

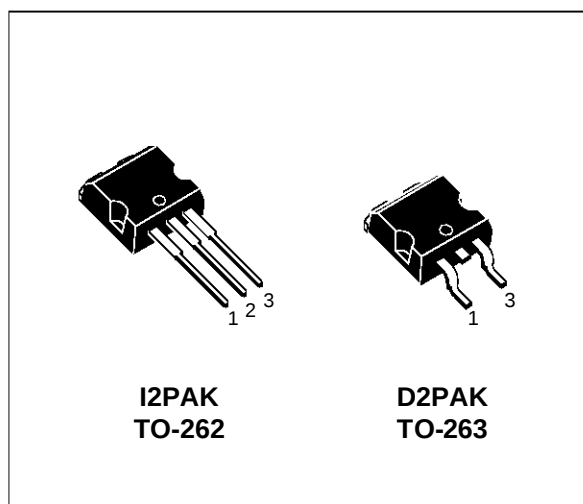
## N - CHANNEL ENHANCEMENT MODE FAST POWER MOS TRANSISTOR

| TYPE     | V <sub>DSS</sub> | R <sub>DS(on)</sub> | I <sub>D</sub> |
|----------|------------------|---------------------|----------------|
| STB8NA50 | 500 V            | < 0.85 $\Omega$     | 8 A            |

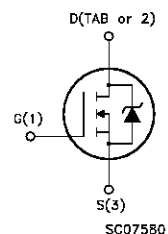
- TYPICAL R<sub>DS(on)</sub> = 0.7  $\Omega$
- $\pm 30$ V GATE TO SOURCE VOLTAGE RATING
- 100% AVALANCHE TESTED
- REPETITIVE AVALANCHE DATA AT 100°C
- LOW INTRINSIC CAPACITANCES
- GATE CHARGE MINIMIZED
- REDUCED THRESHOLD VOLTAGE SPREAD
- THROUGH-HOLE I2PAK (TO-262) POWER PACKAGE IN TUBE (SUFFIX "-1")
- SURFACE-MOUNTING D2PACK (TO-263) POWER PACKAGE IN TUBE (NO SUFFIX) OR IN TAPE & REEL (SUFFIX "T4")

### APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-AC CONVERTERS FOR WELDING EQUIPMENT AND UNINTERRUPTIBLE POWER SUPPLIES AND MOTOR DRIVE



### INTERNAL SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

| Symbol              | Parameter                                              | Value      | Unit |
|---------------------|--------------------------------------------------------|------------|------|
| V <sub>DS</sub>     | Drain-source Voltage (V <sub>GS</sub> = 0)             | 500        | V    |
| V <sub>DGR</sub>    | Drain- gate Voltage (R <sub>GS</sub> = 20 k $\Omega$ ) | 500        | V    |
| V <sub>GS</sub>     | Gate-source Voltage                                    | $\pm 30$   | V    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 25 °C   | 8          | A    |
| I <sub>D</sub>      | Drain Current (continuous) at T <sub>c</sub> = 100 °C  | 5.3        | A    |
| I <sub>DM</sub> (•) | Drain Current (pulsed)                                 | 32         | 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

## STB8NA50

### THERMAL DATA

|                |                                                |     |      |               |
|----------------|------------------------------------------------|-----|------|---------------|
| $R_{thj-case}$ | Thermal Resistance Junction-case               | Max | 1    | $^{\circ}C/W$ |
| $R_{thj-amb}$  | Thermal Resistance Junction-ambient            | Max | 62.5 | $^{\circ}C/W$ |
| $R_{thc-sink}$ | Thermal Resistance Case-sink                   | Typ | 0.5  | $^{\circ}C/W$ |
| $T_l$          | Maximum Lead Temperature For Soldering Purpose |     | 300  | $^{\circ}C$   |

### AVALANCHE CHARACTERISTICS

| Symbol   | Parameter                                                                                                                   | Max Value | Unit |
|----------|-----------------------------------------------------------------------------------------------------------------------------|-----------|------|
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max, $\delta < 1\%$ )                         | 8         | A    |
| $E_{AS}$ | Single Pulse Avalanche Energy (starting $T_j = 25^{\circ}C$ , $I_D = I_{AR}$ , $V_{DD} = 50 V$ )                            | 350       | mJ   |
| $E_{AR}$ | Repetitive Avalanche Energy (pulse width limited by $T_j$ max, $\delta < 1\%$ )                                             | 11        | mJ   |
| $I_{AR}$ | Avalanche Current, Repetitive or Not-Repetitive ( $T_c = 100^{\circ}C$ , pulse width limited by $T_j$ max, $\delta < 1\%$ ) | 5.3       | A    |

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

#### OFF

| Symbol        | Parameter                                        | Test Conditions                                                                              | Min. | Typ. | Max.        | Unit               |
|---------------|--------------------------------------------------|----------------------------------------------------------------------------------------------|------|------|-------------|--------------------|
| $V_{(BR)DSS}$ | Drain-source Breakdown Voltage                   | $I_D = 250 \mu A$ $V_{GS} = 0$                                                               | 500  |      |             | V                  |
| $I_{DSS}$     | Zero Gate Voltage Drain Current ( $V_{GS} = 0$ ) | $V_{DS} = \text{Max Rating}$<br>$V_{DS} = \text{Max Rating} \times 0.8$ $T_c = 125^{\circ}C$ |      |      | 250<br>1000 | $\mu A$<br>$\mu A$ |
| $I_{GSS}$     | Gate-body Leakage Current ( $V_{DS} = 0$ )       | $V_{GS} = \pm 30 V$                                                                          |      |      | $\pm 100$   | nA                 |

#### ON (\*)

| Symbol       | Parameter                         | Test Conditions                                                               | Min. | Typ. | Max.        | Unit                 |
|--------------|-----------------------------------|-------------------------------------------------------------------------------|------|------|-------------|----------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{DS} = V_{GS}$ $I_D = 250 \mu A$                                           | 2.25 | 3    | 3.75        | V                    |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS} = 10V$ $I_D = 4 A$<br>$V_{GS} = 10V$ $I_D = 4 A$ $T_c = 100^{\circ}C$ |      | 0.7  | 0.85<br>1.7 | $\Omega$<br>$\Omega$ |
| $I_{D(on)}$  | On State Drain Current            | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$<br>$V_{GS} = 10 V$                  | 8    |      |             | A                    |

### DYNAMIC

| Symbol       | Parameter                    | Test Conditions                                       | Min. | Typ. | Max. | Unit |
|--------------|------------------------------|-------------------------------------------------------|------|------|------|------|
| $g_{fs} (*)$ | Forward Transconductance     | $V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 4 A$ | 4.5  | 6.5  |      | S    |
| $C_{iss}$    | Input Capacitance            | $V_{DS} = 25 V$ $f = 1 MHz$ $V_{GS} = 0$              |      | 1200 | 1600 | pF   |
| $C_{oss}$    | Output Capacitance           |                                                       |      | 190  | 250  | pF   |
| $C_{rss}$    | Reverse Transfer Capacitance |                                                       |      | 55   | 75   | pF   |

**ELECTRICAL CHARACTERISTICS** (continued)**SWITCHING ON**

| Symbol         | Parameter             | Test Conditions                                                                                                         | Min. | Typ. | Max. | Unit       |
|----------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------|------|------|------|------------|
| $t_{d(on)}$    | Turn-on Time          | $V_{DD} = 250\text{ V}$ $I_D = 4\text{ A}$                                                                              |      | 18   | 25   | ns         |
| $t_r$          | Rise Time             | $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$<br>(see test circuit, figure 3)                                              |      | 25   | 35   | ns         |
| $(di/dt)_{on}$ | Turn-on Current Slope | $V_{DD} = 400\text{ V}$ $I_D = 8\text{ A}$<br>$R_G = 47\ \Omega$ $V_{GS} = 10\text{ V}$<br>(see test circuit, figure 5) |      | 220  |      | A/ $\mu$ s |
| $Q_g$          | Total Gate Charge     | $V_{DD} = 400\text{ V}$ $I_D = 8\text{ A}$ $V_{GS} = 10\text{ V}$                                                       |      | 55   | 75   | nC         |
| $Q_{gs}$       | Gate-Source Charge    |                                                                                                                         |      | 9    |      | nC         |
| $Q_{gd}$       | Gate-Drain Charge     |                                                                                                                         |      | 25   |      | nC         |

**SWITCHING OFF**

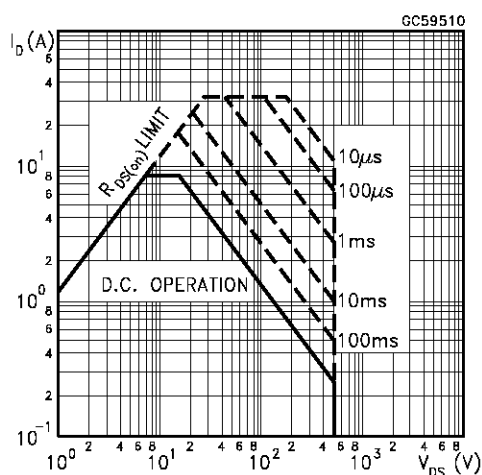
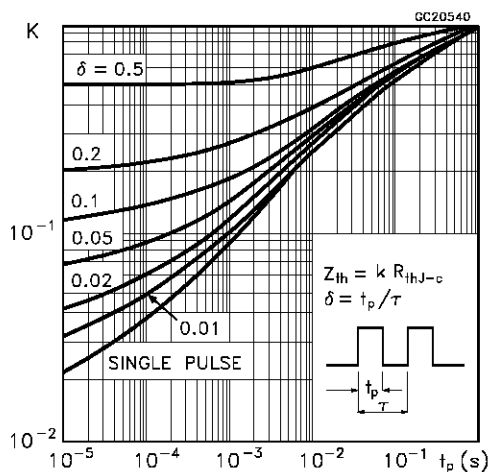
| Symbol        | Parameter             | Test Conditions                                                            | Min. | Typ. | Max. | Unit |
|---------------|-----------------------|----------------------------------------------------------------------------|------|------|------|------|
| $t_{r(Voff)}$ | Off-voltage Rise Time | $V_{DD} = 400\text{ V}$ $I_D = 8\text{ A}$                                 |      | 15   | 22   | ns   |
| $t_f$         | Fall Time             | $R_G = 4.7\ \Omega$ $V_{GS} = 10\text{ V}$<br>(see test circuit, figure 5) |      | 15   | 22   | ns   |
| $t_c$         | Cross-over Time       |                                                                            |      | 25   | 35   | ns   |

**SOURCE DRAIN DIODE**

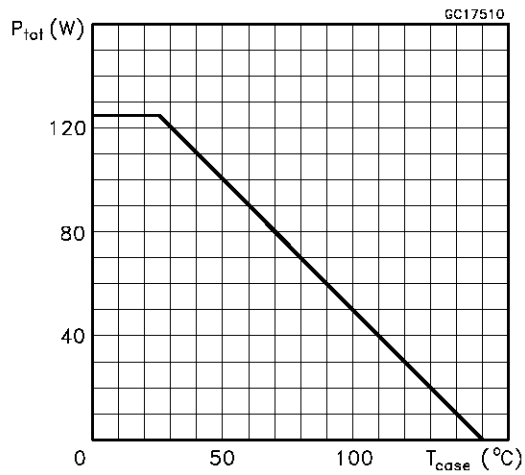
| Symbol             | Parameter                     | Test Conditions                                                                                                                                       | Min. | Typ. | Max. | Unit          |
|--------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| $I_{SD}$           | Source-drain Current          |                                                                                                                                                       |      |      | 8    | A             |
| $I_{SDM}(\bullet)$ | Source-drain Current (pulsed) |                                                                                                                                                       |      |      | 32   | A             |
| $V_{SD} (*)$       | Forward On Voltage            | $I_{SD} = 8\text{ A}$ $V_{GS} = 0$                                                                                                                    |      |      | 1.6  | V             |
| $t_{rr}$           | Reverse Recovery Time         | $I_{SD} = 8\text{ A}$ $di/dt = 100\text{ A}/\mu\text{s}$<br>$V_{DD} = 100\text{ V}$ $T_j = 150\text{ }^\circ\text{C}$<br>(see test circuit, figure 5) |      | 500  |      | ns            |
| $Q_{rr}$           | Reverse Recovery Charge       |                                                                                                                                                       |      | 6.5  |      | $\mu\text{C}$ |
| $I_{RRM}$          | Reverse Recovery Current      |                                                                                                                                                       |      | 26   |      | A             |

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

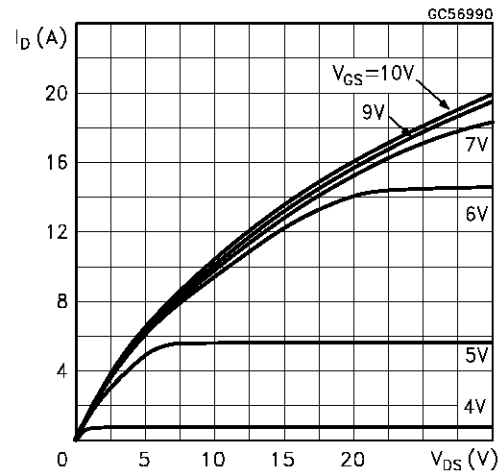
(•) Pulse width limited by safe operating area

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

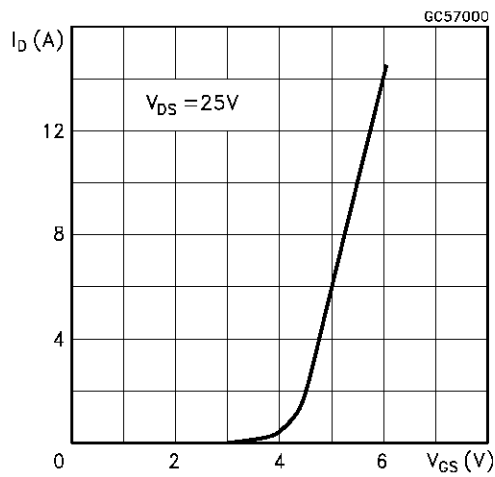
Derating Curve



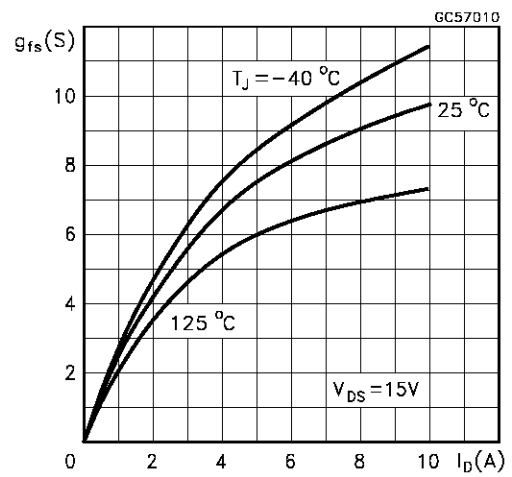
Output Characteristics



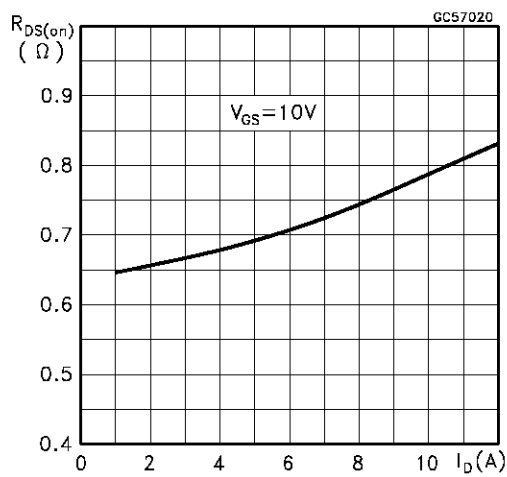
Transfer Characteristics



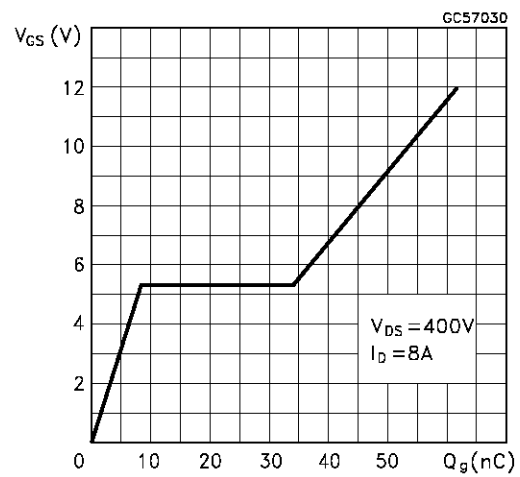
Transconductance



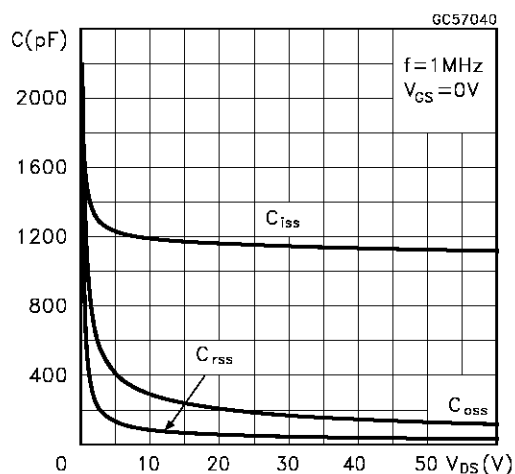
Static Drain-source On Resistance



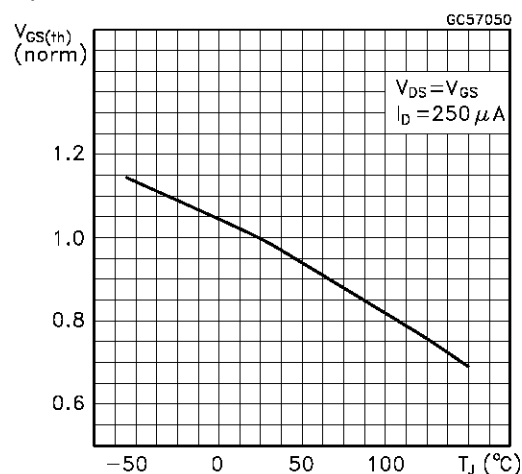
Gate Charge vs Gate-source Voltage



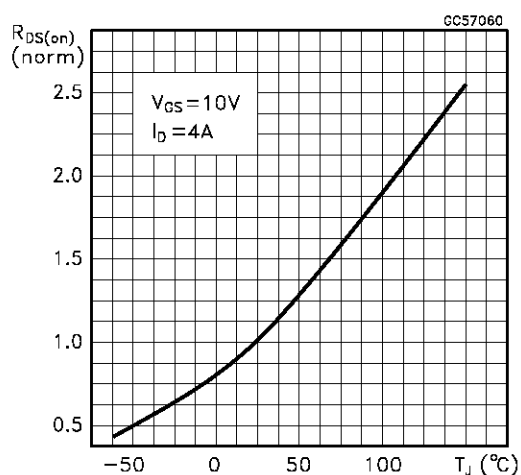
## Capacitance Variations



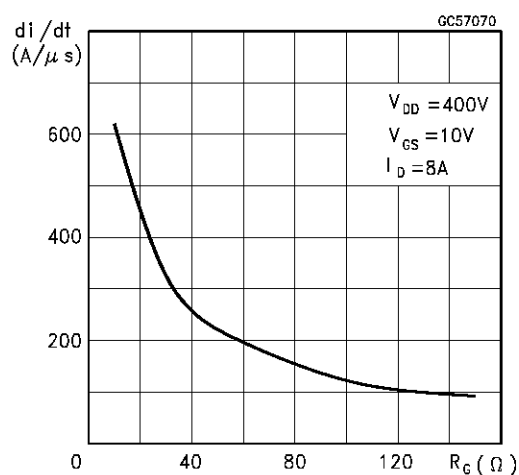
## Normalized Gate Threshold Voltage vs Temperature



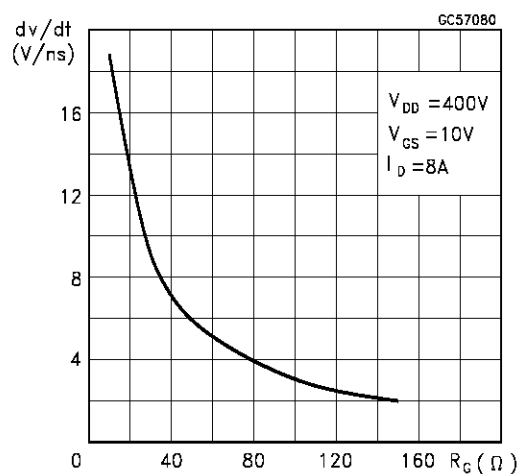
## Normalized On Resistance vs Temperature



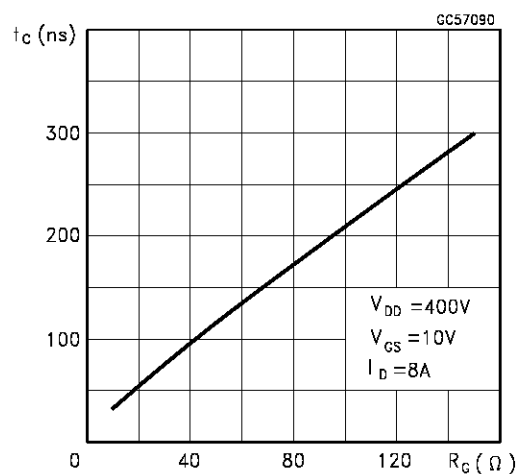
## Turn-on Current Slope



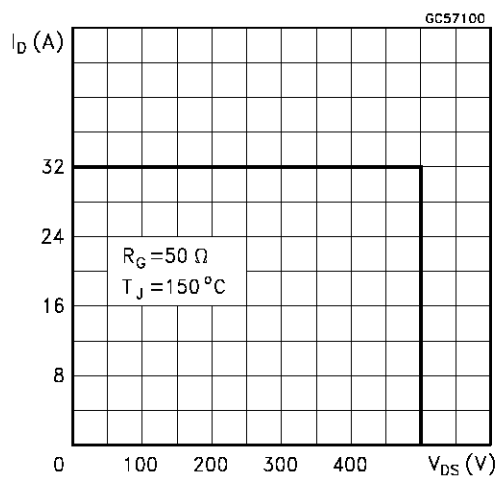
## Turn-off Drain-source Voltage Slope



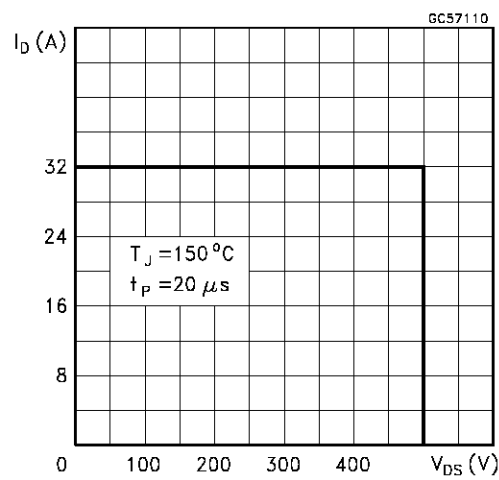
## Cross-over Time



Switching Safe Operating Area



Accidental Overload Area



Source-drain Diode Forward Characteristics

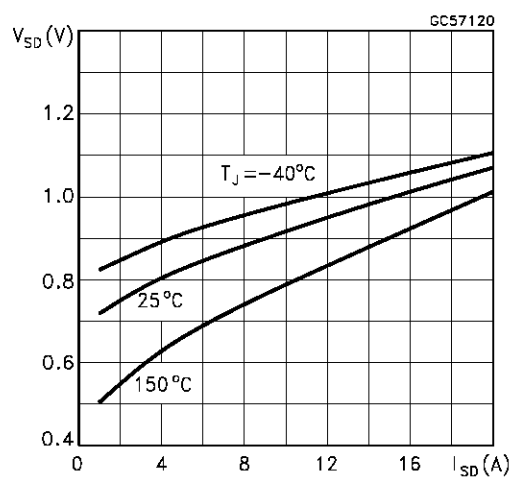


Fig. 1: Unclamped Inductive Load Test Circuit

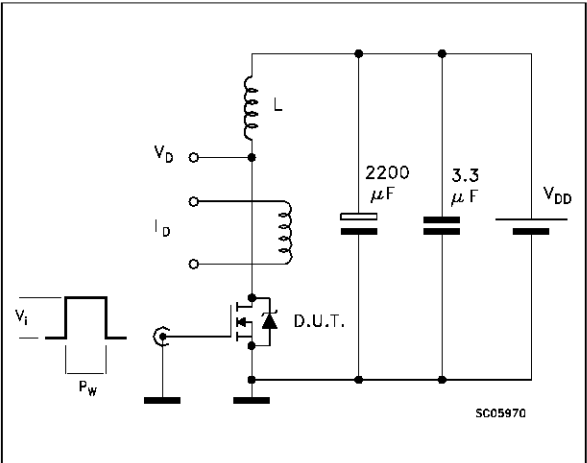
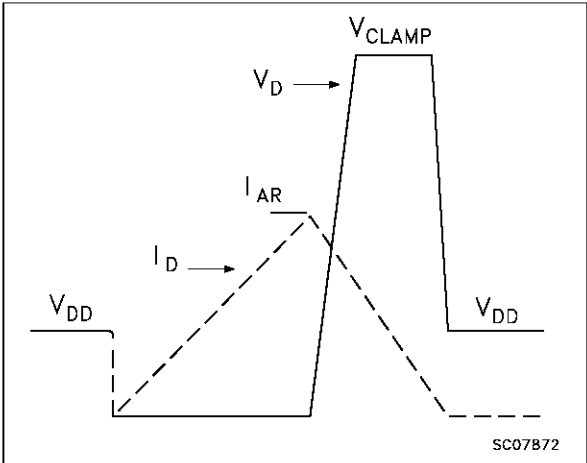
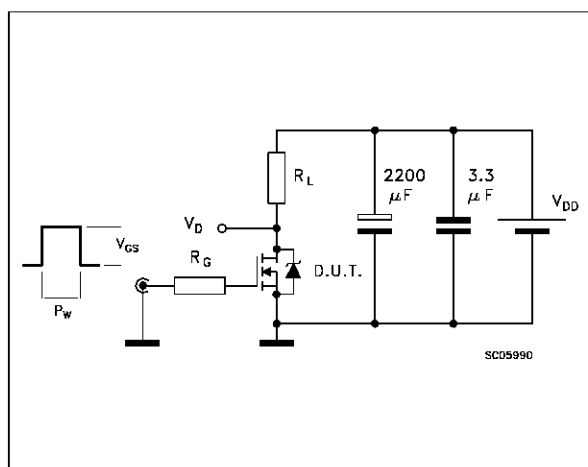


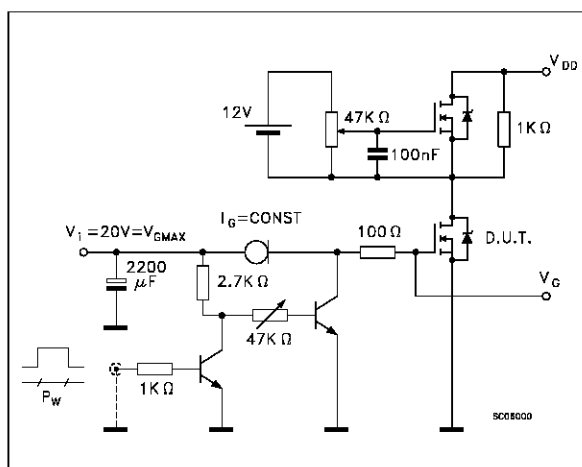
Fig. 2: Unclamped Inductive Waveform



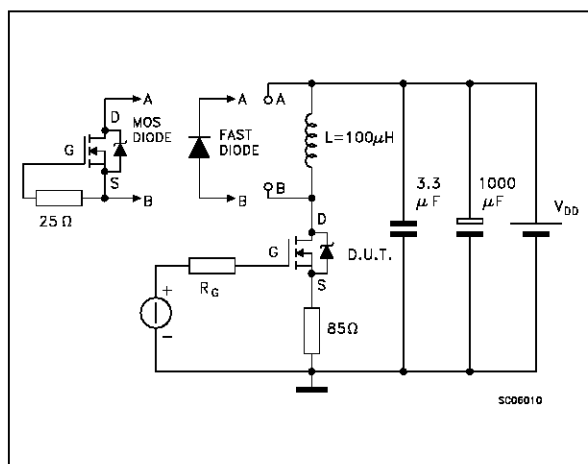
**Fig. 3: Switching Times Test Circuits For Resistive Load**



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

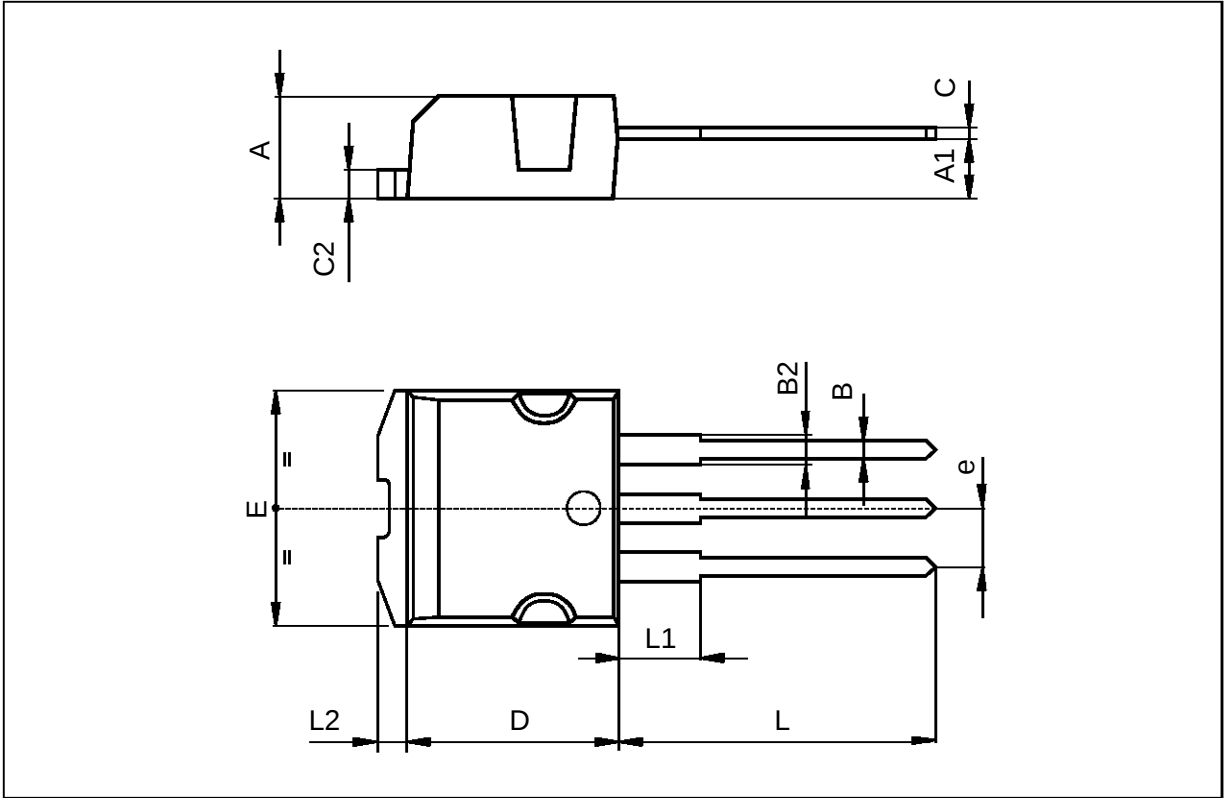


**Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times**



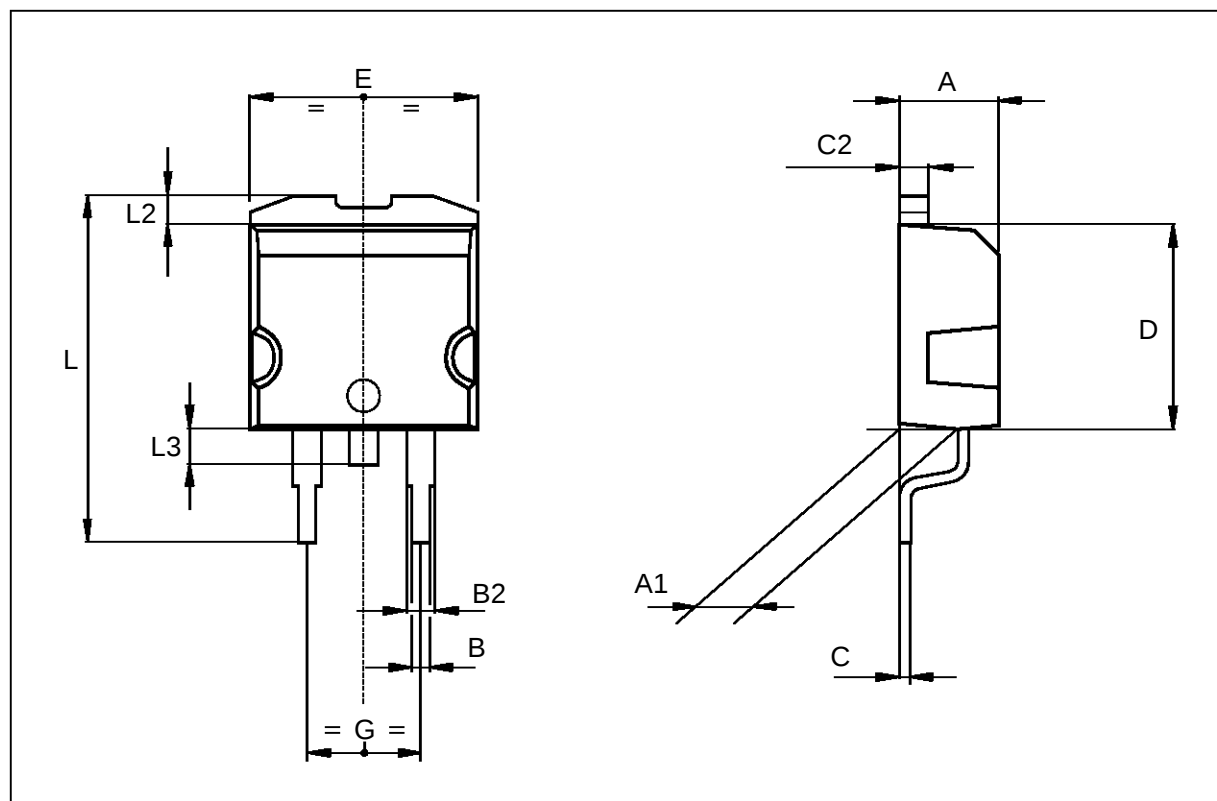
TO-262 (I2PAK) MECHANICAL DATA

| 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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