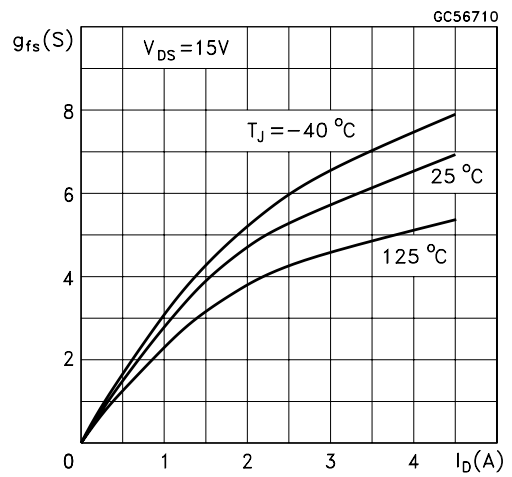
Output Characteristics



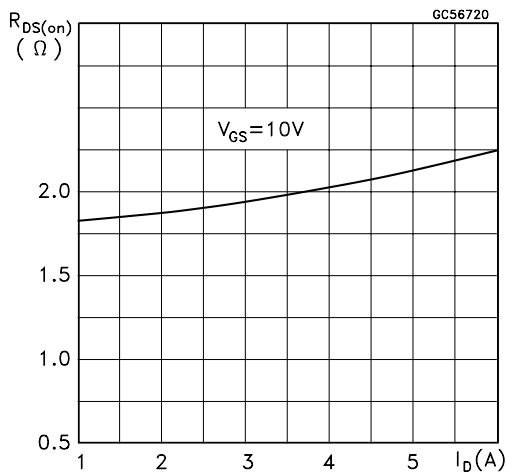
Transfer Characteristics



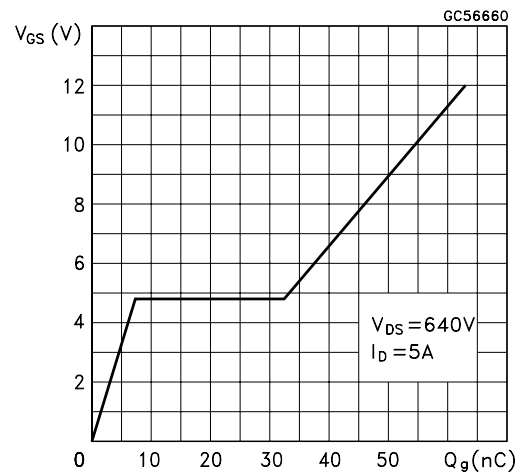
Transconductance



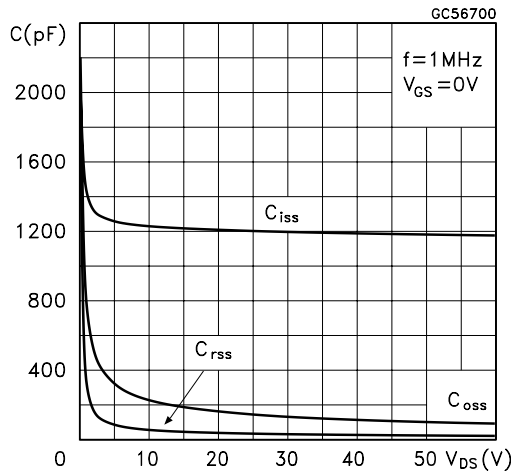
Static Drain-source On Resistance



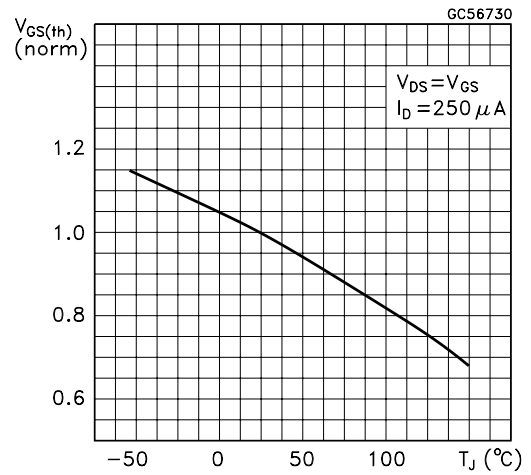
Gate Charge vs Gate-source Voltage



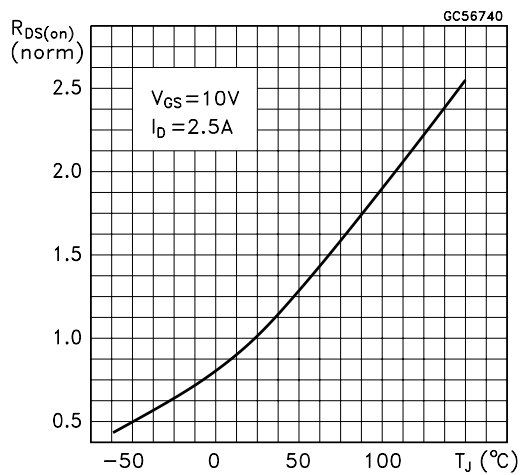
Capacitance Variations



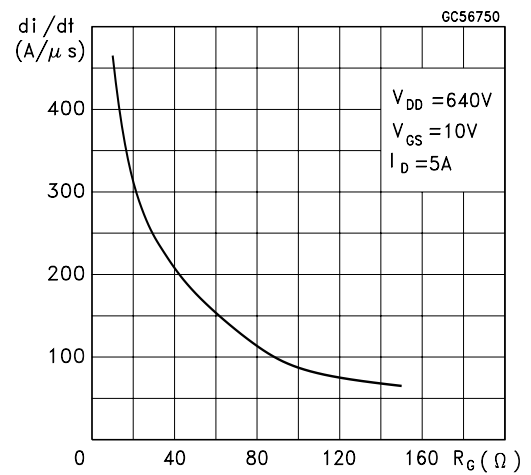
Normalized Gate Threshold Voltage vs Temperature



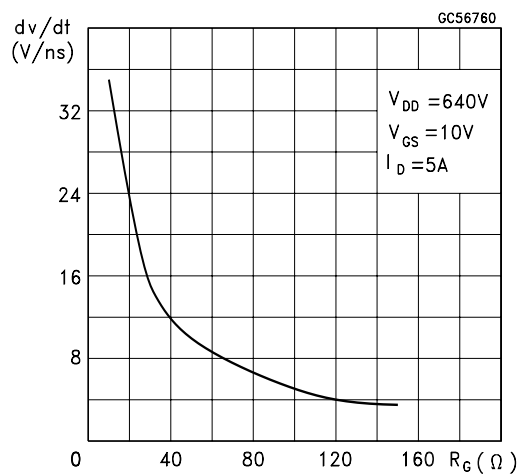
Normalized On Resistance vs Temperature



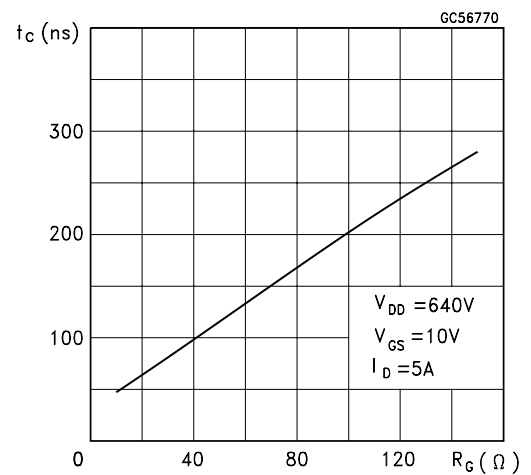
Turn-on Current Slope



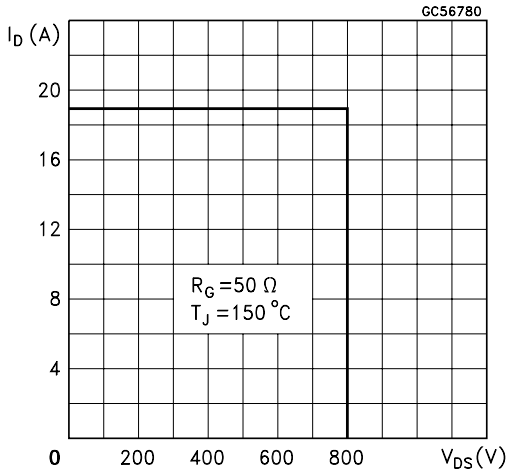
Turn-off Drain-source Voltage Slope



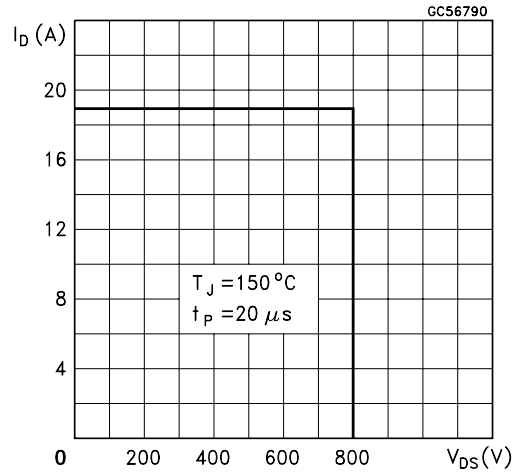
Cross-over Time



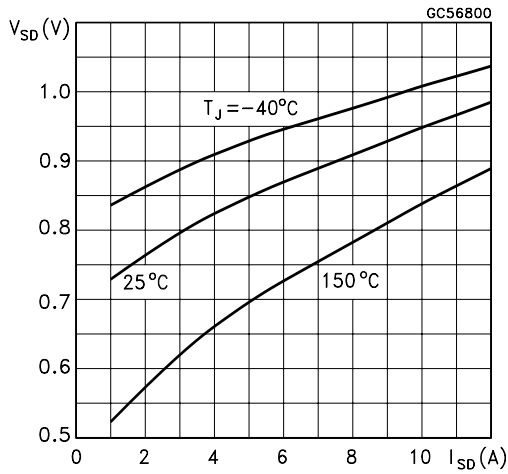
Switching Safe Operating Area



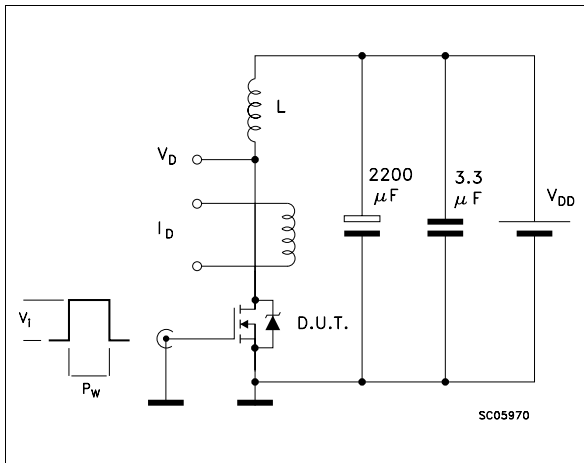
Accidental Overload Area



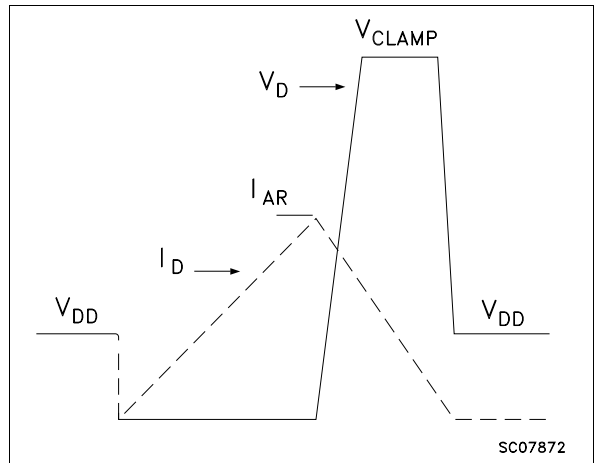
Source-drain Diode Forward Characteristics



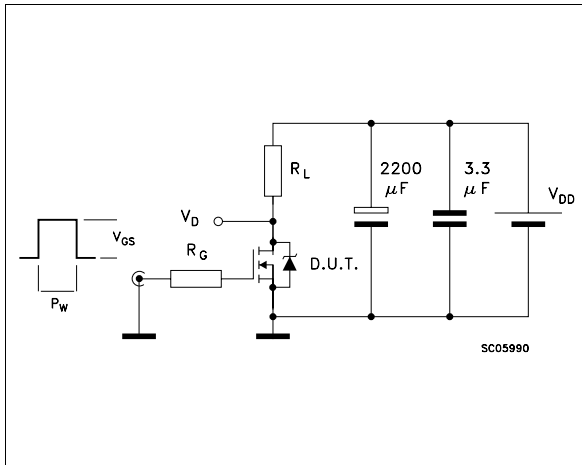
**Fig. 1:** Unclamped Inductive Load Test Circuit



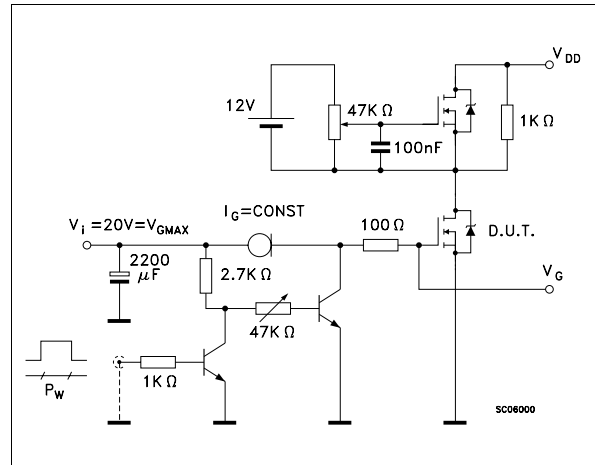
**Fig. 2:** Unclamped Inductive Waveform



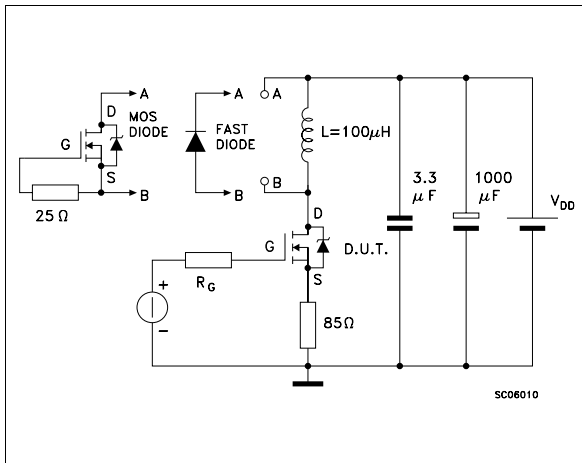
**Fig. 3: Switching Times Test Circuits For Resistive Load**



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

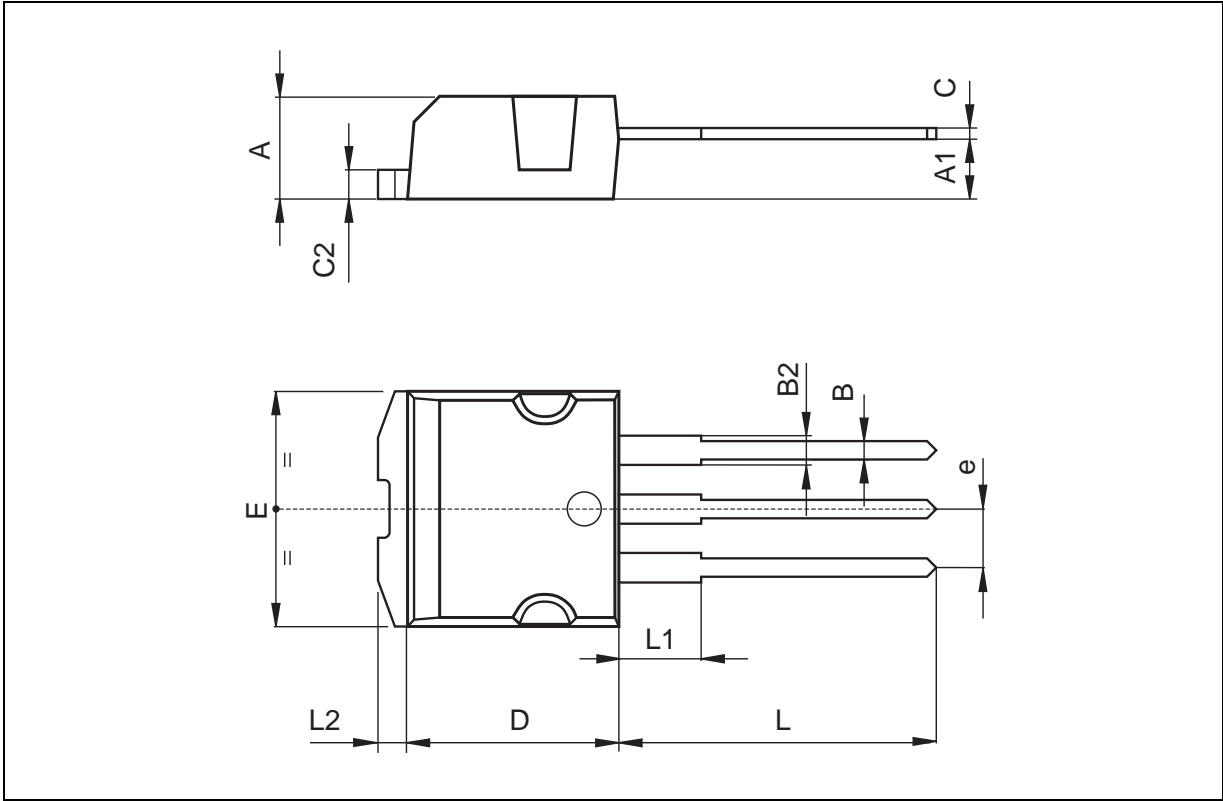


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



**TO-262 (I2PAK) MECHANICAL DATA**

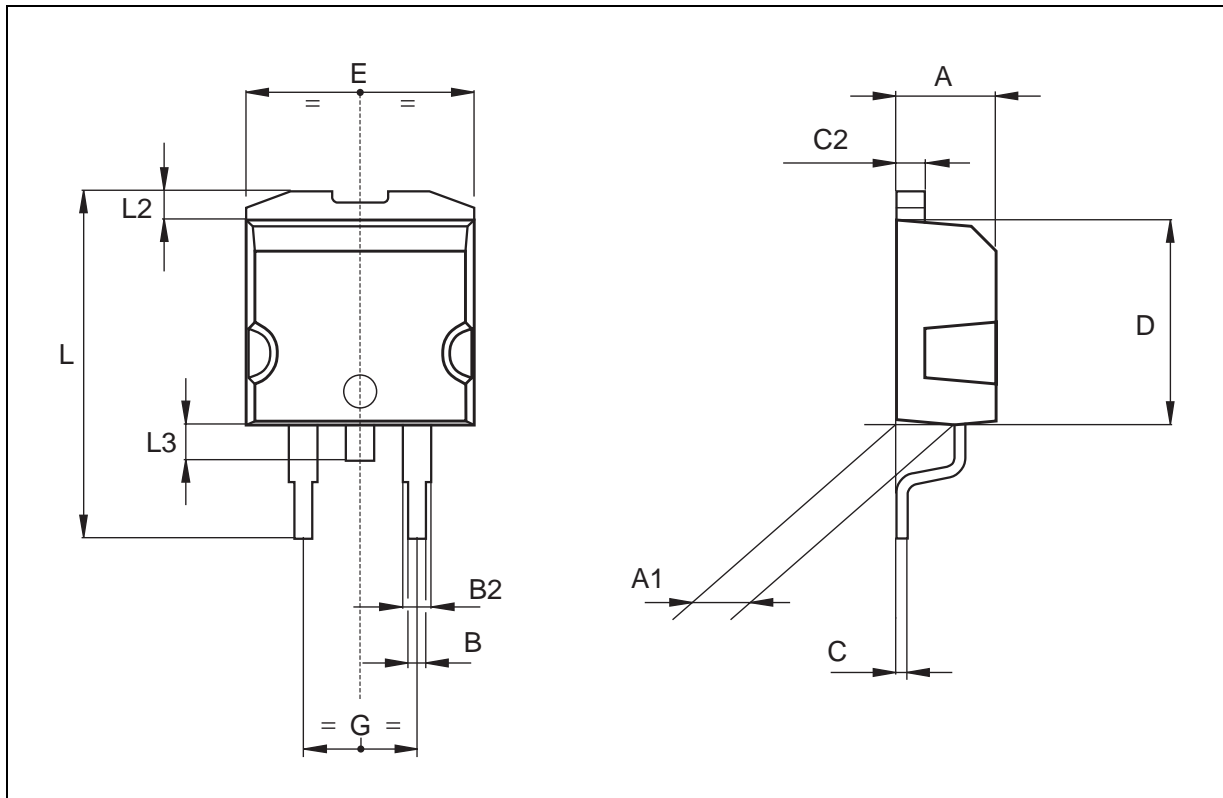
| DIM. | mm   |      |       | inch  |      |       |
|------|------|------|-------|-------|------|-------|
|      | MIN. | TYP. | MAX.  | MIN.  | TYP. | MAX.  |
| A    | 4.3  |      | 4.6   | 0.169 |      | 0.181 |
| A1   | 2.49 |      | 2.69  | 0.098 |      | 0.106 |
| B    | 0.7  |      | 0.93  | 0.027 |      | 0.036 |
| B1   | 1.2  |      | 1.38  | 0.047 |      | 0.054 |
| B2   | 1.25 |      | 1.4   | 0.049 |      | 0.055 |
| C    | 0.45 |      | 0.6   | 0.017 |      | 0.023 |
| C2   | 1.21 |      | 1.36  | 0.047 |      | 0.053 |
| D    | 9    |      | 9.35  | 0.354 |      | 0.368 |
| e    | 2.44 |      | 2.64  | 0.096 |      | 0.104 |
| E    | 10   |      | 10.28 | 0.393 |      | 0.404 |
| L    | 13.2 |      | 13.5  | 0.519 |      | 0.531 |
| L1   | 3.48 |      | 3.78  | 0.137 |      | 0.149 |
| L2   | 1.27 |      | 1.37  | 0.050 |      | 0.054 |





## TO-263 (D2PAK) MECHANICAL DATA

| DIM. | mm   |      |       | inch  |      |       |
|------|------|------|-------|-------|------|-------|
|      | MIN. | TYP. | MAX.  | MIN.  | TYP. | MAX.  |
| A    | 4.3  |      | 4.6   | 0.169 |      | 0.181 |
| A1   | 2.49 |      | 2.69  | 0.098 |      | 0.106 |
| B    | 0.7  |      | 0.93  | 0.027 |      | 0.036 |
| B2   | 1.25 |      | 1.4   | 0.049 |      | 0.055 |
| C    | 0.45 |      | 0.6   | 0.017 |      | 0.023 |
| C2   | 1.21 |      | 1.36  | 0.047 |      | 0.053 |
| D    | 9    |      | 9.35  | 0.354 |      | 0.368 |
| E    | 10   |      | 10.28 | 0.393 |      | 0.404 |
| G    | 4.88 |      | 5.28  | 0.192 |      | 0.208 |
| L    | 15   |      | 15.85 | 0.590 |      | 0.624 |
| L2   | 1.27 |      | 1.37  | 0.050 |      | 0.054 |
| L3   | 1.4  |      | 1.75  | 0.055 |      | 0.068 |



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